Project Manual

Endoscopy Center

Addition and Renovation

ST. JOSEPH MEMORIAL HOSPITAL

2 South Hospital Drive
Murphysboro, IL 62966

Issue Date: February 18, 2013
Project No.: 12192
IDPH No.: 9816

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ENDOSCOPY CENTER – Addition and Renovation 12192

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GENERAL AND SUPPLEMENTARY CONDITIONS

Endoscopy Center Addition & Renovation
SIH St. Joseph Memorial Hospital
2 South Hospital Drive
Murphysboro, IL 62966

A. The General Conditions of this Contract are the American Institute of Architect's Document **A201** - 2007, "General Conditions of the Contract for the Construction," 2007 Edition - Electronic Format, 15 Articles hereinafter referred to as the "General Conditions."

B. The following Supplementary Conditions contain modifications, changes, deletions from, or additions to the "General Conditions". Where any Article or Clause thereof is modified or deleted by these Supplementary Conditions, these Supplementary Conditions shall govern work under this Contract.

SUPPLEMENTARY CONDITIONS

ARTICLE 1 – GENERAL PROVISIONS

Delete Subparagraph 1.1.1 in its entirety and substitute the following Subparagraph:

1.1.1 The Contract Documents consist of the Instructions to Bidders (including Invitation to Bid), the Contract between Owner and Contractor (hereinafter the Agreement), the Conditions of the Contract (General, Supplementary and other Conditions), the Drawings, the Project Manual, and all Addenda issued prior to and all Modifications issued after execution of the Contract. A Modification is (1) a written amendment to the Contract signed by both parties, (2) a Change Order, (3) a written interpretation issued by the Architect pursuant to Subparagraph 4.2.11 or (4) a written order for a minor change in the work issued by the Architect pursuant to paragraph 7.4.

Subparagraph 1.1.6, add the following:

For the purposes of this document, the terms “Specifications” and “Project Manual” are synonymous.

Add the following new Subparagraph:

1.2.1.1 In case of conflict within the Contract Documents, the document or part thereof requiring the greater quantity or quality of materials or equipment, as determined by the Architect, shall take precedence. In case of conflict between Instructions to Bidders, General Conditions, Supplemental Conditions, Change Orders, Addenda, Drawings, Specifications, and, the following order of precedence will be followed: (1) Change Orders; (2) Addenda; (3) Instructions to Bidders; (4) Special Conditions; (5) Supplemental Conditions; (6) General Conditions; (7) Specifications; (8) Drawings.

Add the Following new Paragraphs and Subparagraphs to the end of Article 1:

1.7 Confidentiality. The Contractor warrants and represents that the Contractor shall not knowingly or negligently communicate or disclose at any time to any person or entity any information in connection with the Work or the Project, except: (1) with prior written consent of the Owner, (2) information that was in the public domain prior to the date of this Contract, (3) information which becomes part of the public domain by publication or otherwise not due to any unauthorized act or omission of the Contractor, or (4) as may be required to perform the Work or by any applicable law.

1.7.1 The Contractor, at any time upon the request of the Owner, shall immediately return and surrender to the Owner all copies of any materials, records, notices, memoranda, recordings, drawings, specifications and mock-ups and any other documents furnished by the Owner or the Architect to the Contractor.

1.7.2 The Contractor shall specifically cause all Subcontractors or any other person or entity performing any services or furnishing any materials or equipment for the Work to warrant and represent all items set forth in this Paragraph 1.7.

1.7.3 The representations and warranties contained in this Paragraph 1.7 shall survive the complete performance of the Work or earlier termination of this Contract.

ARTICLE 2 - OWNER

Delete the last sentence of Subparagraph 2.1.1 and substitute the following language:

Where the term "Owner" appears, it refers to:

St. Joseph Memorial Hospital
2 South Hospital Drive
Murphysboro, IL 62966

For the purpose of administration of this Contract, the term "Owner" refers to **Ken Conley,** Manager of Design and Construction, who is/are hereby designated by the Owner as its representative(s) and is/are authorized to act on behalf of the Owner, unless a new representative is subsequently designated by the Owner.

Delete Subparagraph 2.2.5 in its entirety and substitute the following Subparagraph:

2.2.5 The Contractor will be furnished, free of charge, all returned bidding copies of the Drawings and Project Manuals. The Contractor will be furnished, at its sole cost and expense, as many additional copies as it may require.

ARTICLE 3 - CONTRACTOR

Add the following paragraph to Paragraph 3.5:

3.5.2 If Contractor uses any portion of the Work or Owner's other property prior to the date of Substantial Completion of the entire Work, such items shall be restored to their condition existing immediately prior to such use, or as otherwise specified in the Contract Documents. Contractor's warranty and agreement to correct defective Work shall specifically include Contractor's obligations under this paragraph.

In the third line of Subparagraph 3.7.2, add the words "and all other requirements" between the words "orders" and "of."

Delete Subparagraph 3.10.2 and substitute the following:

3.10.2 The Contractor shall, within **fifteen** (15) days after the Notice to Proceed and thereafter as necessary to maintain information current, assemble and provide all necessary information and data concerning his activities and the activities of his subcontractors, vendors and suppliers, including durations and crew sizes, planned submission dates of required Shop Drawings, Product Data and Samples and shall submit the schedule(s) and other information for the Architect's approval. The Architect's approval shall not unreasonably be delayed or withheld. In preparation of schedule(s) and other information, each Subcontractor shall prepare and submit such information in the form required by the Contractor. The Architect shall provide all necessary information concerning shop drawing and sample approval time requirements. The submittal schedule shall (1) be coordinated with the Contractor's construction schedule, and (2) allow the Architect reasonable time to review submittals. If the Contractor fails to submit a submittal schedule, the Contractor shall not be entitled to any increase in Contract Sum or extension of Contract Time based on the time required for review of submittals.

Add the following Subparagraphs to Paragraph 3.13:

3.13.2 Only materials and equipment which are to be used directly in the Work shall be brought to and stored on the Project site by the Contractor. After equipment is no longer required for the Work, it shall be promptly removed from the Project site. Protection of construction materials and equipment stored at the Project site from weather, theft, damage and all other adversity is solely the responsibility of the Contractor.

3.13.3 The Contractor and any entity for whom the Contractor is responsible shall not erect any sign on the Project site without the prior written consent of the Owner, which may be withheld in the sole discretion of the Owner.

Delete Paragraph 3.16 and substitute the following:

3.16 ACCESS TO WORK

The Owner and Architect shall at all times have access to the Work wherever it is in preparation and progress. The Contractor shall provide facilities for such access so the Owner and Architect may perform their functions under the Contract Documents.

ARTICLE 4 - ADMINISTRATION OF THE CONTRACT

Add the following to the end of Subparagraph 4.1.1:

Where the term "Architect" appears, it refers to:

The Lawrence Group Architects of St. Louis, Inc.
319 North Fourth Street
Suite 1000
St. Louis, Missouri 63102
(314) 231-5700

ARTICLE 8 - TIME

Delete Subparagraph 8.1.1 in its entirety and substitute the following Subparagraph:

8.1.1 The Contract Time for this project is the period of time from the Date of the Notice to Proceed to the Date of Substantial Completion of the Work as defined in Subparagraph 8.1.3, including authorized adjustments thereto. The time requirements of each individual Subcontractor shall be in accordance with the durations established in the Progress Schedule.

Add the following to the end of Subparagraph 8.1.2:

A Written Notice to Proceed shall not be required prior to the start of work.

Delete Subparagraph 8.1.3 in its entirety and substitute the following Subparagraph:

8.1.3 The Date of Substantial Completion of the Work or designated portion thereof is the Date certified by the Architect when all work categories are sufficiently complete, in accordance with the Contract Documents, so the Owner can occupy or utilize the Work or designated portion thereof for the use for which it is intended.

ARTICLE 9 - PAYMENTS AND COMPLETION

Add the following provision at the end of Paragraph 9.1:

9.1.2 Each Application for Payment shall include such instruments, evidence, and materials as Owner shall require including, without limitation, such requisition forms, disbursement requests, indemnities (including evidence of All Risk physical damage insurance coverage on materials and equipment stored off-site), and undertakings as they may specify and an estimate of the total labor done and materials stored at the site (or other location approved in writing by Owner) or installed in the building, less costs for which payment has been made, and also less retainage. All Applications for Payment shall be made on and in compliance with a form acceptable to Owner and Architect.

In the first sentence of Paragraph 9.2 delete the words "Before the first Application for Payment" and substitute "Upon full execution of the Contract."

In the first sentence of Subparagraph 9.3.1, after the word "payment," insert "unless otherwise required by the Contract."

Add the following clause to the end of Subparagraph 9.3.1:

9.3.1.3 Each Application for Payment shall be accompanied by the following all in form and substance satisfactory to the Owner:

(1) Contractor's lien waiver and duly executed and acknowledged sworn statement showing all Subcontractors and materialmen with whom the Contractor has entered into subcontracts, the amount of each such subcontract, the amount requested for any Subcontractor and materialmen in the requested progress payment and the amount to be paid to the Contractor from such progress payment, together with similar sworn statements from all such Subcontractors and materialmen;

(2) duly executed waivers of mechanics' and materialmen's liens from all Subcontractors and, when appropriate, from materialmen and lower tier Subcontractors establishing payment or satisfaction of payment of all amounts requested by the Contractor on behalf of such entities or

persons in any previous Application for Payment. Waivers of Lien will be submitted with each monthly application for payment, except the first. The second and each subsequent application will be accompanied by waivers covering the full amount paid by the Owner the previous month.

(3) all information and materials required to comply with the requirements of the Contract Documents or reasonably requested by the Owner or the Architect.

Add the following clauses to the end of Subparagraph 9.3.3:

9.3.3.1 The Contractor further expressly undertakes to defend the Indemnitees, at the Contractor's sole expense, against any actions, lawsuits or proceedings brought against Indemnitees as a result of liens filed against the Work, the site of any of the Work, the Project site and any improvements thereon, payments due the Contractor or any portion of the property of any of the Indemnitees (referred to collectively as “liens” in this Paragraph 9.3.3). The Contractor hereby agrees to indemnify and hold Indemnitees harmless against any such liens or claims of lien and agrees to pay any judgment or lien resulting from any such actions, lawsuits or proceedings.

9.3.3.2 The Owner shall release any payments withheld due to a lien or claim of lien if the Contractor obtains security acceptable to the Owner or a lien bond which is: (1) issued by a surety acceptable to the Owner, (2) in form and substance satisfactory to the Owner, and (3) in an amount not less than One Hundred Fifty percent (150%) of such lien claim. By posting a lien bond or other acceptable security, however, the Contractor shall not be relieved of any responsibilities or obligations under this Paragraph 9.3, including, without limitation, the duty to defend and indemnify the Indemnitees. The cost of any premiums incurred in connection with such bonds and security shall be the responsibility of the Contractor and shall not be part of, or cause any adjustment to, the Contract Sum.

Add the following language to the end of Subparagraph 9.8.1:

; provided, however, that as a condition precedent to Substantial Completion, the Owner has received all certificates of occupancy and any other permits, approvals, licenses, and other documents from any governmental authority having jurisdiction thereof necessary for the beneficial occupancy of the Project.

ARTICLE 10 - PROTECTION OF PERSONS AND PROPERTY

Add the following language to the end of Subparagraph 10.2.3:

The Contractor shall also be responsible, at the Contractor's sole cost and expense, for all measures necessary to protect any property adjacent to the Project and improvements therein. Any damage to such property or improvements shall be promptly repaired by the Contractor.

Add the following language to the end of Subparagraph 10.2.8:

Further, the Contractor shall promptly report in writing to the Owner and Architect all accidents arising out of or in connection with the Work which cause death, personal injury, or property damage, giving full details and statements of any witnesses. In addition, if death, serious personal injuries, or serious property damages are caused, the accident shall be reported immediately by telephone or messenger to the Owner and the Architect.

Add the following paragraph to the end of Paragraph 10.2:

10.2.9 When all or a portion of the Work is suspended for any reason, the Contractor shall securely fasten down all coverings and protect the Work, as necessary, from injury by any cause.

Add the following language to the end of Subparagraph 10.3.2:

The term "rendered harmless" shall be interpreted to mean that levels of asbestos and polychlorinated biphenyls are less than any applicable exposure standards set forth in OSHA regulations. In no event, however, shall the Owner have any responsibility for any substance or material that is brought to the Project site by the Contractor, any Subcontractor, any materialman or supplier or any entity for whom any of them is responsible. The Contractor agrees not to use any fill or other materials to be incorporated into the Work which are hazardous, toxic or comprised of any items that are hazardous or toxic.

ARTICLE 11 - INSURANCE AND BONDS

Add the following language to the end of Paragraph 11.1.1:

The Contractor shall require each of his Subcontractors to procure and maintain during the life of his subcontract, insurance of the type and in the amounts specified hereinafter.

Add the following Subparagraph to Subparagraph 11.1.1:

11.1.1.9 Liability Insurance shall include all major divisions of coverage and be on a comprehensive basis, including:

.1 Worker's Compensation.

.2 Comprehensive General Liability - (including Premises Operations; Broad Form Property Damage).

.3 Comprehensive Automobile Liability.

.4 Contractual Liability - applicable to Contractor's obligation under Article 3.18, including all paragraphs thereof as amended.

.5 Personal injury, with Employment Exclusion deleted.

Subparagraph 11.1.2 is deleted and the following is substituted:

11.1.2 Without limiting its liability under this Contract, the Contractor shall procure, pay for and maintain in full force and effect, and shall require each Subcontractor and all sub-subcontractors to procure, and maintain, at all times during the performance of the Work until final acceptance of the Work or until the expiration of the period for correction of Work or for such other period for maintenance of completed operations coverage whichever is longer, policies of insurance issued by a responsible carrier or carriers acceptable to the Owner, and in form and substance reasonably satisfactory to the Owner, which afford the coverages set forth below:

(A) Workmen's compensation insurance in full compliance with the Workmen's Compensation Act of the State of Illinois, All States Endorsement, and Employer's Liability coverage in the amount of $1,000,000.

(B) Comprehensive General Liability bodily injury, including death :

$1,000,000 per occurrence
$1,000,000 per aggregate

Property Damage (Broad Form): $ 500,000 per occurrence
$1,000,000 per aggregate

(C) Comprehensive Automobile liability bodily injury, including death (Owned, leased, or hired, and Non-Owned motor vehicle): $1,000,000 per person
$1,000,000 per occur

Property Damage: $500,000 per aggregate

(D) Contractual Liability:

Body Injury: $1,000,000/$1,000,000

Property Damage: $1,000,000/$1,000,000

Liability insurance shall also include, but not be limited to:

1. Premises - Operations.

2. Products - Completed Operations beyond 2-3 years of project coverage.

3. Independent Contractors.

4. XCU Coverage.

5. Contractual Liability (oral and written).

6. Personal Injury (libel, slander, defamation of character, discrimination).

7. Incidental Medical Malpractice.

(E) Commercial umbrella insurance in excess of above primary limits:

For fire protection, plumbing, mechanical, and electrical subcontractors:

$5,000,000

For all other subcontractors: $1,000,000

(F) Sixty (60) days prior written notice required for coverage cancellation or reduction.

(G) St. Joseph Memorial Hospital to be named as additional insured.

(H) All insurance to be written on an occurrence basis.

Contractor shall also require each Subcontractor to indemnify and hold harmless St. Joseph Memorial Hospital, and its affiliated and related entities, due to such Subcontractor's negligence with respect to

this project, in form and substance acceptable to Owner, and substantially similar to Contractor's indemnification herein.

In the last sentence of Subparagraph 11.3.1, after the word "Owner," add the words "and the Architect."

Add the following language to the end of Subparagraph 11.3.1.1:

Property insurance provided by the Owner shall not cover any tools, apparatus, machinery, scaffolding, hoists, forms, staging, shoring and other similar items commonly referred to as construction equipment, which may be on the site and the capital value of which is not included in the Work. The Contractor shall make its own arrangements for any insurance it may require on such construction equipment. Any such policy obtained by the Contractor under this Paragraph 11.4.1 shall include a waiver of subrogation in accordance with the requirements of Paragraph 11.4.7.

Delete Subparagraph 11.4.1 and substitute the following Subparagraph:

11.5.1 The Contractor shall furnish a Performance Bond and Labor and Material Payment Bond meeting all statutory requirements of the State of Illinois, in form and substance satisfactory to the Owner and, without limitation, complying with the following specific requirements:

.1 Except as otherwise required by statute, the form and substance of such bonds shall be satisfactory to the Owner in the Owner's sole judgment;

.2 Bonds shall be executed by a responsible surety licensed in Illinois, with a Best's rating of no less than A/XII and shall remain in effect for a period not less than two (2) years following the date of Substantial Completion or the time required to resolve any items of incomplete Work and the payment of any disputed amounts, whichever time period is longer;

.3 The performance Bond and the Labor and Material Payment Bond shall each be in an amount equal to the Contract Sum;

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

.5 Every Bond under this Paragraph 11.5.1 must display the Surety's Bond Number. A rider including the following provision shall be attached to each Bond:

(1) Surety hereby agrees that it consents to and waives notice of any addition, alteration, omission, change, or other modification of the Contract Documents which, singularly or in the aggregate, does not exceed 100 percent (100%) of the Contract Sum. Except as to increases in the Contract Sum in excess of the percentage set forth above in this Clause 11.5.1.5(1), any other addition, alteration, change, extension of time, or other modification of the Contract Documents, or a forbearance on the part of either the Owner or the Contractor to the other, shall not release the Surety of its obligations hereunder and notice to the Surety of such matters is hereby waived.

(2) Surety further agrees that in event of any default by the Owner in the performance of the Owner's obligations to the Contractor under the Contract, the Contractor or Surety shall cause written notice of such default (specifying said default in detail) to be given to the Owner, and the Owner shall have thirty (30) days from time after receipt of such notice within which to cure such default, or such additional reasonable period of time as may be required if the nature of such default is such that it cannot be cured within thirty (30) days. Such Notice of Default shall be

sent by certified or registered U.S. Mail, return receipt requested, first class postage prepaid, to Lender and the owner.

(3) Surety agrees that it is obligated under the bonds to any successor, grantee or assignee of the Owner.

Add the following paragraphs to Paragraph 11.4:

11.4.3 The Contractor shall keep the surety informed of the progress of the Work, and, where necessary, obtain the surety's consent to, or waiver of: (1) notice of changes in the Work; (2) request for reduction or release of retention; (3) request for final payment; and (4) any other material required by the surety. The Owner shall be notified by the Contractor, in writing, of all communications with the surety. The Owner may, in the Owner's sole discretion, inform surety of the progress of the Work and obtain consents as necessary to protect the Owner's rights, interest, privileges and benefits under and pursuant to any bond issued in connection with the Work.

11.4.4 Additional performance and payment bonds may be required by the Owner, in the Owner's sole discretion, from any Subcontractor whose Subcontract exceeds One Hundred Thousand Dollars ($100,000.00). The Owner shall pay for any premiums charged for obtaining required Subcontractor bonds by executing a Change Order which shall increase the Contract Sum in an amount equal to such premiums. All such bonds shall be in form and substance satisfactory to the Owner in the Owner's sole judgment.

Add the following Paragraph and Subparagraphs to Article 11:

11.5 General Requirements

11.5.1 All insurance coverage procured by the Contractor shall be provided by insurance companies having policyholder ratings no lower than "A" and financial ratings not lower than "XII" in the Best's Insurance Guide, latest edition in effect as of the date of the Contract, and subsequently in effect at the time of renewal of any policies required by the Contract Documents.

11.5.2 If the Owner or the Contractor is damaged by the failure of the other party to purchase or maintain insurance required under Article 11, then the party who failed to purchase or maintain the insurance shall bear all reasonable costs (including attorneys' fees and court and settlement expenses) properly attributable thereto.

ARTICLE 13 - MISCELLANEOUS PROVISIONS

At the beginning of Subparagraph 13.4.1, add "Except as expressly provided in the Contract Documents."

Add the following language to the end of Subparagraph 13.5.3:

The Contractor also agrees that the cost of testing services required for the convenience of the Contractor in his scheduling and performance of the Work, and the cost of testing services related to remedial operations performed to correct deficiencies in the Work shall be borne by the Contractor.

END OF GENERAL AND SUPPLEMENTARY CONDITIONS

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SUBSURFACE EXPLORATION AND FOUNDATION RECOMMENDATIONS NEW ENDOSCOPIC CENTER FOR ST. JOSEPH MEMORIAL HOSPITAL MURPHYSBORO, ILLINOIS

Prepared for:

Southern Illinois Healthcare
C/O Memorial Hospital of Carbondale
405 West Jackson St.
Carbondale, Illinois

Prepared by:

HOLCOMB FOUNDATION ENGINEERING CO.

Carbondale, Illinois

August 30, 2005

File H-05203

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SUBSURFACE EXPLORATION AND FOUNDATION RECOMMENDATIONS

NEW ENDOSCOPIC CENTER FOR ST. JOSEPH MEMORIAL HOSPITAL

MURPHYSBORO, ILLINOIS

1.0 Introduction

Southern Illinois Healthcare is planning a new Endoscopic Center addition to St. Joseph Memorial Hospital in Murphysboro, Illinois. This report provides a summary of the subsurface exploration and engineering recommendations for foundation design of the proposed facility. Mr. Tom Stewart, Director of Facilities for Southern Illinois Healthcare authorized this project on August 11, 2005.

2.0 Scope and Purpose of Report

The purpose of this geotechnical exploration is to determine subsurface conditions at the specific locations of four soil borings, conduct field and laboratory tests to gather data necessary to perform an evaluation of the subsurface conditions, and prepare engineering recommendations relative to the following items:

- Subsurface conditions encountered in the soil borings, including material types to be expected at existing grades and their impact on the construction scheme.
- Site preparation considerations relative to the subsurface conditions.
- Foundation support of the proposed addition, including acceptable bearing pressures, anticipated bearing levels, and settlement estimates.
- Floor slab support and construction.
- Anticipation and management of ground water during construction.
- Soil material and compaction requirements to construct the proposed building pad.

- Seismic design recommendations for the proposed structure.
- Presence of mining activity as indicated on the Illinois State Geological Survey underground mine maps.

3.0 Site Description

The proposed site is located in the NW ¼ of Section 3, Township 9 South, Range 2 West of the Third Principal Meridian in Jackson County, Illinois. Specifically, the new endoscopic center lies on the southeast corner of the existing hospital building, and will be an L shaped structure. The site was partially a paved parking lot, and partially a grassy lawn area adjacent to the hospital building. The enclosed Boring Location Diagram indicates the borehole locations at this site in relation to the proposed structure.

4.0 Project Description

This project is to consist of construction of a new one story steel frame addition to the hospital building. Plan dimensions are approximately 40 by 160 feet. Maximum column loads are estimated at about 60 kips. The structure will be configured as indicated on the enclosed Boring Location Diagram.

5.0 Field Exploration

On August 24, 2005, we drilled four soil borings at this site. Boring locations were staked by Holcomb Foundation Engineering personnel using a site plan provided by The Lawrence Group, Project Architects.

5.1 Drilling and Sampling Procedures

The soil borings were drilled with a CME-750 all terrain drilling rig. Conventional 3.25 inch inside diameter hollow stem augers were used to advance the boreholes. Representative soil samples were obtained on 2.5 foot intervals employing split barrel sampling procedures in accordance with ASTM D-1586. Upon completion of drilling, the boreholes were backfilled with the soil cuttings.

5.2 Field Tests and Measurements

The following field tests and measurements were performed during the course of exploration activities at the site:

- Ground water readings were obtained during and upon completion of drilling at all soil boring locations.
- Standard penetration tests were performed and penetration resistances recorded during the recovery of all split barrel samples.
- Approximate measurements of undrained shear strength were taken on all cohesive soil samples with a calibrated hand penetrometer.
- All samples were visually classified, according to the Unified Classification System, by the boring technician in preparation of the field boring logs. The samples were then placed into glass jars for transport to our laboratory.

The field test data and measurements are summarized in the Boring Logs located in the appendix to this report.

6.0 Laboratory Tests

In addition to the field exploration, a laboratory-testing program was conducted to determine additional engineering characteristics of the foundation subsoils. All tests were performed in general accordance with applicable ASTM specifications. The laboratory-testing program included the following tests:

6.1 Natural Moisture Content

Natural moisture content determinations were performed on all samples. Moisture content determinations aid in estimating the settlement potential of a soil stratum. The in-situ moistures also yield information as to the workability of a soil type. Moisture content results are graphically presented on the Boring Logs.

6.2 Visual Classifications

All soil samples were visually classified by the geotechnical engineer in accordance with the Unified Classification System. The visual classifications are noted on the Boring Logs.

6.3 Unconfined Compressive Strengths

Cohesive soil samples were subjected to unconfined compressive strength tests. Unconfined compressive strengths are used to determine the maximum allowable bearing capacity of a soil. Results of the compressive strength tests are plotted on the Boring Logs.

6.4 Sample Disposal

The soil samples are stored in our laboratory for further analysis, if desired. Unless notified to the contrary, the samples will be disposed of six months after the date of this report.

7.0 Subsurface Conditions

The types of subsurface materials encountered in the soil borings are briefly described on the Boring Logs in the appendix to this report. The general characteristics are described in the following paragraphs. The conditions represented by these test borings should be considered applicable only at the test boring locations on the dates shown. It is possible the conditions encountered may be different at other locations or at other times.

7.1 General Subsurface Profile

The subsurface profile at this site consists of about one foot of pavement or five inches of topsoil overlying eleven feet of silty clay to clayey silt (CL to ML classification). Below eleven feet lies a silty sand to sandy silt (ML to SC that extends down to at least the bottom of the soil borings, which were terminated at fifteen feet in depth.

7.2 Silty Clay to Clayey Silt

The upper eleven feet of silty clay to clayey silt is firm to stiff, with unconfined compressive strengths ranging from 1.0 to 5.0 tons per square foot, averaging 2.0 tsf. Moisture contents vary from 11 to 27 percent, averaging 20 percent. These soils have a moderate to low settlement potential.

7.3 Silty Sand to Sandy Silt

The silt and sand encountered below eleven feet in depth is firm to stiff, with unconfined compressive strengths ranging from 0.5 to 1.6 tons per square foot, averaging 1.1 tsf. Moisture contents vary from 11 to 25 percent, averaging 18 percent. These soils have a moderate settlement potential.

7.4 Ground Water

During drilling operations, ground water was not encountered in the soil borings. Due to the relatively high elevation of this site in relation to the surrounding terrain, we estimate a low ground water elevation in this area year – round.

7.5 Undermining

Mine maps available from the Illinois State Geological Survey indicate the hospital has been undermined by the Big Muddy Iron and Coal Company "Harrison Mine", abandoned in 1916. No one can predict that subsidence will or will not occur when an area has been undermined. Possible disconformities in the limestone cover, low bearing capacity of the fire clay, and loss of water in the mined out area can all contribute to subsidence. However, at the present time, due to the past history of this site, it is our opinion the potential for future subsidence is low in the vicinity of this addition.

8.0 Grading Considerations

8.1 Site Preparation

Prior to site preparation procedures, the upper few inches of bituminous concrete should be stripped from this site to facilitate installation of utilities. The underlying crushed limestone may remain in place, if possible. Any topsoil in landscaped areas should also be stripped and wasted.

Upon stripping the pavement and topsoil, the exposed subgrade should be proofrolled with a loaded tandem dump truck. Any areas that pump or rut should be either undercut and replaced with a select silty clay fill; or disced and aerated to reduce the moisture content. After aeration, the soil may be compacted to a minimum of 95% of the maximum standard laboratory dry density in accordance with ASTM D-698.

If at all possible the site grading should be performed during hot, dry months of the year. If site grading is performed when the soils are wet, the subgrade may pump to such a degree that it may have to be removed and replaced, or require additional hydrated lime for drying prior to compaction.

8.2 Fill Placement

After stripping the pavement and proofrolling the subgrade, fill soils may be placed to grade the site. It is recommended the fill soils are placed in maximum eight inch loose lifts, with each lift compacted to a minimum of 98% of the maximum standard laboratory dry density *below* the proposed

footing elevations, and 95% compaction *above* the footing elevations. A low plastic silty clay, or crushed limestone may be used for fill to grade the site.

A sufficient number of in-place field density tests should be performed by an engineering technician to evaluate the contractor's performance during fill soil placement and compaction. The tests will also aid in determining whether project specifications are being met. A minimum of four compaction tests per every lift are recommended, with not less than one test per 5000 square feet of fill soil placed.

8.3 Subgrade Preparation of Floor Slabs

Environmental conditions and construction traffic often disturb even a well prepared soil surface at the final grade elevation. Provisions should be made in the construction specifications for the contractor to restore the subgrade soils to a stable condition prior to placing the granular mat. Backfilling of utility trenches is often accomplished in an uncontrolled manner, leading to cracking of floor slabs and pavements. We recommend the utility trenches are backfilled with acceptable fill in eight inch lifts and compacted with piston tampers to the project requirements.

The concrete floor slabs may be supported upon a four inch layer of free draining granular material. Generally, CA-7 or CA-11 crushed limestone is used in Illinois for this purpose. This is to provide a capillary break and a uniform leveling course beneath the slab.

8.4 Ground Water Control

During preparation of the subgrade near the existing ground surface, no ground water is anticipated. However, if free water is encountered in the footing excavations, the contractor should make provisions for temporary drainage through the use of sumps and interceptor ditches.

9.0 Engineering Recommendations

9.1 Building Foundations

Based upon results of the field and laboratory tests, the proposed structure may be supported upon shallow foundations consisting of isolated column and continuous wall footings. It is recommended a maximum allowable soil bearing capacity of up to 2200 pounds per square foot be used to dimension the foundations. Exterior footings should be founded at a minimum depth of 2.5 feet for frost protection. Interior footings in heated areas may be founded at one foot below the final subgrade elevation. It is also recommended the footings have a minimum width of 24 inches to avoid a punching type failure of the foundation.

There is the possibility of encountering foundation soils with less than the required bearing pressure at the foundation elevation. We recommend all foundation subsoils be tested for bearing capacity with a calibrated penetrometer prior to placement of concrete. Should soils with less than the specified bearing capacity be encountered, it is recommended they be excavated and replaced with a properly compacted granular fill soil or lean concrete.

Total settlements of a 60 kip column are estimated to range from approximately 0.4 to 0.8 inch, with less than approximately 0.5 inch of differential settlement. Settlements may be minimized by testing all foundation subsoils and undercut of any unsuitable soils encountered.

9.2 Seismic Design

Based upon the seismic zone maps provided by BOCA, this site has an effective peak velocity related acceleration (A_v) of 0.18, and an effective peak acceleration (A_a) of 0.18. The soils encountered in the borings have an S_1 site classification.

The International Building Code indicates this site has a type "D" site classification, based upon the soil borings.

Due to the clayey soils at this site, there is an extremely low liquefaction potential of the subsoils at this site. The clayey soils are too cohesive for liquefaction to occur.

9.3 Retaining Wall Design

Coefficients for active and passive pressures acting upon retaining walls in the upper ten feet of this site are estimated as follows:

Coefficient of Active Pressure:	0.36
Coefficient of Passive Pressure:	2.77
Coefficient of At-Rest Pressure:	0.53

The silty clay subsoils encountered on this site have a wet soil density of approximately 125 pounds per cubic foot. It is recommended the retaining walls be backfilled with a free draining sand or crushed stone up to within one foot of the final ground line, with perforated PVC pipe at the base of the wall sloped to gravity drain or drain to a sump.

The recommended coefficient of friction between the concrete and soils, which may be used for design is 0.33.

9.4 Floor Slab Design

The proposed concrete slab on grade may be designed using a modulus of subgrade reaction estimated at approximately 100 psi per inch. The soil subgrade beneath the crushed stone and concrete slab should be properly compacted per the recommendations in Section 8 of this report.

10.0 Summary

This subsurface exploration has been conducted at the site of a proposed new Endoscopic Center addition to the existing St. Joseph Memorial Hospital in Murphysboro, Illinois.

Design and construction criteria have been suggested and potential problems have been discussed.

The following information has been discussed in this report:

- Soils encountered on the site consist of one foot of pavement or a few inches of topsoil overlying ten feet of brown silty clay to clayey silt. Below the silty clay lies a sandy silt to silty sand that extends to at least fifteen feet in depth.
- Site grading will include removing the bituminous concrete pavement and topsoil, proofrolling the exposed crushed stone and soil subgrade, and compaction of any fill material placed.
- Foundation design criteria have been discussed, and allowable soil bearing pressures have been recommended for shallow foundations.
- A maximum allowable soil bearing pressure of up to 2200 pounds per square foot has been recommended.
- Prior to placement of concrete in the footing excavations, it is recommended all footings are tested for unsuitable foundation soils. Should unsuitable soil be encountered, it should be overexcavated and replaced.
- Earthquake design criteria include an effective peak velocity related acceleration (A_v) of 0.18, and an effective peak acceleration (A_a) of 0.18. The soils encountered in the boring have an S_1 site classification.
- The International Building Code indicates this site has a type "D" site classification, based upon the soil borings.

The analyses, conclusions, and recommendations contained in this report are professional opinions based on the site conditions and project scope described herein. It is assumed the conditions observed in the exploratory borings are representative of subsurface conditions throughout the site. If during construction, subsurface conditions differ from those encountered in the exploratory borings are observed or appear to be present beneath excavations, we should be advised at once so that we can review these conditions and reconsider our recommendations where necessary. Unless specifically noted, the scope of our services did not include an assessment of the effects of flooding and natural erosion of creeks or rivers adjacent to the project site.

If there is a substantial lapse in time between the submittal of this report and the start of work at this site, or if site conditions are changed due to natural causes or construction operations, we recommend that this report be reviewed to determine the applicability of conclusions and recommendations considering the changed conditions and time lapse.

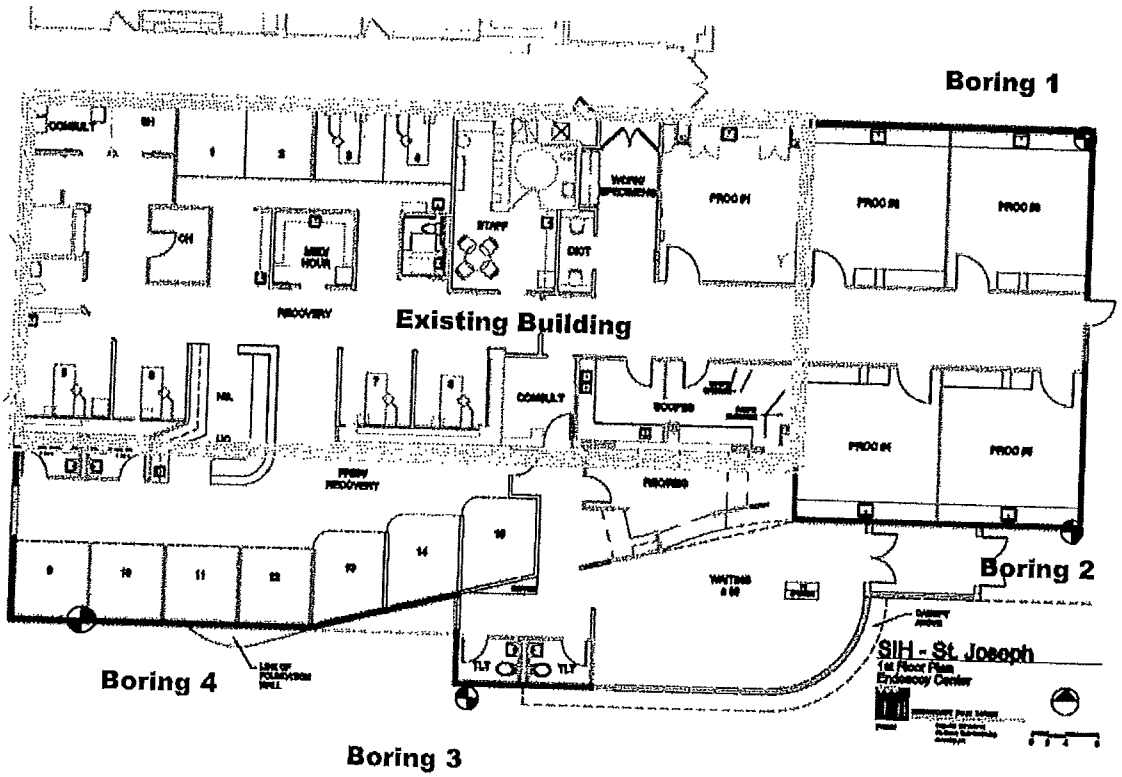
In order for us to provide a complete professional geotechnical engineering service, we should be retained to observe construction, particularly site grading, earthwork and foundation construction.

The scope of our services for this phase of the project does not include any environmental assessment or investigation for the presence or absence of wetlands or hazardous or toxic material in the soil, surface or ground water or air, on or below this site. Any statements in this report or on the boring logs regarding any odors or unusual or suspicious items or conditions observed are strictly for the information of our client.

This report was prepared for the exclusive use of the owner, architect, or engineer for evaluating the design of the project as it relates to the geotechnical aspects discussed herein. It should be made available to prospective contractors for information on factual data only and not as a warranty of subsurface conditions included in this report. Unanticipated soil conditions or rock may require that additional expense be made to attain a properly constructed project. Therefore, some contingency fund is recommended to accommodate such potential extra costs.

It is recommended that we be retained to review final project layout and those portions of plans and specifications which pertain to foundations and earthwork to determine if they are consistent with our findings and recommendations.

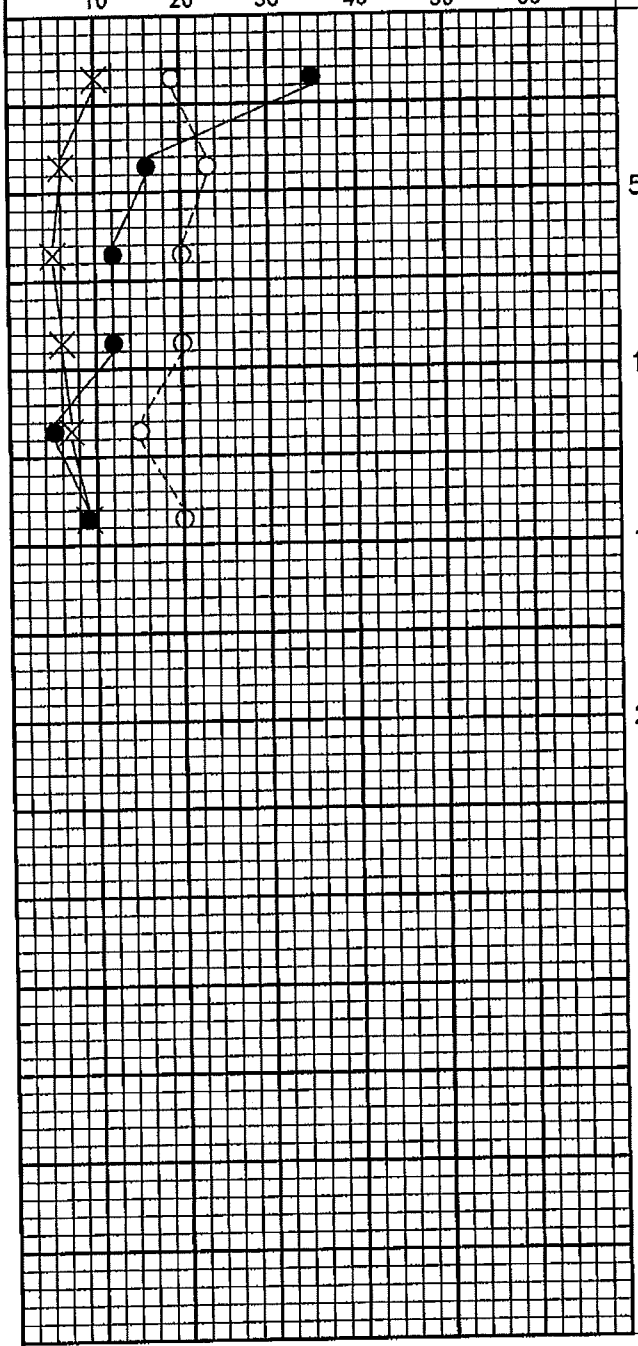
Timothy J. Holcomb, P.E.



Proposed Endoscopic Center St. Joseph Memorial Hospital Murphysboro, Illinois Southern Illinois Healthcare Carbondale, Illinois	**Boring Location Diagram**	North	Project No. H-05203 Not to Scale August 24, 2005

LOG of BORING 1

Holcomb Foundation Engineering Co.



Depth in Feet	Sample No.	Type Sample	Sample Distance	Description of Material
				Surface Elevation
				3.5" Bit. Conc./ 11" C. Stone
	1	ss		Brown Mottled Gray Silty CLAY (CL)
5	2	ss		
	3	ss		
	4	ss		
10	5	ss		Brown Sandy SILT to Silty SAND (SM-ML)
	6	ss		
15				End of Boring @ -15.0'
20				
25				
30				
35				

Ground Water Data
No Ground Water Encountered During Drilling.

Project: Proposed Endoscopic Center
St. Joseph Hospital, Murphysboro, Illinois

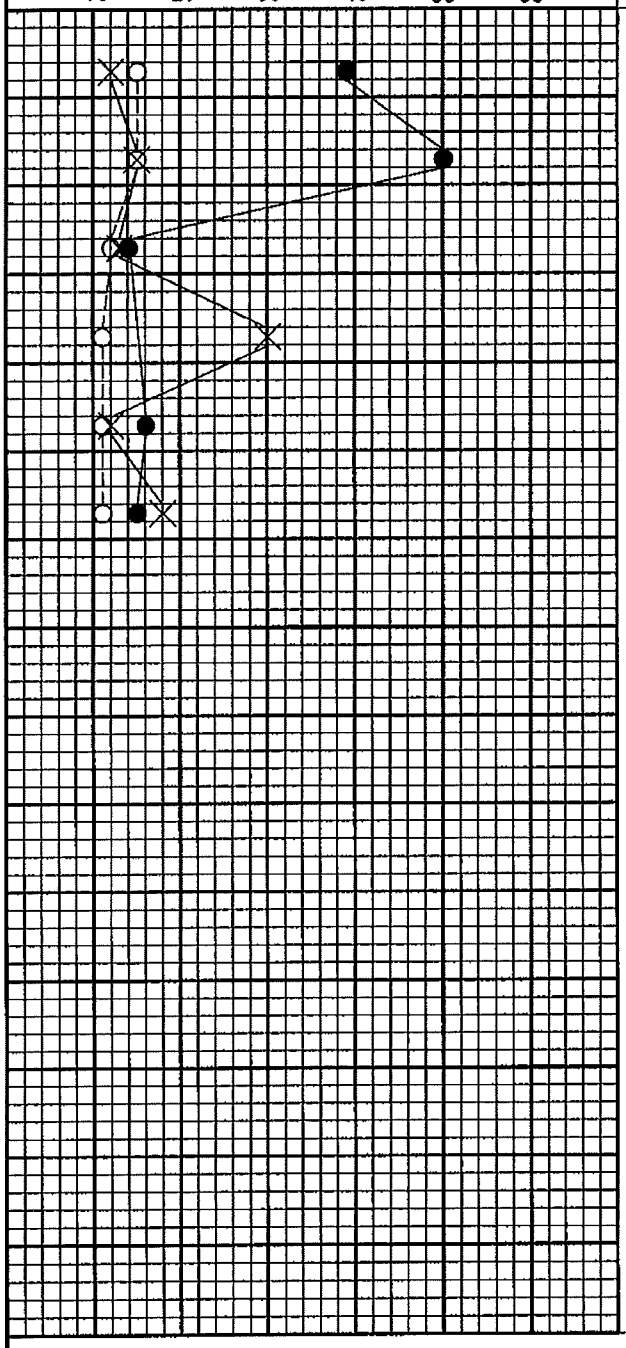
Date of Boring
August 24, 2005

Client: Southern Illinois Healthcare
Carbondale, Illinois

Project No.
H-05203

LOG of BORING 2

Holcomb Foundation Engineering Co.



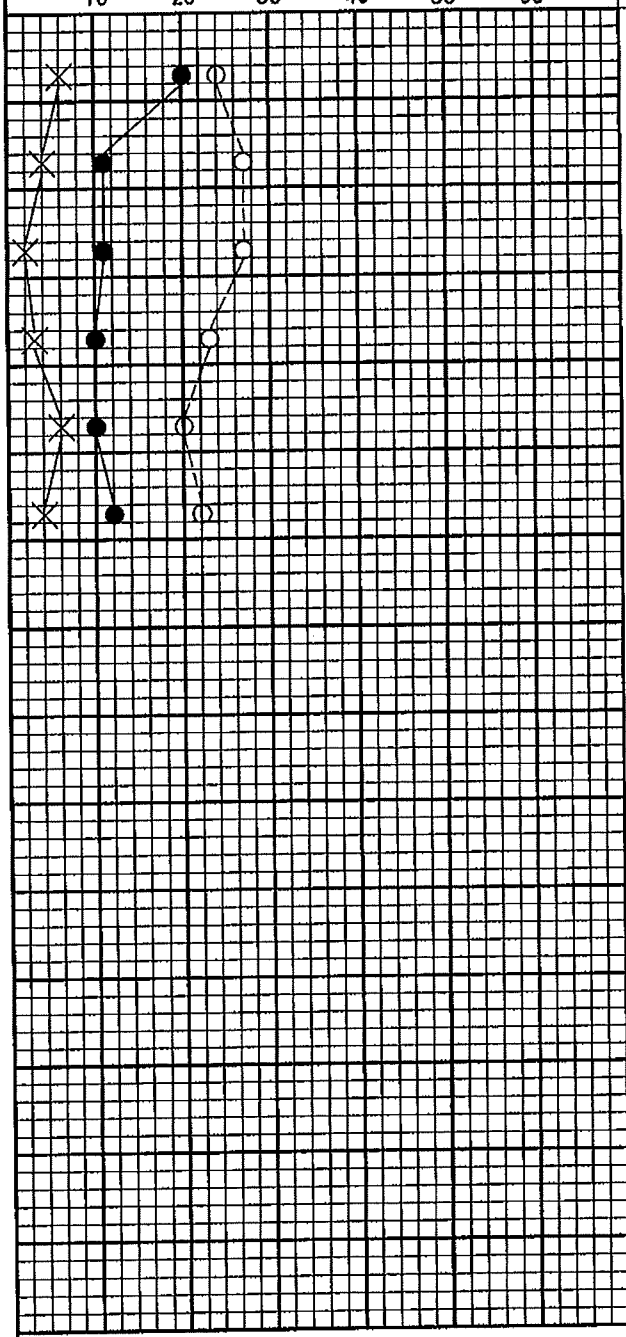
Depth in Feet	Sample No.	Type Sample	Sample Distance	Description of Material
				Surface Elevation
				5" Topsoil
5	1	ss		Brown Mottled Gray Silty CLAY (CL)
	2	ss		
	3	ss		Brown Silty CLAY to Clayey SILT (CL–ML)
10	4	ss		
	5	ss		Brown Sandy SILT to Silty SAND (SM–ML)
15	6	ss		
				End of Boring @ –15.0'
20				
25				
30				
35				

Ground Water Data
No Ground Water Encountered During Drilling.

Project: Proposed Endoscopic Center St. Joseph Hospital, Murphysboro, Illinois	Date of Boring August 24, 2005
Client: Southern Illinois Healthcare Carbondale, Illinois	Project No. H–05203

LOG of BORING 3

Holcomb Foundation Engineering Co.



Depth in Feet	Sample No.	Type Sample	Sample Distance	Description of Material
				Surface Elevation
				3.5" Bit. Conc./ 8" C. Stone
	1	ss		Brown Mottled Gray Silty CLAY (CL)
5	2	ss		
	3	ss		Brown Silty CLAY to Clayey SILT (CL–ML)
10	4	ss		
	5	ss		Brown Sandy SILT to Silty SAND (SM–ML)
	6	ss		
15				End of Boring @ –15.0'
20				
25				
30				
35				

Ground Water Data
No Ground Water Encountered During Drilling.

Project: Proposed Endoscopic Center
St. Joseph Hospital, Murphysboro, Illinois

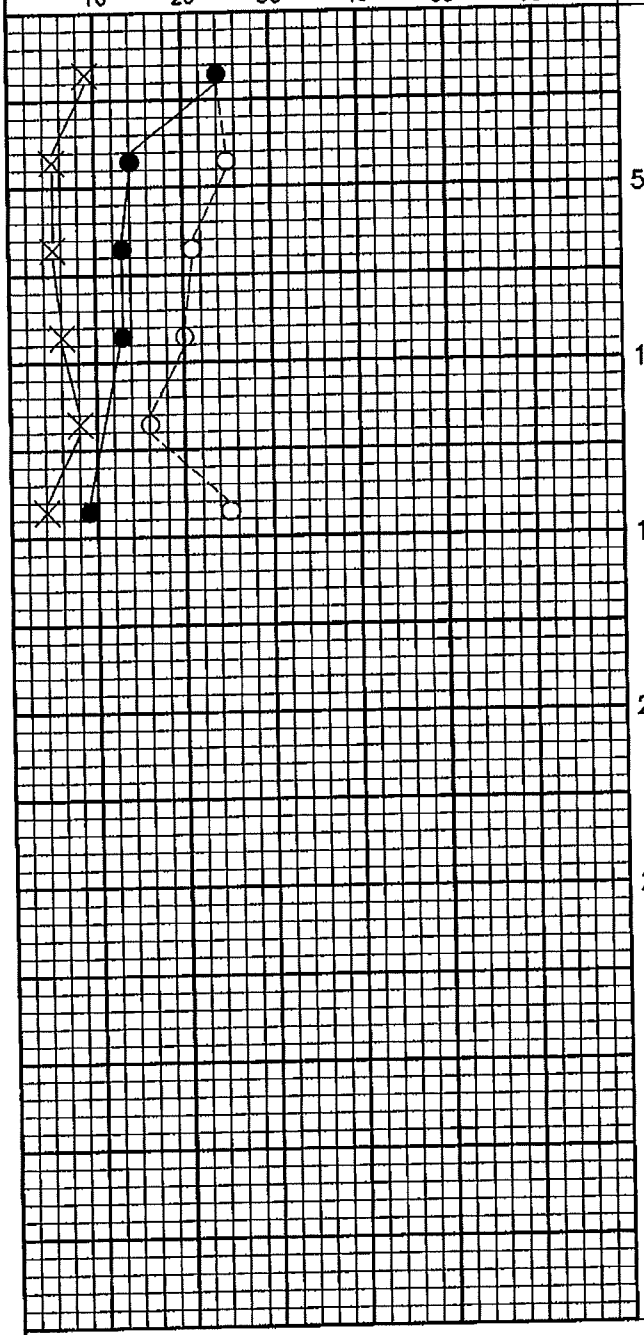
Date of Boring
August 24, 2005

Client: Southern Illinois Healthcare
Carbondale, Illinois

Project No.
H–05203

LOG of BORING 4

Holcomb Foundation Engineering Co.



Depth in Feet	Sample No.	Type Sample	Sample Distance	Description of Material
				Surface Elevation
				3.5" Bit. Conc./ 8" C. Stone
	1	ss		Brown Mottled Gray Silty CLAY (CL)
	2	ss		
5	3	ss		Brown Silty CLAY to Sandy CLAY (CL)
	4	ss		
10	5	ss		Brown Clayey SAND (SC)
	6	ss		Brown Sandy SILT to Silty SAND (SM-ML)
15				End of Boring @ -15.0'
20				
25				
30				
35				

Ground Water Data
. No Ground Water Encountered During Drilling.

Project: Proposed Endoscopic Center
St. Joseph Hospital, Murphysboro, Illinois

Date of Boring
August 24, 2005

Client: Southern Illinois Healthcare
Carbondale, Illinois

Project No.
H-05203

GENERAL NOTES

SAMPLE IDENTIFICATION

The Unified Classification System is used to identify the soil unless otherwise noted.

RELATIVE DENSITY & CONSISTENCY CLASSIFICATION

TERM (NON-COHESIVE SOILS)	BLOWS PER FOOT
Very Loose	0 - 4
Loose	5 - 10
Firm	11 - 30
Dense	31 - 50
Very Dense	Over 50

TERM (COHESIVE SOILS)	QU (tsf)
Very Soft	0 - 0.25
Soft	0.25 - 0.50
Firm	0.50 - 1.00
Stiff	1.00 - 2.00
Very Stiff	2.00 - 4.00
Hard	4.00+

DRILLING & SAMPLING SYMBOLS

ss:	Split Spoon - 1 3/8" I.D., 2" O.D.
st:	Shelby Tube - 2.80"I.D., 3" O.D.
au:	Auger Samples
cs:	Continuous Sampling - 2.0" I.D.

SOIL PROPERTY SYMBOLS

●	Unconfined Compressive Strength, Qu, (tsf)
+	Penetrometer Value, (tsf)
	Plastic Limit (%)
O	Water Content (%)
	Liquid Limit (%)
X	Standard "N" Penetration: Blows per foot of a 140 pound hammer falling 30 inches on a 2" O.D. Split Spoon

PARTICLE SIZE

Boulders	8 in. +	Medium Sand	0.6 mm to 0.2 mm
Cobbles	8 in. to 3 in.	Fine Sand	0.2 mm to 0.74 mm
Gravel	3 in. to 5 mm	Silt	0.074 mm to 0.0005 mm
Coarse Sand	5 mm to 0.6 mm	Clay	less than 0.005 mm

UNIFIED SOIL CLASSIFICATIONS

MAJOR DIVISIONS			SYMBOL	TYPICAL DESCRIPTION
COARSE GRAINED SOILS	GRAVEL AND GRAVELLY SOILS	CLEAN GRAVELS	GW	Well graded gravels, gravel-sand mixtures
			GP	Poorly graded gravels, gravel-sand mixtures
		GRAVELS WITH FINES	GM	Silty gravels, gravel-sand silt mixtures
			GC	Clayey gravels, gravel-sand clay mixtures
	SANDS AND SANDY SOILS	CLEAN SANDS	SW	Well-graded sands, gravelly sands
			SP	Poorly graded sands, gravelly sands
		SANDS WITH FINES	SM	Silty sands, sand-silt mixtures
			SC	Clayey sands, clay-sand mixtures
FINE GRAINED SOILS	SILTS AND CLAYS LOW PLASTICITY		ML	Inorganic silts of clayey silts with slight plasticity
			CL	Inorganic clays of low to medium plasticity
			OL	Organic silts and organic silty clays of low plasticity
	SILTS AND CLAYS HIGH PLASTICITY		MH	Inorganic silts of high plasticity
			CH	Inorganic clays of high plasticity
			OH	Organic clays of medium to high plasticity
HIGHLY ORGANIC SOILS			PT	Peat, humus, swamp soils with high organic contents

Conterminous 48 States
2009 International Building Code
Latitude = 37.77335
Longitude = -89.32435000000001
Spectral Response Accelerations Ss and S1
Ss and S1 = Mapped Spectral Acceleration Values
Site Class B - Fa = 1.0 ,Fv = 1.0
Data are based on a 0.01 deg grid spacing

Period (sec)	Sa (g)
0.2	1.061 (Ss, Site Class B)
1.0	0.291 (S1, Site Class B)

Conterminous 48 States
2009 International Building Code
Latitude = 37.77335
Longitude = -89.32435000000001
Spectral Response Accelerations SMs and SM1
SMs = Fa x Ss and SM1 = Fv x S1
Site Class D - Fa = 1.076 ,Fv = 1.818

Period (sec)	Sa (g)
0.2	1.141 (SMs, Site Class D)
1.0	0.529 (SM1, Site Class D)

Conterminous 48 States
2009 International Building Code
Latitude = 37.77335
Longitude = -89.32435000000001
Design Spectral Response Accelerations SDs and SD1
SDs = 2/3 x SMs and SD1 = 2/3 x SM1
Site Class D - Fa = 1.076 ,Fv = 1.818

Period (sec)	Sa (g)
0.2	0.761 (SDs, Site Class D)
1.0	0.353 (SD1, Site Class D)

SECTION 011000 - SUMMARY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Project information.
2. Work covered by Contract Documents.
3. Phased construction.
4. Owner-furnished products.
5. Access to site.
6. Coordination with occupants.
7. Work restrictions.
8. Specification and drawing conventions.
9. Infection Control.
10. Construction Safety.
11. Southern Illinois Healthcare (SIH) House Rules.
12. Contractor and Vendor Identification System.
13. Smoking.
14. Contractor Parking.

B. Related Requirements:

1. Section 015000 "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.

1.3 PROJECT INFORMATION

A. Project Identification: Endoscopy Center Addition and Renovation.

1. Project Location: Saint Joseph Memorial Hospital, 2 South Hospital Drive, Murphysboro, IL 62966.

B. Owner: Saint Joseph Memorial Hospital.

1. Owner's Representative: Dan Boeckman, Director Design and Construction, Southern Illinois Healthcare, phone: 618-549-0721 x 65436.

C. Architect: The Lawrence Group Architects of St. Louis, Inc., 319 North Fourth Street, Suite 1000, St. Louis, Missouri, 63102.

D. Architect's Consultants: The Architect has retained the following design professionals who have prepared designated portions of the Contract Documents:

1. Civil Engineer: Asaturian Eaton & Associates, P.C.; 1440 Old West Main; Carbondale, IL 62901; (618) 529-3414; (618) 529-3423 Fax. Contact: Praveen Sunny.

2. Structural Engineer: SSE, Inc.; 138 W. Clinton Place; St. Louis, MO 63122-5810; (314) 965-2233; (314) 965-8269 Fax. Contact: Jim Myers.

3. Mechanical, Plumbing, Fire Protection, Electrical Engineer: McClure Engineering Associates; 4545 Oleatha; St. Louis, MO 63116; (314) 645-6232; (314) 645-4128 Fax. Electrical Contact: Steve Dietiker; Mechanical Contact: Keith Esarey and Grant Irvine.

E. Other Owner Consultants: The Owner has retained the following design professionals who have prepared designated portions of the Contract Documents:

1. Health Care Planning & Design: Tchoukaleff Kelly Hartke; 121 Hunter Avenue; St. Louis, MO 63124; (314) 721-1618; (314) 721-8119 Fax. Contact: John Kelly.

F. Contractor: TBD

1.4 WORK COVERED BY CONTRACT DOCUMENTS

A. The Work of Project is defined by the Contract Documents and consists of the following:

1. One-story addition at the Southeast Corner of Saint Joseph Memorial Hospital.

2. Renovation of the existing Procedures Area.

B. Type of Contract:

1. Project will be constructed under a single prime contract.

1.5 PHASED CONSTRUCTION

A. The Work shall be conducted in two (2) phases, with interim short sub-phases as indicated on the Drawings:

B. Before commencing Work of each phase, coordinate with SJMH, submit an updated copy of Contractor's construction schedule showing the sequence, commencement and completion dates and move-out and –in dates of Owner’s personnel for all phases of the Work.

1.6 OWNER-FURNISHED PRODUCTS

A. Unless otherwise indicated, the Owner will furnish and install, under separate contract or other arrangement, the following components of the Work:
1. Telephone instruments and equipment. Work of this contract includes conduit and pull wire.
2. Computer systems and equipment.

3. Office furnishings and equipment.
4. Artwork, interior signage and graphics.
5. Under counter and stand-up refrigerators.
6. Other equipment indicated as furnished by Owner.

1.7 ACCESS TO SITE

A. 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.

B. Use of Site: Limit use of Project site to areas within the limits of Construction. Do not disturb portions of Project site beyond areas in which the Work is indicated.
1. Driveways, Walkways and Entrances: Keep driveways and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials.

a. Schedule deliveries to minimize use of driveways and entrances by construction operations.
b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.
c. Maintain clear access for Ambulances at the Ambulance and Entrance at the South end.

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

1.8 COORDINATION WITH OCCUPANTS

A. Full Owner Occupancy: Owner will occupy site and existing building(s) during entire construction period. 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.

B. Owner Limited Occupancy of Completed Areas of Construction: Owner reserves the right to occupy and to place and install equipment in completed portions of the Work, prior to Substantial Completion of the Work, provided such occupancy does not interfere with completion of the Work. Such placement of equipment and limited occupancy shall not constitute acceptance of the total Work.

1. Architect will prepare a Certificate of Substantial Completion for each specific portion of the Work to be occupied prior to Owner acceptance of the completed Work.
2. Obtain a Certificate of Occupancy from authorities having jurisdiction before limited Owner Occupancy.

3. Before limited Owner occupancy, mechanical and electrical systems shall be fully operational, and required tests and inspections shall be successfully completed. On occupancy, Owner will operate and maintain mechanical and electrical systems serving occupied portions of Work.
4. On occupancy, Owner will assume responsibility for maintenance and custodial service for occupied portions of Work.

1.9 WORK RESTRICTIONS

A. Work Restrictions, General: Comply with restrictions on construction operations.

1. Comply with limitations on use of public streets and with other requirements of authorities having jurisdiction.

B. SIH “House Rules”: Comply with SIH “House Rules” attached at the end of this section.

1. Post copies of the SIH House Rules on the construction site in prominent locations.
2. Provide periodic training to all construction personnel to ensure understanding of the SIH House Rules.
3. Provide training to all construction personnel in fire safety and the proper use of fire extinguishers.
4. Provide the Owner with written verification that training in fire safety, use of fire extinguishers and procedures contained in the SIH House Rules has occurred.

C. On-Site Work Hours: Limit work in the existing building to normal business working hours of 7:00 a.m. to 5:00 p.m., Monday through Friday, unless otherwise indicated.

D. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after providing temporary utility services according to requirements indicated:

1. Notify Owner not less than two days in advance of proposed utility interruptions.
2. Obtain Owner's written permission before proceeding with utility interruptions.

E. Noise, Vibration, and Odors: Coordinate operations that may result in high levels of noise and vibration, odors, or other disruption to Owner occupancy with Owner.

1. Notify Owner not less than two days in advance of proposed disruptive operations.
2. Obtain Owner's written permission before proceeding with disruptive operations.

F. Nonsmoking Building: Smoking is not permitted within the building or within 25 feet (8m) of entrances, operable windows or outdoor-air intakes.

G. Controlled Substances: Use of tobacco products and other controlled substances is not permitted.

H. Employee Identification: Owner will provide identification tags for Contractor personnel working on Project site. Require personnel to use identification tags at all times.

I. Employee Screening: Comply with Owner's requirements for drug and background screening of Contractor personnel working on Project site.

1. Maintain list of approved screened personnel with Owner's representative.

1.10 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 published as part of the U.S. National CAD Standard.
3. Keynoting: Materials and products are identified by reference keynotes referencing Specification Section numbers found in this Project Manual.

1.11 INFECTION CONTROL

A. Contractor shall make every effort to prevent dust and debris generated by construction activities from contaminating adjacent hospital areas. Build perimeter barriers, control air pressure, and institute procedures as required so that airborne pathogens that cause infections and that are associated with construction dust and debris can be confined and not be spread to adjacent areas.

1. Provide negative air pressure within the construction area in relation to adjacent occupied spaces within the existing hospital. Test air pressure daily in construction areas and maintain an air pressure log to show that negative air pressure is being maintained.
2. Where renovation work takes place within the existing building provide temporary partitions as required to secure construction area, to confine dust, and to maintain a negative pressure wherever construction activities take place, including areas above the ceiling.
3. Where renovation work takes place within the existing building provide construction area access doors that are lockable and that close tightly. Install walk-off mats at construction access points and clean mats daily.
4. Remove trash and debris within the construction area on a daily basis. Cover trash carts if transported through hospital areas. Do not allow dust and dirt to accumulate within construction area.
5. Prior to commencing work in the respective sub-phases, coordinate with SJMH Infectious Control Department.

1.12 CONSTRUCTION SAFETY

A. Contractor Use of the Existing Building: The Contractor is responsible for safety within the construction area and for the safety of the general public where it relates to the construction process. Take all precautions necessary to insure safety within the areas.

1. Keep public areas such as hallways, stairs, elevator lobbies and toilet rooms free from accumulation of waste material, rubbish or construction debris.
2. Maintain all public exits in an unobstructed condition and usable for emergency exiting. Where construction requires that exits be closed, provide alternate routes that are properly marked and lighted.
3. Ensure free and unobstructed access for vehicles and pedestrians to all hospital entrances. Where construction must interfere with any access, provide alternate routing that is properly marked and lighted.
4. Restrict the construction area from access by the general public through the use of temporary partitions, locks, etc., as required for public safety. Keep construction area clean and maintain safety precautions. Do not use public areas for storage of materials, staging areas, or work areas. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on the site.
5. Maintain all fire alarm, detection, and suppression systems during the construction period or provide temporary devices where construction requires dismantling or shutdown of existing devices or systems. In no case shall fire safety devices be left inoperable when construction personnel are not on the premises. Temporary systems shall be inspected and tested monthly. Written tests results shall be provided to Owner.
6. Open flames of any kind, including the use of acetylene torches or any open flame tools, will not be permitted on the premises without a written permit issued by the Contractor. The permit forms to be used will be supplied to the Contractor by the Hospital and require that during the use of open flame tools a person stand as fire watch who has had training and experience in putting out minor fires.

1.13 SOUTHERN ILLINOIS HEALTHCARE (SIH) HOUSE RULES

A. House Rules: Post copies of the Saint Joseph Memorial SIH ‘House Rules’ on the construction site in prominent locations. A copy of the ‘House Rules’ is attached at the end of this section and additional copies of the ‘House Rules’ are available from the hospital Engineering Office.

1. Provide periodic training to all construction personnel to insure understanding of the ‘House Rules’.
2. Provide training to all construction personnel in fire safety and the proper use of fire extinguishers.
3. Provide the Owner with written verification that training in fire safety, use of fire extinguishers, and ‘House Rules’ has occurred.
4. Construction personnel will be required to wear Contractor ID badges while on hospital premises. Badges will be issued by the hospital on receipt of a copy of each individual’s driver’s license.

1.14 CONTRACTOR AND VENDOR IDENTIFICATION SYSTEM

A. All employees of contractors and vendors serving Southern Illinois Healthcare must visibly display an SIH-issued identification badge at all times while serving in a professional capacity on SIH-controlled property.

1. Each employee of a contractor or vendor requiring access to any SIH facility or property must submit to a criminal history background check that will be conducted by SIH Security prior to being issued an identification badge. Persons with criminal histories can be denied access to SIH facilities and properties.
2. No person with a felony conviction will be granted access to any SIH facility. Persons with certain high and aggravated misdemeanors may be denied access based on a decision of the security supervisor after consideration of the type of crime, age of the offense, and length of criminal history.

B. Each employee of the contractor requesting an SIH-issued identification badge is required to fill out and sign the form notifying them of a background check. These forms will be submitted to the security office of SIH.

C. Each employee of the contractor requesting an SIH-issued identification badge is required to submit a photo copy of the employee's driver's license or identification card to the Security Office of Saint Joseph Memorial Hospital.

1.15 SMOKING

A. Smoking and any use tobacco products is not allowed by the Contractor, subcontractors, their employees, suppliers, or any construction personnel on hospital property, including outdoor areas. The General Contractor has the responsibility to enforce this requirement. Violators may be barred from the construction site.

1.16 CONTRACTOR PARKING

A. Park Contractor vehicles in the Contractor Parking Lot – coordinate with SJMH. No parking will be permitted on sidewalks, grassy medians, of driveways. Violators will be warned once and subsequent violations will result in vehicles being towed at the expense of the vehicle's owner.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 011000

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SIH HOUSE RULES

January 1, 2013

BEHAVIOR: Contractors are expected to be on their best behavior and treat everyone with courtesy and respect. Harassment of any sort will not be tolerated.

ABOVE CEILING WORK: An Above Ceiling Permit is required for ANY work above the ceiling. Contact Facilities Engineering.

Removable ceiling tiles and grid that are removed for work during the day must be reinstalled at night in all areas that are not protected by construction partitions.

CLEANUP: Contractors are responsible for their own daily and final cleaning.

CONFINED SPACE ENTRY: OSHA compliance is mandatory. Warning labels on spaces are required. Permits are issued by Facilities Engineering. All other entry is prohibited.

DATA ROOM WORK: Must be reviewed and approved by Information Technologies and Facilities Engineering before work begins. Special precautions are required to minimize dust and heat.

DEMOLITION MATERIALS: SIH retains right of first refusal of demolition materials.

DINING: Contact Facilities Engineering to determine if access to cafeteria is permitted.

DOORS: Doors to construction sites remain closed at all times and locked when site is not occupied. Fire rated doors will not be propped or blocked open in any manner that would prevent them from closing in event of fire. Always close and lock doors providing access to a roof (even when contractors are on site).

DRAINS: Facilities Engineering approval is required prior to pouring anything down a drain.

ELECTRICAL PANELS/DISCONNECTS: Notify Facilities Engineering before turning off any electrical circuit breaker or disconnect switch. Panel covers in occupied areas must be in place and locked. If this is not possible, a person must be stationed within arm's reach at all times.

FIRE PROTECTION:

Notify Facilities Engineering **prior to performing any work on any fire alarm system device or sprinkler system device**. Permission from Facilities Engineering is required to leave any part of these systems inoperable or deactivated.

Detectors connected to the building fire alarm system shall be installed and remain operational in the construction area. Dust can easily set off a smoke detector, as can the release of some aerosols. If in doubt, ask!

Coordinate **installation and monthly testing of temporary fire protection systems** with Facilities Engineering.

Provide **required fire extinguishers** for use in the construction area.

To report a fire, immediately close doors to area and activate closest pull station (located near all exits).

If the **fire alarm sounds** (Code Red, Zone ……), close all doors, stay where you are, and follow directions of staff.

FIRESTOPPING: Proper firestopping of all penetrations is the responsibility of the contractor. Methods for sealing of all penetrations of corridor walls, smoke walls, firewalls, and rated ceiling assemblies must be approved by Facilities Engineering , both before work starts and after it is completed.

FLAMMABLE LIQUIDS must be removed from the premises at the end of each work period/day unless contained in appropriate fire rated containers.

HAZARDOUS CHEMICALS: File an MSDS sheet with Facilities Engineering on all hazardous chemicals used. MSDS sheets are available for hazardous chemicals used by the hospital.

IDENTIFICATION: Contractors are required to wear identification badges at all times and are issued per SIH policy.

INFECTION CONTROL: Contractors follow the hospital's required Infection Control Risk Assessment program (ICRA).

LOCKOUT/TAGOUT: OSHA compliance is mandatory. Honor all locks and tags.

PAGING SYSTEM: Notify Facilities Engineering prior to any work on the overhead paging system. Do not make any part of this system inoperable without specific permission.

PARKING: Unload construction vehicles as quickly as possible, move to the designated parking area, and comply with all requests made by Security or Facilities Engineering. Loading dock may be used for loading and unloading only when it does not interfere with normal operation of the area. Permission from Facilities Engineering is required to leave materials at the area.

PROTECTION OF BUILDING SITE: Contractor will protect building from damage and maintain weather tight conditions during construction. Contractor will repair/replace all damage caused by construction operations. Report any damage during construction to Facilities Engineering immediately.

NOISE/LANGUAGE: Loud noises and offensive language are prohibited. Personal radios are allowed in unoccupied areas if the volume is kept low and there are no complaints.

RADIOS/CELLULAR PHONES: The use of 2-way radios is prohibited. Cellular phones may be restricted in certain areas of the facility. Obey all signs and instructions of SIH staff.

REST ROOMS: You will be shown which rest rooms you may use.

ROUTES: Entrances and routes to and from your job sites will be identified. You may be required to provide protection to building finishes when using these routes.

STOP WORK: You may be asked to stop working if it is disrupting the activities of the facility. You will be notified when you may resume work.

SMOKING/TOBACCO: Use of tobacco products by employees, non-employee workers, visitors, and patients is prohibited on any SIH campus. This includes all indoor and outdoor areas owned or occupied by SIH regardless of whether they touch hospital or other building property or not, company vehicles, and areas that the general public perceives as SIH property; includes sidewalks, the area between the sidewalks, and the streets surrounding actual SIH property.

TOOLS/LADDERS/EQUIPMENT: Contractors are expected to provide their own. Facilities Engineering must approve exceptions.

WELDING/CUTTING/BURNING: A Hot Work permit from Facilities Engineering is required before doing any welding, cutting, etc. Adhere to requirements on permit.

THESE RULES APPLY TO ALL CONTRACTORS AND SERVICE PERSONNEL WHO WORK AT AN SIH FACILITY.

FAILURE TO ABIDE BY THESE RULES MAY RESULT IN YOUR REMOVAL FROM THE JOBSITE AND SUSPENSION OF FUTURE BUSINESS WITH YOU OR YOUR FIRM.

SECTION 012100 - ALLOWANCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements governing allowances.

1. Certain items are specified in the Contract Documents by allowances. Allowances have been established in lieu of additional requirements and to defer selection of actual materials and equipment to a later date when direction will be provided to Contractor. If necessary, additional requirements will be issued by Change Order.

B. Types of allowances include the following:
1. Unit-cost allowances.
2. Quantity allowances.

C. Related Requirements:

1. Section 012200 "Unit Prices" for procedures for using unit prices.

D. Include in the Contract Sum all allowances stated in the Contract Documents and/or listed at the end of this section.

1.3 SELECTION AND PURCHASE

A. At the earliest practical date after award of the Contract, advise Architect of the date when final selection and purchase of each product or system described by an allowance must be completed to avoid delaying the Work.

B. At Architect's request, obtain proposals for each allowance for use in making final selections. Include recommendations that are relevant to performing the Work.

C. Purchase products and systems selected by Architect from the designated supplier.

1.4 ACTION SUBMITTALS

A. Submit proposals for purchase of products or systems included in allowances, in the form specified for Change Orders.

1.5 INFORMATIONAL SUBMITTALS

A. Submit invoices or delivery slips to show actual quantities of materials delivered to the site for use in fulfillment of each allowance.

B. Submit time sheets and other documentation to show labor time and cost for installation of allowance items that include installation as part of the allowance.

C. Coordinate and process submittals for allowance items in same manner as for other portions of the Work.

1.6 COORDINATION

A. Coordinate allowance items with other portions of the Work. Furnish templates as required to coordinate installation.

1.7 UNIT-COST AND QUANTITY ALLOWANCES

A. Allowance shall include cost to Contractor of specific products and materials ordered by Owner or selected by Architect under allowance and shall include applicable taxes, freight, and delivery to Project site.
   1. The amount of each allowance includes the cost to the Contractor, less any applicable trade discounts, of the materials and equipment required by the allowance.

B. Unless otherwise indicated, Contractor's costs for receiving and handling at Project site, labor, installation, overhead and profit, and similar costs related to products and materials selected by Architect under allowance shall be included as part of the Contract Sum and not part of the allowance.
   1. Further, the following Contractor's costs shall be included in the Contract Sum and not in the allowance:
      a. Handling at the site; including unloading, uncrating, storing, and protecting.
      b. Labor including installation and finishing, except where labor is specified to be included in the allowance.
      c. All other expenses required to complete the installation.
      d. Contractor's and subcontractor's overhead and profit.

C. Unused Materials: Return unused materials purchased under an allowance to manufacturer or supplier for credit to Owner, after installation has been completed and accepted.

   1. If requested by Architect, retain and prepare unused material for storage by Owner. Deliver unused material to Owner's storage space as directed.

1.8 CONTINGENCY ALLOWANCES

A. Use the contingency allowance only as directed by Architect for Owner's purposes and only by Change Orders that indicate amounts to be charged to the allowance.

B. Contractor's overhead, profit, and related costs for products and equipment ordered by Owner under the contingency allowance are included in the allowance and are not part of the Contract Sum. These costs include delivery, installation, insurance, equipment rental, and similar costs.

C. Change Orders authorizing use of funds from the contingency allowance will include Contractor's related costs and reasonable overhead and profit margins.

D. At Project closeout, credit unused amounts remaining in the contingency allowance to Owner by Change Order.

1.9 ADJUSTMENT OF ALLOWANCES

A. Allowance Adjustment: To adjust allowance amounts, prepare a Change Order proposal based on the difference between purchase amount and the allowance, multiplied by final measurement of work-in-place where applicable. 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.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine products covered by an allowance promptly on delivery for damage or defects. Return damaged or defective products to manufacturer for replacement.

3.2 PREPARATION

A. Coordinate materials and their installation for each allowance with related materials and installations to ensure that each allowance item is completely integrated and interfaced with related work.

3.3 SCHEDULE OF ALLOWANCES

A. **Allowance No. 1: Earthwork Quantity Allowance:** Include 2000 cu. yd. (1529 cu. m) of unsatisfactory soil excavation and disposal off-site and replacement with satisfactory soil material from off-site, as specified in Section 312213 "Rough Grading."

1. Coordinate quantity allowance adjustment with unit-price requirements in Section 012200 "Unit Prices."

B. **Allowance No. 2: Floor Preparation Quantity Allowance:**
1. **Allowance No. 2A:** Include the sum of **$80,000.00** for topical moisture mitigation, as specified in Section 096010 “Topical Moisture Vapor Mitigation Systems,” at **new** concrete floor slabs.
2. **Allowance No. 2B:** Include the sum of **$50,000.00** for topical moisture mitigation, as specified in Section 096010 “Topical Moisture Vapor Mitigation Systems,” at **existing** concrete floor slabs.

C. **Allowance No. 3: Flooring Adhesive Quantity Allowance:**
1. **Allowance No. 3A:** Include the sum of **$4,000.00** for spray-applied adhesive, as specified in Section 096516 “Resilient Sheet Flooring,” Section 096519 “Resilient Tile Flooring,” and Section 096813 “Tile Carpeting” used in lieu of standard adhesive at resilient flooring installed over **new** concrete floor slabs.
2. **Allowance No. 3B:** Include the sum of **$2,500.00** for spray-applied adhesive, as specified in Section 096516 “Resilient Sheet Flooring,” Section 096519 “Resilient Tile Flooring,” and Section 096813 “Tile Carpeting” used in lieu of standard adhesive at resilient flooring installed over **existing** concrete floor slabs.

D. **Allowance No. 4: Masonry Unit-Cost Allowance:** Include the sum of **$425.00** per thousand for colored and textured face brick as specified in Section 042000 "Unit Masonry" and as shown on Drawings.

END OF SECTION 012100

SECTION 012200 - UNIT PRICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for unit prices.

B. Related Requirements:

1. Section 012600 "Contract Modification Procedures" for procedures for submitting and handling Change Orders.
2. Section 014000 "Quality Requirements" for general testing and inspecting requirements.

1.3 DEFINITIONS

A. Unit price is an amount incorporated in the Agreement, applicable during the duration of the Work as a price per unit of measurement for materials, equipment, or services, or a portion of the Work, added to or deducted from the Contract Sum by appropriate modification, if the scope of Work or estimated quantities of Work required by the Contract Documents are increased or decreased.

1.4 PROCEDURES

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

B. Measurement and Payment: See individual Specification Sections for work that requires establishment of unit prices. Methods of measurement and payment for unit prices are specified with Unit Prices.

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 schedule of unit prices is included in Part 3. 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 SCHEDULE OF UNIT PRICES

A. **Unit Price 1:** Removal of unsatisfactory soil and replacement with satisfactory soil material.

1. Description: Unsatisfactory soil excavation and disposal off site and replacement with satisfactory fill material or engineered fill from off site, as required, according to Section 312213 "Rough Grading."
2. Unit of Measurement: Cubic yard (Cubic meter) of soil excavated, based on survey of volume removed.
3. Quantity Allowance: Coordinate unit price with allowance adjustment requirements in Section 012100 "Allowances."

B. **Unit Price No. 2:** Floor Preparation.

1. Description: Topical moisture vapor mitigation system installed over concrete floor slabs according to Section 096010 “Topical Moisture Vapor Mitigation Systems."
2. Unit of Measurement: Square feet (Square meters) of moisture mitigation installed.
3. Quantity Allowance: Coordinate unit price with allowance adjustment requirements in Section 012100 "Allowances."

C. **Unit Price No. 3:** Flooring Adhesive.

1. Description: Spray-applied adhesive in lieu of standard adhesive at flooring installed over concrete floor slabs according to Section 096516 “Resilient Sheet Flooring,” Section 096519 “Resilient Tile Flooring,” and Section 096813 “Tile Carpeting.”
2. Unit of Measurement: Square feet (Square meters) of adhesive installed.
3. Quantity Allowance: Coordinate unit price with allowance adjustment requirements in Section 012100 "Allowances."

END OF SECTION 012200

SECTION 012300 - ALTERNATES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for alternates.

1.3 DEFINITIONS

A. Alternate: An amount proposed by bidders and stated on the Bid Form for certain work defined in the bidding requirements that may be added to or deducted from the base bid amount if Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.

1. 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.

1.4 PROCEDURES

A. Coordination: Revise or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.

1. Include as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not indicated as part of alternate.

B. Notification: Immediately following award of the Contract, notify each party involved, in writing, of the status of each alternate. Indicate if alternates have been accepted, rejected, or deferred for later consideration. Include a complete description of negotiated revisions 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

1. **Alternate No. 1** – Construction of Shell for the Endoscopy Center – Waiting/Reception and Registration See Sheets A211, A212, A222, A232, A242, A401, A402, A403, A404, A502, A601, A701, A801 and Engineering drawings.

   a) Construct shell space, including structural foundation, concrete slab, structural steel, exterior walls, roof structure and roofing as indicated on Drawings.
   b) C Provide a HM Frame (HM-1) and Wood Door (WD-A) 3'-0" W x 7'-0" H ilo of Door 1051 and BL-1
   c) Provide 1 HR Smoke Barrier (Part. Type 2A) on the west and south walls of the Shell Space.
   d) Provide the Plumbing Rough-Ins for the Sink on the west wall of Waiting 1051 and the Plumbing Rough-Ins for the Women's Rest Room 1056 and Men's Rest Room 1057.
   e) Concrete Slab is not to be poured.
   f) 5/8" Type "X" Gyp Bd on the exterior walls (North and East) is not in this scope.
   g) See MEPFP drawings for MEPFP scope of work in the Shell.

2. **Alternate No. 2** – Construction of Fit Out of Waiting, Reception and Registration. See Sheets A211, A232, A242, A502, A601, A701, A801, I100, I102, I202 and Engineering drawings.

   a) Provide fit out as indicated.

3. **Alternate No. 3** – Additional Parking / Site Lighting Power/Control

   a) See Civil drawings for Parking Lot.
   b) Include separate pricing to provide and install exterior site lighting as shown on the electrical site plan. Lighting shall be controlled via building automation system relay. Programming/scheduling to be coordinated with SJMH Facilities Engineering and Premium Mechanical.

4. **Alternate No. 4** – Solid Surface Countertops + Backsplashes, Integral Sinks.

   a) **Alternate 4A:** Include separate pricing to provide and install solid surface countertops and backsplashes (SS-1-A) with integral solid surface sinks (SS-2-B) in lieu of plastic laminate tops/backsplash and stainless steel drop-in sinks at the following locations: Meds 1024, Nourish 1103, and Staff Lounge 1119.

   b) **Alternate 4B:** Include separate pricing to remove existing countertops, backsplash, and drop-in sink and replace with new solid surface top and backsplash (SS-1-A) and integral solid surface sink (SS-2-B) at the following locations: Procedure #2 1043, Procedure #1 1044, and Recovery 1109.

5. **Alternate No. 5** – Sheet Vinyl, Wall Base

a) Include separate pricing to remove existing vinyl composition tile and vinyl wall base in its entirety, patch/prep slab and wall as required to receive new homogeneous sheet goods (SV-1, SV-3), and 4"H vinyl wall base (RB-1-A) at the following locations: Alcove 1001, Corridor 1003, Corridor 1006, and Alcove 1007. Refer to Finish Plan 1/I103 for extent of work and floor pattern layout.

6. **Alternate No. 6** – Sinks, Wall Tile

a) **Alternate 6A:** Include separate pricing to provide and install, upgraded wall mounted sinks, American Standard Murro or similar where hand wash sinks are located on the North and South Wall of Corridor 1109, North and South Wall at Corridor 1106.

b) **Alternate 6B:** Include separate pricing to provide and install, ceramic wall tile (CWT-1-A) from top of base to 4'-0" AFF on 3 walls of hand wash sink alcove at North, South Wall of Corridor 1009, South Wall at Corridor 1106. Install Schluter Systems Quadec Trim where top of tile meets wall. At sink on North wall of Corridor 1106, install ceramic wall tile from outside corner to edge of door frame to the west, from top of wall base to 4'-0" AFF. Install Schluter Systems Quadec Trim where top of tile meets wall, and vertically at outside corner.

7. **Alternate No. 7** – Electronic Shade Window Treatment

a) Include separate pricing to provide and install, electronic roller shades (WT-1-A) in lieu of a manual roller shade on the North and East wall of Waiting Room 1051.

8. **Alternate No. 8** – Procedure Rooms 1 and 2 Audio Systems

a) Include separate pricing to provide and install audio systems in the existing Procedure Rooms #1 (1044) and #2 (1043). Reference sheet E6.1 for detailed wiring diagram. (Procedure Rooms #3 (1033) and #4 (1034) shall be included in base bid)

END OF SECTION 012300

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SECTION 012500 - SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for substitutions.

B. Related Requirements:
1. Section 012300 "Alternates" for products selected under an alternate.
2. Section 016000 "Product Requirements" for requirements for submitting comparable product submittals for products by listed manufacturers.
3. All other Sections for specific requirements and limitations for substitutions.

1.3 DEFINITIONS

A. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.

1. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.
2. Substitutions for Convenience: Changes proposed by Contractor or Owner that are not required in order to meet other Project requirements but may offer advantage to Contractor or Owner.
3. The following are not considered substitutions:
   a. Substitutions requested during the bidding period and accepted prior to award of Contract.
   b. Revisions to Contract Documents requested by the Owner or Architect.
   c. Specified options of products and construction methods included in Contract Documents.
   d. Compliance with governing regulations and orders issued by governing authorities.

1.4 ACTION SUBMITTALS

A. Substitution Requests: Submit **three** copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

1. Substitution Request Form: Use **CSI Form 13.1A**, or General Contractor's equivalent acceptable to Architect.
2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:

    a. Statement indicating why specified product or fabrication or installation cannot be provided, if applicable.
    b. Coordination information, including a list of changes or revisions needed to other parts of the Work and to construction performed by Owner and separate contractors, that will be necessary to accommodate proposed substitution.
    c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Include annotated copy of applicable Specification Section. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.
    d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
    e. Samples, where applicable or requested.
    f. Certificates and qualification data, where applicable or requested.
    g. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners.
    h. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
    i. Research reports evidencing compliance with building code in effect for Project, or from a model code organization acceptable to authorities having jurisdiction.
    j. Detailed comparison of Contractor's construction schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.
    k. Cost information, including a proposal of change, if any, in the Contract Sum.
    l. Contractor's certification that proposed substitution complies with requirements in the Contract Documents except as indicated in substitution request, is compatible with related materials, and is appropriate for applications indicated.
    m. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.

3. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within **seven** days of receipt of a request for substitution. Architect will notify Contractor of acceptance or rejection of proposed substitution within **10** days of receipt of request, or **5** days of receipt of additional information or documentation, whichever is later.

    a. Forms of Acceptance: Change Order, Construction Change Directive, or Architect's Supplemental Instructions for minor changes in the Work.
    b. Use product specified if Architect does not issue a decision on use of a proposed substitution within time allocated.

1.5 QUALITY ASSURANCE

A. Compatibility of Substitutions: Investigate and document compatibility of proposed substitution with related products and materials. Engage a qualified testing agency to perform compatibility tests recommended by manufacturers.

1.6 PROCEDURES

A. Coordination: Revise or adjust affected work as necessary to integrate work of the approved substitutions.

PART 2 - PRODUCTS

2.1 SUBSTITUTIONS

A. Substitutions for Cause: Submit requests for substitution immediately on discovery of need for change, but not later than **15** days prior to time required for preparation and review of related submittals.

1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:

a. Requested substitution is consistent with the Contract Documents and will produce indicated results.
b. Requested substitution provides sustainable design characteristics that specified product provided.
c. Substitution request is fully documented and properly submitted.
d. Requested substitution will not adversely affect Contractor's construction schedule.
e. Requested substitution has received necessary approvals of authorities having jurisdiction.
f. Requested substitution is compatible with other portions of the Work.
g. Requested substitution has been coordinated with other portions of the Work.
h. Requested substitution provides specified warranty.
i. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

B. Substitutions for Convenience: Architect will consider requests for substitution if received within **60** days after commencement of the Work. Requests received after that time may be considered or rejected at discretion of Architect.

1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:

a. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
b. Requested substitution does not require extensive revisions to the Contract Documents.
c. Requested substitution is consistent with the Contract Documents and will produce indicated results.
d. Requested substitution provides sustainable design characteristics that specified product provided.
e. Substitution request is fully documented and properly submitted.
f. Requested substitution will not adversely affect Contractor's construction schedule.
g. Requested substitution is directly related to an “or equal” clause or similar language in the Contract Documents.
h. Requested substitution has received necessary approvals of authorities having jurisdiction.
i. Requested substitution is compatible with other portions of the Work.
j. Requested substitution has been coordinated with other portions of the Work.
k. Requested substitution provides specified warranty.
l. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

PART 3 - EXECUTION (Not Used)

END OF SECTION 012500

SECTION 012600 - CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for handling and processing Contract modifications.

B. Related Requirements:

1. Section 012500 "Substitution Procedures" for administrative procedures for handling requests for substitutions made after the Contract award.

1.3 MINOR CHANGES IN THE WORK

A. Architect will issue, through Construction Manager or General Contractor, supplemental instructions authorizing minor changes in the Work, not involving adjustment to the Contract Sum or the Contract Time, on **AIA Document G710, "Architect's Supplemental Instructions."**

1.4 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. Work Change Proposal Requests issued by Architect are not instructions either to stop work in progress or to execute the proposed change.
2. Within **10** days, when not otherwise specified, 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 costs of labor and supervision directly attributable to the change.
d. 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 fin-

ish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.

e. Quotation Form: Use forms acceptable to Architect.

B. Contractor-Initiated Proposals: If latent or changed conditions require modifications to the Contract, Contractor may initiate a claim by submitting a request for a change to Architect.

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 costs of labor and supervision directly attributable to the change.
5. 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.
6. Comply with requirements in Section 012500 "Substitution Procedures" if the proposed change requires substitution of one product or system for product or system specified.
7. Proposal Request Form: Use **AIA Document G709** for Proposal Requests.

1.5 ADMINISTRATIVE CHANGE ORDERS

A. Allowance Adjustment: See Section 012100 "Allowances" for administrative procedures for preparation of Change Order Proposal for adjusting the Contract Sum to reflect actual costs of allowances.

B. Unit-Price Adjustment: See Section 012200 "Unit Prices" for administrative procedures for preparation of Change Order Proposal for adjusting the Contract Sum to reflect measured scope of unit-price work.

1.6 CHANGE ORDER PROCEDURES

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

1.7 CONSTRUCTION CHANGE DIRECTIVE

A. Construction Change Directive: Architect may issue a Construction Change Directive on **AIA Document G714**. Construction Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.

1. Construction Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.

B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.

1. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012600

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SECTION 012900 - PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements necessary to prepare and process Applications for Payment.

1.3 DEFINITIONS

A. Schedule of Values: A statement furnished by Contractor allocating portions of the Contract Sum to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.

1.4 SCHEDULE OF VALUES

A. Coordination: Coordinate preparation of the schedule of values with preparation of Contractor's construction schedule.

1. Coordinate line items in the schedule of values with other required administrative forms and schedules, including the following:

a. Application for Payment forms with continuation sheets.
b. Submittal schedule.
c. List of Subcontractors.
d. Schedule of Alternates.

2. Submit the schedule of values to Architect at earliest possible date, but no later than **seven** days before the date scheduled for submittal of initial Applications for Payment.
3. Subschedules for Phased Work: Where the Work is separated into phases requiring separately phased payments, provide subschedules showing values coordinated with each phase of payment.

B. Format and Content: Use Project Manual table of contents as a guide to establish line items for the schedule of values. Provide at least one line item for each Specification Section.

1. Identification: Include the following Project identification on the schedule of values:

a. Project name and location.
b. Name of Architect.

c. Architect's project number.
d. Contractor's name and address.
e. Date of submittal.

2. Arrange the schedule of values in tabular form with separate columns to indicate the following for each item listed and consistent with format of **AIA Document G703**:

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 of the following, as a percentage of the Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent.

1) Labor.
2) Materials.
3) Equipment.

3. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with Project Manual table of contents. Provide multiple line items for principal subcontract amounts in excess of **five** percent of the Contract Sum.

4. Round amounts to nearest whole dollar; total shall equal the Contract Sum.

5. Provide a separate line item in the schedule of values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.

a. Differentiate between items stored on-site and items stored off-site. If required, include evidence of insurance.

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. 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.

a. 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.

8. 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.

1.5 APPLICATIONS FOR PAYMENT

A. Each Application for Payment following the initial Application for Payment shall be consistent with previous applications and payments as certified by Architect and paid for by Owner.

1. Initial Application for Payment, Application for Payment at time of Substantial Completion, and final Application for Payment involve additional requirements.

B. Payment Application Times: The date for each progress payment is indicated in the Agreement between Owner and Contractor. The period of construction work covered by each Application for Payment is the period indicated in the Agreement.

C. Application for Payment Forms: Use **AIA Document G702 and AIA Document G703** as form for Applications for Payment.

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 for work completed following previous Application for Payment, whether or not payment has been received. Include only amounts for work completed at time of Application for Payment.
3. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.

E. 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. Value of materials previously stored and remaining stored as of date of previous Applications for Payment.
    b. Value of previously stored materials put in place after date of previous Application for Payment and on or before date of current Application for Payment.
    c. Value of materials stored since date of previous Application for Payment and remaining stored as of date of current Application for Payment.

F. Transmittal: Submit **three** signed and notarized original copies of each Application for Payment to Architect by a method ensuring receipt within 24 hours. One copy shall include waivers of lien and similar attachments if required.

1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.

G. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's liens from entities lawfully entitled to file a mechanic's lien arising out of the Contract and related to the Work covered by the payment including, but not necessarily limited to, subcontractors, sub-subcontractors, and suppliers for construction period covered by the previous application, including work self-performed by General Contractor. Total of lien waivers must total

amount requested in previous Application for Payment to assure that all parties have been properly paid.

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 conditional final or full waivers.
3. Owner reserves the right to designate which entities involved in the Work must submit waivers.
4. Waiver Forms: Submit waivers of lien on forms, executed in a manner acceptable to Owner.

H. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:

1. List of subcontractors.
2. Schedule of values.
3. Contractor's construction schedule (preliminary if not final).
4. Combined Contractor's construction schedule (preliminary if not final) incorporating Work of multiple contracts, with indication of acceptance of schedule by each Contractor.
5. Products list (preliminary if not final).
6. Submittal schedule (preliminary if not final).
7. List of Contractor's staff assignments.
8. List of Contractor's principal consultants.
9. Copies of building permits.
10. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
11. Initial progress report.
12. Report of preconstruction conference.
13. Certificates of insurance and insurance policies.
14. Performance and payment bonds.
15. Data needed to acquire Owner's insurance.

I. Application for Payment at Substantial Completion: After Architect issues 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 Certificate(s) of Substantial Completion issued previously for Owner occupancy of designated portions of the Work.
3. Administrative actions and submittals that shall precede or coincide with this application include:

    a. Occupancy permits and similar approvals.
    b. Warranties (guarantees) and maintenance agreements.
    c. Test/adjust/balance records.
    d. Maintenance instructions.
    e. Startup performance reports.
    f. Changeover information related to Owner's occupancy, use, operation, and maintenance.
    g. Final cleaning.

h. Application for reduction of retainage and consent of surety.
i. Advice on shifting insurance coverages.
j. List of incomplete Work, recognized as exceptions to Architect's Certificate of Substantial Completion.

J. Final Payment Application: After completing Project closeout requirements, submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:

1. Evidence of completion of Project closeout requirements.
2. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
3. Updated final statement, accounting for final changes to the Contract Sum.
4. **AIA Document G706, "Contractor's Affidavit of Payment of Debts and Claims."**
5. **AIA Document G706A, "Contractor's Affidavit of Release of Liens."**
6. **AIA Document G707, "Consent of Surety to Final Payment."**
7. Evidence that claims have been settled.
8. Final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Substantial Completion or when Owner took possession of and assumed responsibility for corresponding elements of the Work.
9. Final liquidated damages settlement statement.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012900

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SECTION 013100 - PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:

1. General coordination procedures.
2. Coordination drawings.
3. Requests for Information (RFIs).
4. Project meetings.

B. Each contractor shall participate in coordination requirements. Certain areas of responsibility are assigned to a specific contractor.

C. Related Requirements:
1. Section 013200 "Construction Progress Documentation" for preparing and submitting Contractor's construction schedule.
2. Section 017300 "Execution" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.
3. Section 017700 "Closeout Procedures" for coordinating closeout of the Contract.

1.3 DEFINITIONS

A. RFI: Request from Owner, Construction Manager, Architect, or Contractor seeking information required by or clarifications of the Contract Documents.

1.4 INFORMATIONAL SUBMITTALS

A. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:

1. Name, address, and telephone number of entity performing subcontract or supplying products.
2. Number and title of related Specification Section(s) covered by subcontract.
3. Drawing number and detail references, as appropriate, covered by subcontract.

B. Key Personnel Names: Within **15** days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including home, office, and cellular telephone numbers and e-mail addresses. Provide names, addresses, and telephone numbers of individuals assigned as alternates in the absence of individuals assigned to Project.

1. Post copies of list in project meeting room, in temporary field office, and by each temporary telephone. Keep list current at all times.

2. Include special personnel required for coordination of operations with other contractors.

1.5 GENERAL 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, that 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.
4. Where availability of space is limited, coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair of all components, including mechanical and electrical.

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.

1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.

C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities and activities of other contractors 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. Project closeout activities.
8. Startup and adjustment of systems.

D. Trade Union Jurisdictions: Maintain current information on jurisdictional matters, regulations, actions and pending actions, and administer/supervise performance of work in a manner which will minimize possibility of disputes, conflicts, delays, claims or loses.

E. 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. Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work. See other Sections for disposition of salvaged materials that are designated as Owner's property.

1.6 COORDINATION DRAWINGS

A. Coordination Drawings, General: Prepare coordination drawings according to requirements in individual Sections, and additionally 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. Comply with requirements of Section 013300 “Submittal Procedures” as well as requirements contained within individual specification sections.
2. Coordination Drawing Prints:
a. Sheet Size: At least 8-1/2 by 11 inches (215 by 280 mm) but no larger than 30 by 42 inches.
b. Number of Copies: Submit **two** opaque copies of each submittal. Architect will return one copy.
1) Submit **three** copies where Coordination Drawings are required for operation and maintenance manuals. Architect will retain **one** copy; remainder will be returned. Mark up and retain one returned copy as a Project Record Drawing.

3. Content: Project-specific information, drawn accurately to a scale large enough to indicate and resolve conflicts. Do not base coordination drawings on reproductions of the Contract Documents or 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.

B. Coordination Drawing Organization: Organize coordination drawings as follows:

1. Floor Plans and Reflected Ceiling Plans: Show architectural and structural elements, and mechanical, plumbing, fire-protection, fire-alarm, and electrical Work. Show locations of visible ceiling-mounted devices relative to acoustical ceiling grid. Supplement plan drawings with section drawings where required to adequately represent the Work.
2. Plenum Space: Indicate subframing for support of ceiling and wall systems, mechanical and electrical equipment, and related Work. Locate components within ceiling plenum to accommodate layout of light fixtures indicated on Drawings. Indicate areas of conflict between light fixtures and other components.
3. Mechanical Rooms: Provide coordination drawings for mechanical rooms showing plans and elevations of mechanical, plumbing, fire-protection, fire-alarm, and electrical equipment.
4. Structural Penetrations: Indicate penetrations and openings required for all disciplines.
5. Slab Edge and Embedded Items: Indicate slab edge locations and sizes and locations of embedded items for metal fabrications, sleeves, anchor bolts, bearing plates, angles, door floor closers, slab depressions for floor finishes, curbs and housekeeping pads, and similar items.
6. Mechanical and Plumbing Work: Show the following:

    a. Sizes and bottom elevations of ductwork, piping, and conduit runs, including insulation, bracing, flanges, and support systems.
    b. Dimensions of major components, such as dampers, valves, diffusers, access doors, cleanouts and electrical distribution equipment.
    c. Fire-rated enclosures around ductwork.

7. Electrical Work: Show the following:

    a. Runs of vertical and horizontal conduit 1-1/4 inches (32 mm) in diameter and larger.
    b. Light fixture, exit light, emergency battery pack, smoke detector, and other fire-alarm locations.
    c. Panel board, switch board, switchgear, transformer, busway, generator, and motor control center locations.
    d. Location of pull boxes and junction boxes, dimensioned from column center lines.

8. Fire-Protection System: Show the following:

    a. Locations of standpipes, mains piping, branch lines, pipe drops, and sprinkler heads.

9. Review: Architect will review coordination drawings to confirm that the Work is being coordinated, but not for the details of the coordination, which are Contractor's responsibility. If Architect determines that coordination drawings are not being prepared in sufficient scope or detail, or are otherwise deficient, Architect will so inform Contractor, who shall make changes as directed and resubmit.

1.7 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 in the form specified.

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. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:

1. Project name.
2. Project number.
3. Date.
4. Name of Contractor.
5. Name of Architect.
6. RFI number, numbered sequentially.
7. RFI subject.
8. Specification Section number and title and related paragraphs, as appropriate.
9. Drawing number and detail references, as appropriate.
10. Field dimensions and conditions, as appropriate.
11. Contractor's suggested resolution. If Contractor's suggested resolution impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
12. Contractor's signature.
13. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.

    a. Include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments on attached sketches.

C. RFI Forms: **AIA Document G716** or General Contractor’s standard form, with substantially the same content as indicated above, as acceptable to Architect.

D. Architect's Action: Architect will review each RFI, determine action required, and respond. Allow **seven** 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 Contractor-generated RFIs will be returned without action:

    a. Requests for approval of submittals.
    b. Requests for approval of substitutions.
    c. Requests for approval of Contractor's means and methods.
    d. Requests for coordination information already indicated in the Contract Documents.
    e. Requests for adjustments in the Contract Time or the Contract Sum.
    f. Requests for interpretation of Architect's actions on submittals.
    g. 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 012600 "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.

E. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log weekly. 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 returned without action or withdrawn.
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.
9. Identification of related Field Order, Work Change Directive, and Proposal Request, as appropriate.

F. 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 **seven** days if Contractor disagrees with response.

1.8 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, time and location 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: General Contractor shall record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Architect, within **three** 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. Hold the conference at Project site or another convenient location.

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, if any.
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. Preparation of record documents.
m. Use of the premises.
n. Work restrictions.
o. Working hours.
p. Owner's occupancy requirements.
q. Responsibility for temporary facilities and controls.
r. Procedures for moisture and mold control.
s. Procedures for disruptions and shutdowns.
t. Construction waste management and recycling.
u. Parking availability.
v. Office, work, and storage areas.
w. Equipment deliveries and priorities.
x. First aid.
y. Security.
z. Progress cleaning.

4. Minutes: General Contractor shall 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, times and locations.
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 requirements.
k. Time schedules.
l. Weather limitations.
m. Manufacturer's written instructions.
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 operations and maintenance data.
e. Requirements for delivery of material samples, attic stock, and spare parts.
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. Coordination of separate contracts.
k. Owner's partial occupancy requirements.
l. Installation of Owner's furniture, fixtures, and equipment.
m. Responsibility for removing temporary facilities and controls.

4. Minutes: General Contractor shall record and distribute meeting minutes.

E. Progress Meetings: Conduct progress meetings at regular 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.

        1) Review schedule for next period.

    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: General Contractor shall record and distribute the meeting minutes to each party present and to parties requiring information.

    a. Schedule Updating: Revise Contractor's construction schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

F. Coordination Meetings: Conduct Project coordination meetings at intervals appropriate to stage of construction. 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 013100

SECTION 013200 - CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:

1. Startup construction schedule.
2. Contractor's construction schedule.
3. Construction schedule updating reports.
4. Daily construction reports.
5. Material location reports.
6. Site condition reports.
7. Special reports.

B. Related Requirements:
1. Section 012900 "Payment Procedures" for submitting the Schedule of Values.
2. Section 013300 "Submittal Procedures" for submitting schedules and reports.
3. Section 014000 "Quality Requirements" for submitting a schedule of tests and inspections.

1.3 DEFINITIONS

A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction project. Activities included in a construction schedule consume time and resources.

1. Critical Activity: An activity on the critical path that must start and finish on the planned early start and finish times.
2. Predecessor Activity: An activity that precedes another activity in the network.
3. Successor Activity: An activity that follows another activity in the network.

B. Cost Loading: The allocation of the schedule of values for the completion of an activity as scheduled. The sum of costs for all activities must equal the total Contract Sum unless otherwise approved by Architect.

C. CPM: Critical path method, which is a method of planning and scheduling a construction project where activities are arranged based on activity relationships. Network calculations determine when activities can be performed and the critical path of Project.

D. Critical Path: The longest connected chain of interdependent activities through the network schedule that establishes the minimum overall Project duration and contains no float.

E. Event: The starting or ending point of an activity.

F. Float: The measure of leeway in starting and completing an activity.

1. Float time is not for the exclusive use or benefit of either Owner or Contractor, but is a jointly owned, expiring Project resource available to both parties as needed to meet schedule milestones and Contract completion date.
2. Free float is the amount of time an activity can be delayed without adversely affecting the early start of the successor activity.
3. Total float is the measure of leeway in starting or completing an activity without adversely affecting the planned Project completion date.

G. Resource Loading: The allocation of manpower and equipment necessary for the completion of an activity as scheduled.

H. Major Area: A story of construction, a separate building, or a similar significant construction element.

I. Milestone: A key or critical point in time for reference or measurement.

J. Network Diagram: A graphic diagram of a network schedule, showing activities and activity relationships.

1.4 INFORMATIONAL SUBMITTALS

A. Format for Submittals: Submit required submittals in the following format:
1. PDF electronic file.

B. Startup construction schedule.

1. Approval of cost-loaded, startup construction schedule will not constitute approval of schedule of values for cost-loaded activities.

C. Startup Network Diagram: Of size required to display entire network for entire construction period. Show logic ties for activities.

D. Contractor's Construction Schedule: Initial schedule, of size required to display entire schedule for entire construction period.

E. CPM Reports: Concurrent with CPM schedule, submit each of the following reports. Format for each activity in reports shall contain activity number, activity description, cost and resource loading, original duration, remaining duration, early start date, early finish date, late start date, late finish date, and total float in calendar days.

1. Activity Report: List of all activities sorted by activity number and then early start date, or actual start date if known.
2. Logic Report: List of preceding and succeeding activities for all activities, sorted in ascending order by activity number and then early start date, or actual start date if known.
3. Total Float Report: List of all activities sorted in ascending order of total float.

4. Earnings Report: Compilation of Contractor's total earnings from commencement of the Work until most recent Application for Payment.

F. Construction Schedule Updating Reports: Submit with Applications for Payment.

G. Daily Construction Reports: Submit at intervals described in Owner Contractor Agreement.

H. Material Location Reports: Submit at **monthly** intervals, corresponding to application for payment.

I. Site Condition Reports: Submit at time of discovery of differing conditions.

J. Special Reports: Submit at time of unusual event.

K. Qualification Data: For scheduling consultant.

1.5 QUALITY ASSURANCE

A. Scheduling Consultant Qualifications: An experienced specialist in CPM scheduling and reporting, with capability of producing CPM reports and diagrams within 24 hours of Architect's request.

B. Prescheduling Conference: Conduct conference at Project site to comply with requirements in Section 013100 "Project Management and Coordination." Review methods and procedures related to the preliminary construction schedule and Contractor's construction schedule, including, but not limited to, the following:

1. Review software limitations and content and format for reports.
2. Verify availability of qualified personnel needed to develop and update schedule.
3. Discuss constraints, including phasing, work stages, area separations, interim milestones and partial Owner occupancy.
4. Review delivery dates for Owner-furnished products.
5. Review schedule for work of Owner's separate contracts, if any.
6. Review submittal requirements and procedures.
7. Review time required for review of submittals and resubmittals.
8. Review requirements for tests and inspections by independent testing and inspecting agencies.
9. Review time required for Project closeout and Owner startup procedures, including commissioning activities, if any.
10. Review and finalize list of construction activities to be included in schedule.
11. Review procedures for updating schedule.

1.6 COORDINATION

A. Coordinate preparation and processing of schedules and reports with performance of construction activities and with scheduling and reporting of separate contractors.

B. Coordinate Contractor's construction schedule with the schedule of values, list of subcontracts, submittal schedule, progress reports, payment requests, and other required schedules and reports.

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

PART 2 - PRODUCTS

2.1 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

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

B. Time Frame: Extend schedule from date established for **commencement of the Work** to date of **final completion** and **Owner Occupancy**.

1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.

C. Activities: Treat each story or separate area as a separate numbered activity for each main element of the Work. Comply with the following:

1. Activity Duration: Define activities so no activity is longer than **20** days, unless specifically allowed by Architect.
2. Procurement Activities: Include procurement process activities for long lead items and major items, requiring a cycle of more than 60 days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.
3. Submittal Review Time: Include review and resubmittal times indicated in Section 013300 "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's construction schedule with submittal schedule.
4. Startup and Testing Time: Include no fewer than **10** days for startup and testing.
5. Substantial Completion: Indicate completion in advance of date established for Substantial Completion, and allow time for Architect's administrative procedures necessary for certification of Substantial Completion.
6. Punch List and Final Completion: Include not more than **30** days for completion of punch list items and final completion.

D. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule, and show how the sequence of the Work is affected.

1. Phasing: Arrange list of activities on schedule by phase.
2. Work under More Than One Contract: Include a separate activity for each contract.
3. Work by Owner: Include a separate activity for each portion of the Work performed by Owner.
4. Products Ordered in Advance: Include a separate activity for each product. Include delivery date indicated in Section 011000 "Summary." Delivery dates indicated stipulate the earliest possible delivery date.
5. Owner-Furnished Products: Include a separate activity for each product. Include delivery date indicated in Section 011000 "Summary." Delivery dates indicated stipulate the earliest possible delivery date.
6. Work Restrictions: Show the effect of the following items on the schedule:

a. Coordination with existing construction.
b. Limitations of continued occupancies, if any.
c. Uninterruptible services.
d. Partial occupancy before Substantial Completion, if any.
e. Use of premises restrictions.
f. Provisions for future construction, if any.
g. Seasonal variations.
h. Environmental control.

7. Work Stages: Indicate important stages of construction for each major portion of the Work, including, but not limited to, the following:

a. Subcontract awards.
b. Submittals.
c. Purchases.
d. Mockups.
e. Fabrication.
f. Sample testing.
g. Deliveries.
h. Installation.
i. Tests and inspections.
j. Adjusting.
k. Curing.
l. Building flush-out.
m. Startup and placement into final use and operation.

8. Construction Areas: Identify each major area of construction for each major portion of the Work. Indicate where each construction activity within a major area must be sequenced or integrated with other construction activities to provide for the following:

a. Structural completion.
b. Temporary enclosure and space conditioning.
c. Permanent space enclosure.
d. Completion of mechanical installation.
e. Completion of electrical installation.
f. Substantial Completion.

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

1. Include any other intermediate milestones, such as completion of each phase, partial Owner occupancy, or other milestones requested by Owner or Architect.

F. Cost Correlation: Superimpose a cost correlation timeline, indicating planned and actual costs. On the line, show planned and actual dollar volume of the Work performed as of planned and actual dates used for preparation of payment requests.

1. See Section 012900 "Payment Procedures" for cost reporting and payment procedures.

G. Upcoming Work Summary: Prepare summary report indicating activities scheduled to occur or commence prior to submittal of next schedule update. Summarize the following issues:

1. Unresolved issues.

2. Unanswered Requests for Information.
3. Rejected or unreturned submittals.
4. Notations on returned submittals.
5. Pending modifications affecting the Work and Contract Time.

H. Recovery Schedule: When periodic update indicates the Work is **14** or more calendar days behind the current approved schedule, submit a separate recovery schedule indicating means by which Contractor intends to regain compliance with the schedule. Indicate changes to working hours, working days, crew sizes, and equipment required to achieve compliance, and date by which recovery will be accomplished.

2.2 STARTUP CONSTRUCTION SCHEDULE

A. Bar-Chart Schedule: Submit startup, horizontal, bar-chart-type construction schedule within **seven** days of date established for **commencement of the Work**.

B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line. Outline significant construction activities for first **60** days of construction. Include skeleton diagram for the remainder of the Work and a cash requirement prediction based on indicated activities.

2.3 CONTRACTOR'S CONSTRUCTION SCHEDULE (CPM SCHEDULE)

A. General: Prepare network diagrams using AON (activity-on-node) format.

B. Startup Network Diagram: Submit diagram within **14** days of date established for **the Notice to Proceed**. Outline significant construction activities for the first **60** days of construction. Include skeleton diagram for the remainder of the Work and a cash requirement prediction based on indicated activities.

C. CPM Schedule: Prepare Contractor's construction schedule using a time-scaled CPM network analysis diagram for the Work.

1. Develop network diagram in sufficient time to submit CPM schedule so it can be accepted for use no later than **30** days after date established for **the Notice to Proceed**.

   a. Failure to include any work item required for performance of this Contract shall not excuse Contractor from completing all work within applicable completion dates, regardless of Architect's approval of the schedule.

2. Conduct educational workshops to train and inform key Project personnel, including subcontractors' personnel, in proper methods of providing data and using CPM schedule information.
3. Establish procedures for monitoring and updating CPM schedule and for reporting progress. Coordinate procedures with progress meeting and payment request dates.
4. Use "one workday" as the unit of time for individual activities. Indicate nonworking days and holidays incorporated into the schedule in order to coordinate with the Contract Time.

D. CPM Schedule Preparation: Prepare a list of all activities required to complete the Work. Using the startup network diagram, prepare a skeleton network to identify probable critical paths.

1. Activities: Indicate the estimated time duration, sequence requirements, and relationship of each activity in relation to other activities. Include estimated time frames for the following activities:

    a. Preparation and processing of submittals.
    b. Mobilization and demobilization.
    c. Purchase of materials.
    d. Delivery.
    e. Fabrication.
    f. Utility interruptions.
    g. Installation.
    h. Work by Owner that may affect or be affected by Contractor's activities.
    i. Testing and commissioning.
    j. Punch list and final completion.
    k. Activities occurring following final completion.

2. Critical Path Activities: Identify critical path activities, including those for interim completion dates. Scheduled start and completion dates shall be consistent with Contract milestone dates.
3. Processing: Process data to produce output data on a computer-drawn, time-scaled network. Revise data, reorganize activity sequences, and reproduce as often as necessary to produce the CPM schedule within the limitations of the Contract Time.
4. Format: Mark the critical path. Locate the critical path near center of network; locate paths with most float near the edges.

    a. Subnetworks on separate sheets are permissible for activities clearly off the critical path.

5. Cost- and Resource-Loading of CPM Schedule: Assign cost to construction activities on the CPM schedule. Do not assign costs to submittal activities. Obtain Architect's approval prior to assigning costs to fabrication and delivery activities. Assign costs under main subcontracts for testing and commissioning activities, operation and maintenance manuals, punch list activities, Project record documents, LEED documentation (if applicable) and demonstration and training (if applicable), in the amount of 5 percent of the Contract Sum.

    a. Each activity cost shall reflect an appropriate value subject to approval by Architect.
    b. Total cost assigned to activities shall equal the total Contract Sum.

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

F. Initial Issue of Schedule: Prepare initial network diagram from a sorted activity list indicating straight "early start-total float." Identify critical activities. Prepare tabulated reports showing the following:

1. Contractor or subcontractor and the Work or activity.
2. Description of activity.
3. Main events of activity.
4. Immediate preceding and succeeding activities.
5. Early and late start dates.

6. Early and late finish dates.
7. Activity duration in workdays.
8. Total float or slack time.
9. Average size of workforce.
10. Dollar value of activity (coordinated with the schedule of values).

G. Schedule Updating: Concurrent with making revisions to schedule, prepare tabulated reports showing the following:

1. Identification of activities that have changed.
2. Changes in early and late start dates.
3. Changes in early and late finish dates.
4. Changes in activity durations in workdays.
5. Changes in the critical path.
6. Changes in total float or slack time.
7. Changes in the Contract Time.

H. 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.

2.4 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. Equipment at Project site.
5. Material deliveries.
6. High and low temperatures and general weather conditions, including presence of rain or snow.
7. Accidents.
8. Meetings and significant decisions.
9. Unusual events (see special reports).
10. Stoppages, delays, shortages, and losses.
11. Meter readings and similar recordings.
12. Emergency procedures.
13. Orders and requests of authorities having jurisdiction.

14. Change Orders received and implemented.
15. Construction Change Directives received and implemented.
16. Services connected and disconnected.
17. Equipment or system tests and startups.
18. Partial completions and occupancies.
19. Substantial Completions authorized.

B. Material Location Reports: At **monthly** intervals, prepare and submit a comprehensive list of materials delivered to and stored at Project site. List shall be cumulative, showing materials previously reported plus items recently delivered. Include with list a statement of progress on and delivery dates for materials or items of equipment fabricated or stored away from Project site. Indicate the following categories for stored materials:

1. Material stored prior to previous report and remaining in storage.
2. Material stored prior to previous report and since removed from storage and installed.
3. Material stored following previous report and remaining in storage.

C. Site Condition Reports: Immediately on discovery of a difference between site conditions and the Contract Documents, prepare and submit a detailed report. Submit with a **Request for Information.** Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

2.5 SPECIAL REPORTS

A. General: Submit special reports directly to Owner within **one** day of an occurrence. Distribute copies of report to parties affected by the occurrence.

B. Reporting Unusual Events: 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. List chain of events, persons participating, response by Contractor's personnel, evaluation of results or effects, and similar pertinent information. Advise Owner in advance when these events are known or predictable.

PART 3 - EXECUTION

3.1 CONTRACTOR'S CONSTRUCTION SCHEDULE

A. Scheduling Consultant: Engage a consultant to provide planning, evaluation, and reporting using CPM scheduling.

1. In-House Option: Owner may waive the requirement to retain a consultant if Contractor employs skilled personnel with experience in CPM scheduling and reporting techniques. Submit qualifications.
2. Meetings: Scheduling consultant shall attend all meetings related to Project progress, alleged delays, and time impact.

B. Contractor's Construction Schedule 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 final completion percentage for each activity.

C. Distribution: Distribute copies of approved schedule to Architect, Owner, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.

1. Post copies in Project meeting rooms and temporary field offices.
2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

END OF SECTION 013200

SECTION 013300 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes requirements for the submittal schedule and administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.

1.3 DEFINITIONS

A. Action Submittals: Written and graphic information and physical samples that require Architect's responsive action. Action submittals are those submittals indicated in individual Specification Sections as "action submittals."

B. Informational Submittals: Written and graphic information and physical samples that do not require Architect's responsive action. Submittals may be rejected for not complying with requirements. Informational submittals are those submittals indicated in individual Specification Sections as "informational submittals."

C. File Transfer Protocol (FTP): Communications protocol that enables transfer of files to and from another computer over a network and that serves as the basis for standard Internet protocols. An FTP site is a portion of a network located outside of network firewalls within which internal and external users are able to access files.

D. Portable Document Format (PDF): An open standard file format licensed by Adobe Systems used for representing documents in a device-independent and display resolution-independent fixed-layout document format.

1.4 ACTION SUBMITTALS

A. Submittal Schedule: Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or revisions to submittals noted by Architect and additional time for handling and reviewing submittals required by those corrections.

1. Coordinate submittal schedule with list of subcontracts, the schedule of values, and Contractor's construction schedule.
2. Initial Submittal: Submit concurrently with startup construction schedule. Include submittals required during the first **60** days of construction. List those submittals required to

maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.

3. Final Submittal: Submit concurrently with the first complete submittal of Contractor's construction schedule.

    a. Submit revised submittal schedule to reflect changes in current status and timing for submittals.

4. Format: Arrange the following information in a tabular format:

    a. Scheduled date for first submittal.
    b. Specification Section number and title.
    c. Submittal category: Action; informational.
    d. Name of subcontractor.
    e. Description of the Work covered.
    f. Scheduled date for Architect's final release or approval.
    g. Scheduled date of fabrication.
    h. Scheduled dates for purchasing.
    i. Scheduled dates for installation.
    j. Activity or event number.

1.5 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

A. Architect's Digital Data Files: Electronic digital data files of the Contract Drawings will **not** be provided by Architect for Contractor's use in preparing submittals, except as follows:

1. Architect will furnish Contractor one set of digital data drawing files of the Contract Drawings for use in preparing Shop Drawings.

    a. Architect makes no representations as to the accuracy or completeness of digital data drawing files as they relate to the Contract Drawings.
    b. Digital Drawing Software Program: The Contract Drawings are available in the format used by the Architect in their preparation.
    c. Contractor shall execute a data licensing agreement in the form of **AIA Document C106, Digital Data Licensing Agreement** or other Agreement form acceptable to Owner and Architect.
    d. The following digital data files will by furnished for each appropriate discipline:

        1) Floor plans.
        2) Reflected ceiling plans.

B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.

1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
3. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.

4. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.

    a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

C. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.

1. Initial Review: Allow **10** 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 **15** 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 **21** days for initial review of each submittal.
    a. All submittals, including those requiring review by Architect’s consultants, are to be transmitted through the Architect. Direct transmittal to Architect’s consultant is not allowed, unless agreed to by Architect in advance of transmitting submittal. When so agreed, provide duplicate copy of transmittal to Architect. Submittal will be returned to Architect before being returned to Contractor.

D. Paper Submittals: Place a permanent label or title block on each submittal item for identification.

1. Indicate name of firm or entity that prepared each submittal on label or title block.
2. Provide a space approximately **4 by 5 inches** (100 by 125 mm) on label or beside title block to record Contractor's review and approval markings and action taken by Architect.
3. Include the following information for processing and recording action taken:

    a. Project name.
    b. Date.
    c. Name of Architect.
    d. Name of Construction Manager.
    e. Name of Contractor.
    f. Name of subcontractor.
    g. Name of supplier.
    h. Name of manufacturer.
    i. Submittal number or other unique identifier, including revision identifier.

        1) Submittal number shall use Specification Section number followed by a decimal point and then a sequential number (e.g., 061000.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., 061000.01.A).

    j. Number and title of appropriate Specification Section.
    k. Drawing number and detail references, as appropriate.
    l. Location(s) where product is to be installed, as appropriate.

m. Other necessary identification.

4. Additional Paper Copies: Unless additional copies are required for final submittal, and unless Architect observes noncompliance with provisions in the Contract Documents, initial submittal may serve as final submittal.
   a. Additional copies submitted for maintenance manuals will be marked with action taken and will be returned.

5. Transmittal for Paper Submittals: Assemble each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal form. Architect will return without review submittals received from sources other than Contractor.
   a. Transmittal Form for Paper Submittals: Provide locations on form for the following information:

      1) Project name.
      2) Date.
      3) Destination (To:).
      4) Source (From:).
      5) Name and address of Architect.
      6) Name of Construction Manager.
      7) Name of Contractor.
      8) Name of firm or entity that prepared submittal.
      9) Names of subcontractor, manufacturer, and supplier.
      10) Category and type of submittal.
      11) Submittal purpose and description.
      12) Specification Section number and title.
      13) Specification paragraph number or drawing designation and generic name for each of multiple items.
      14) Drawing number and detail references, as appropriate.
      15) Indication of full or partial submittal.
      16) Transmittal number, numbered consecutively.
      17) Submittal and transmittal distribution record.
      18) Remarks.
      19) Signature of transmitter.

E. Electronic Submittals: Identify and incorporate information in each electronic submittal file as follows:

1. Assemble complete submittal package into a single indexed file incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.
2. Name file with submittal number or other unique identifier, including revision identifier.

   a. File name shall use project identifier and Specification Section number followed by a decimal point and then a sequential number (e.g., LNHS-061000.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., LNHS-061000.01.A).

3. Provide means for insertion to permanently record Contractor's review and approval markings and action taken by Architect.
4. Transmittal Form for Electronic Submittals: Use software-generated form from electronic project management software or other electronic form acceptable to Architect and Owner, containing the following information:

a. Project name.
b. Date.
c. Name and address of Architect.
d. Name of Construction Manager.
e. Name of Contractor.
f. Name of firm or entity that prepared submittal.
g. Names of subcontractor, manufacturer, and supplier.
h. Category and type of submittal.
i. Submittal purpose and description.
j. Specification Section number and title.
k. Specification paragraph number or drawing designation and generic name for each of multiple items.
l. Drawing number and detail references, as appropriate.
m. Location(s) where product is to be installed, as appropriate.
n. Related physical samples submitted directly.
o. Indication of full or partial submittal.
p. Transmittal number, numbered consecutively.
q. Submittal and transmittal distribution record.
r. Other necessary identification.
s. Remarks.

5. Metadata: Include the following information as keywords in the electronic submittal file metadata:

a. Project name.
b. Number and title of appropriate Specification Section.
c. Manufacturer name.
d. Product name.

F. Options: Identify options requiring selection by Architect.

G. Deviations and Additional Information: 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 identification 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.
3. Resubmit submittals until they are marked **"Reviewed"** or **"Reviewed as Noted (Resubmission is Not Required)."**

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: Retain complete copies of submittals on Project site. Use only final submittals with mark indicating **"Reviewed"** or **"Reviewed as Noted (Resubmission is Not Required)"** taken by Architect.

PART 2 - PRODUCTS

2.1 SUBMITTAL PROCEDURES

A. General Submittal Procedure Requirements: Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections. Generally, submit paper copies of submittals. Review submittal schedule with Architect and determine which submittals are acceptable to be submitted electronically.

1. Submit electronic submittals via email as PDF electronic files. If available and acceptable to Architect, electronic submittals may be posted as PDF electronic files directly to Architect's FTP site specifically established for Project.

    a. Architect will return annotated file. Annotate and retain one copy of file as an electronic Project record document file.

2. Action Submittals: Submit **one** correctable, translucent, reproducible print and **two** blue- or black-line prints. Architect will return the reproducible print.
    a. Architect will retain one marked up print for in-house record and forward other marked up print to Owner for their record.
    b. Produce additional prints from final returned, marked up transparency, where prints are required for operation and maintenance manuals.
    c. Produce one additional print from final returned, marked up transparency, for use as a Project Record Drawing.
3. Informational Submittals: Submit **one** paper copy of each submittal unless otherwise indicated. Architect will not return copies.

    a. General Contractor shall retain one additional copy as a Project Record Document.
4. Certificates and Certifications Submittals: Provide a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.

    a. Provide a digital signature with digital certificate on electronically submitted certificates and certifications where indicated.
    b. Provide a notarized statement on original paper copy certificates and certifications where indicated.

B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.

1. If information must be specially prepared for submittal because standard published data are 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 the following information, as applicable:

    a. Manufacturer's written recommendations for use, installation, and maintenance of product.
    b. Manufacturer's catalog cuts.

c. Manufacturer's product specifications.
d. Standard color charts.
e. Statement of compliance with specified referenced standards.
f. Testing by recognized testing agency.
g. Application of testing agency labels and seals.
h. Notation of coordination requirements.
i. Availability and delivery time information.

4. For equipment, include the following in addition to the above, as applicable:

a. Wiring diagrams showing factory-installed wiring.
b. Printed performance curves.
c. Operational range diagrams.
d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.
e. Standard product operation and maintenance manuals.

5. Submit Product Data before or concurrent with Samples.
6. Submit Product Data in the following format:
   a. **Three** paper copies of Product Data unless otherwise indicated. Architect will return **two** copies. Retain one copy as a Project Record Document.
      1) If acceptable to Architect and Owner, Product Data may be submitted in PDF electronic file format.

C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data, unless submittal based on Architect's digital data drawing files is otherwise permitted as described above.

1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:

a. Identification of products.
b. Schedules.
c. Compliance with specified standards.
d. Notation of coordination requirements.
e. Notation of dimensions established by field measurement.
f. Relationship and attachment to adjoining construction clearly indicated.
g. Dimensions.
h. Fabrication and installation drawings.
i. Roughing-in and setting diagrams.
j. Wiring diagrams showing field-installed wiring, including power, signal, and control wiring. Differentiate between manufacturer-installed and field-installed wiring.
k. Shopwork manufacturing instructions.
l. Templates and patterns.
m. Design calculations.
n. Seal and signature of professional engineer 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 inches (215 by 280 mm), but no larger than 30 by 42 inches (750 by 1067 mm).
3. Submit Shop Drawings in the following format:

a. Submit **one** correctable, translucent, reproducible print and **two** blue- or black-line prints. Architect will return the reproducible print. If acceptable to Architect and Owner, Shop Drawings may be submitted in PDF electronic file format.

D. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.

1. Comply with requirements in Division 01 Section "Quality Requirements" for mockups.
2. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
3. Identification: Attach label on unexposed side of Samples that includes the following:

   a. Generic description of Sample.
   b. Product name and name of manufacturer.
   c. Sample source.
   d. Number and title of applicable Specification Section.
   e. Specification paragraph number and generic name of each item.

4. For projects where electronic submittals are required, provide corresponding electronic submittal of Sample transmittal, digital image file illustrating Sample characteristics, and identification information for record.
5. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.

   a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
   b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.

6. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.

   a. Number of Samples: Submit **one** full set of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will return submittal with options selected.

7. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the 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. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.

   a. Number of Samples: Submit **three** sets of Samples. Architect will retain **one** Sample set; remainder will be returned. Mark up and retain one returned Sample set as a project record sample.

1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least **three** sets of paired units that show approximate limits of variations.

E. Product Schedule: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:

1. Type of product. Include unique identifier for each product indicated in the Contract Documents or assigned by Contractor if none is indicated.
2. Manufacturer and product name, and model number if applicable.
3. Number and name of room or space.
4. Location within room or space.
5. Submit product schedule in the following format:

a. **Three** paper copies of product schedule or list unless otherwise indicated. Architect will return **two** copies. Retain one returned copy as a Project Record Document. If acceptable to Architect and Owner, Shop Product Schedule may be submitted in PDF electronic file format.

F. Coordination Drawing Submittals: Comply with requirements specified in Section 013100 "Project Management and Coordination."

G. Contractor's Construction Schedule: Comply with requirements specified in Section 013200 "Construction Progress Documentation."

H. Application for Payment and Schedule of Values: Comply with requirements specified in Section 012900 "Payment Procedures."

I. Test and Inspection Reports and Schedule of Tests and Inspections Submittals: Comply with requirements specified in Section 014000 "Quality Requirements."

J. Closeout Submittals and Maintenance Material Submittals: Comply with requirements specified in Section 017700 "Closeout Procedures."

K. Maintenance Data: Comply with requirements specified in Section 017823 "Operation and Maintenance Data."

L. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.

M. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification and Procedure Qualification Record on AWS forms. Include names of firms and personnel certified.

N. Installer Certificates: Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.

O. Manufacturer Certificates: Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.

P. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.

Q. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.

R. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.

S. Product Test Reports: Submit written reports indicating that 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.

T. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:

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.

U. Preconstruction Test Reports: Submit 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.

V. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.

W. Field Test Reports: Submit written reports 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.

X. Manufacturer's Instructions: Prepare written or published information that documents manufacturer's recommendations, guidelines, and procedures for installing or operating a product or equipment. Include name of product and name, address, and telephone number of manufacturer. Include the following, as applicable:

1. Preparation of substrates.
2. Required substrate tolerances.
3. Sequence of installation or erection.
4. Required installation tolerances.

5. Required adjustments.
6. Recommendations for cleaning and protection.

Y. Design Data: Prepare and submit 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. Include page numbers.

Z. Insurance Certificates and Bonds: Prepare 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.

2.2 DELEGATED-DESIGN SERVICES

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. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.

B. Delegated-Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit digitally signed PDF electronic file or **three** paper copies of certificate, 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.

1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

A. Action and Informational Submittals: 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. Project Closeout and Maintenance Material Submittals: See requirements in Section 017700 "Closeout Procedures."

C. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

3.2 ARCHITECT'S ACTION

A. General: **Architect will not review submittals that do not bear Contractor's approval stamp and will return them without action.**

B. Action Submittals: Architect will review each submittal, make marks to indicate corrections or revisions required, and return it. Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate **action, as follows:**

1. Final Unrestricted Release: When the Architect marks a submittal **"Reviewed,"** the Work covered by the submittal may proceed provided it complies with requirements of the Contract Documents. Final payment depends on that compliance.
2. Final-But-Restricted Release: When the Architect marks a submittal **"Reviewed as Noted,"** the Work covered by the submittal may proceed provided it complies with notations or corrections on the submittal and requirements of the Contract Documents. Final payment depends on that compliance.
3. Returned for Resubmittal: When the Architect marks a submittal **"Not In compliance, Revise and Resubmit,"** do not proceed with Work covered by the submittal, including purchasing, fabrication, delivery, or other activity. Revise or prepare a new submittal according to the notations; resubmit without delay. Repeat if necessary to obtain different action mark.

    a. Do not use, or allow others to use, submittals marked "Not In Compliance, Revise and Resubmit" at the Project Site or elsewhere where Work is in progress.

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. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Architect.

E. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.

F. Submittals not required by the Contract Documents may be returned by the Architect without action.

END OF SECTION 013300

SECTION 014000 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 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. Specific quality-assurance and -control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and -control procedures that facilitate compliance with the Contract Document requirements.
3. Requirements for Contractor to provide quality-assurance and -control services required by Architect, Owner, or authorities having jurisdiction are not limited by provisions of this Section.
4. Specific test and inspection requirements are not specified in this Section.

1.3 DEFINITIONS

A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.

B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Services do not include contract enforcement activities performed by Architect.

C. Mockups: Full-size physical assemblies that are constructed on-site. Mockups are constructed to verify selections made under Sample submittals; to demonstrate aesthetic effects and, where indicated, qualities of materials and execution; to review coordination, testing, or operation; to show interface between dissimilar materials; and to demonstrate compliance with specified installation tolerances. Mockups are not Samples. Unless otherwise indicated, approved mockups establish the standard by which the Work will be judged.

1. Laboratory Mockups: Full-size physical assemblies constructed at testing facility to verify performance characteristics.
2. Integrated Exterior Mockups: Mockups of the exterior envelope erected separately from the building but on Project site, consisting of multiple products, assemblies, and subassemblies.
3. Room Mockups: Mockups of typical interior spaces complete with wall, floor, and ceiling finishes, doors, windows, millwork, casework, specialties, furnishings and equipment, and lighting.

D. Preconstruction Testing: Tests and inspections performed specifically for Project before products and materials are incorporated into the Work, to verify performance or compliance with specified criteria.

E. Product Testing: Tests and inspections that are performed by an NRTL, an NVLAP, or a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.

F. Source Quality-Control Testing: Tests and inspections that are performed at the source, e.g., plant, mill, factory, or shop.

G. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.

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

I. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.

1. Use of trade-specific terminology in referring to a trade or entity does not require that certain construction activities be performed by accredited or unionized individuals, or that requirements specified apply exclusively to specific trade(s).

J. Experienced: When used with an entity or individual, "experienced" means having successfully completed a minimum of **five** previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

1.4 CONFLICTING REQUIREMENTS

A. Referenced Standards: If 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 conflicting requirements that are different, but apparently equal, to Architect for a decision before proceeding.

B. 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 requirements. Refer uncertainties to Architect for a decision before proceeding.

1.5 ACTION SUBMITTALS

A. Shop Drawings: For integrated exterior and laboratory mockups, provide plans, sections, and elevations, indicating materials and size of mockup construction.

1. Indicate manufacturer and model number of individual components.
2. Provide axonometric drawings for conditions difficult to illustrate in two dimensions.

1.6 INFORMATIONAL SUBMITTALS

A. Contractor's Quality-Control Plan: For quality-assurance and quality-control activities and responsibilities.

B. Qualification Data : For Contractor's quality-control personnel.

C. Contractor's Statement of Responsibility: When required by authorities having jurisdiction, submit copy of written statement of responsibility sent to authorities having jurisdiction before starting work on the following systems:

1. Seismic-force-resisting system, designated seismic system, or component listed in the designated seismic system quality-assurance plan prepared by Architect.
2. Main wind-force-resisting system or a wind-resisting component listed in the wind-force-resisting system quality-assurance plan prepared by Architect.

D. Testing Agency Qualifications: 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.

E. Schedule of Tests and Inspections: Prepare in tabular form and include the following:

1. Specification Section number and title.
2. Entity responsible for performing tests and inspections.
3. Description of test and inspection.
4. Identification of applicable standards.
5. Identification of test and inspection methods.
6. Number of tests and inspections required.
7. Time schedule or time span for tests and inspections.
8. Requirements for obtaining samples.
9. Unique characteristics of each quality-control service.

1.7 REGULATORY REQUIREMENTS

A. Copies of Regulations: Obtain copies of all regulations applicable to project and make available for reference by parties who have a reasonable need.

1.8 REPORTS AND DOCUMENTS

A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. 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. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
12. Name and signature of laboratory inspector.
13. Recommendations on retesting and reinspecting.

B. Manufacturer's Technical Representative's Field Reports: Prepare written information documenting manufacturer's technical representative's tests and inspections specified in other Sections. Include the following:

1. Name, address, and telephone number of technical 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.

C. Factory-Authorized Service Representative's Reports: Prepare written information documenting manufacturer's factory-authorized service representative's tests and inspections specified in other Sections. Include the following:

1. Name, address, and telephone number of factory-authorized service representative making report.
2. Statement that equipment complies with requirements.
3. Results of operational and other tests and a statement of whether observed performance complies with requirements.
4. Statement whether conditions, products, and installation will affect warranty.
5. Other required items indicated in individual Specification Sections.

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.

1.9 QUALITY ASSURANCE

A. General: Qualifications paragraphs in this article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.

B. 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, as well as sufficient production capacity to produce required units.

C. 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.

D. 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.

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 product that are similar in material, design, and extent to those indicated for this Project.

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.

1. Requirements of authorities having jurisdiction shall supersede requirements for specialists.

G. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 329; and with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.

1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.
2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.

H. Manufacturer's Technical Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

I. 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.

J. Preconstruction Testing: Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following:

1. Contractor responsibilities include the following:

a. Provide test specimens representative of proposed products and construction.
b. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.

c. Provide sizes and configurations of test assemblies, mockups, and laboratory mockups to adequately demonstrate capability of products to comply with performance requirements.
d. Build site-assembled test assemblies and mockups using installers who will perform same tasks for Project.
e. Build laboratory mockups at testing facility using personnel, products, and methods of construction indicated for the completed Work.
f. When testing is complete, remove test specimens, assemblies, mockups, and laboratory mockups; do not reuse products on Project.

2. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Architect, with copy to Contractor. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.

K. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:

1. Build mockups in location and of size indicated or, if not indicated, as directed by Architect.
2. Notify Architect **seven** days in advance of dates and times when mockups will be constructed.
3. Employ supervisory personnel who will oversee mockup construction. Employ workers that will be employed during the construction at Project.
4. Demonstrate the proposed range of aesthetic effects and workmanship.
5. Obtain Architect's approval of mockups before starting work, fabrication, or construction.

a. Allow **seven** days for initial review and each re-review of each mockup.

6. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
7. Demolish and remove mockups when directed unless otherwise indicated.

L. Integrated Exterior Mockups, if Any: Construct integrated exterior mockups as indicated on Drawings or Specifications. Coordinate installation of exterior envelope materials and products for which mockups are required in individual Specification Sections, along with supporting materials.

M. Room Mockups, if Any: Construct room mockups incorporating required materials and assemblies, finished according to requirements. Provide required lighting and additional lighting where required to enable Architect to evaluate quality of the Work. Provide room mockups of rooms as indicated on Drawings or Specifications.

N. Laboratory Mockups: Comply with requirements of preconstruction testing and those specified in individual Specification Sections.

1.10 QUALITY CONTROL

A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.

1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspecting they are engaged to perform.
2. Payment for these services will be made directly by Owner.
3. Costs for retesting and reinspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor with no change to the contract sum.

B. Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality-control activities required to verify that the Work complies with requirements, whether specified or not.

1. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.
2. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.

    a. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.

3. Notify testing agencies at least **24** hours in advance of time when Work that requires testing or inspecting will be performed.
4. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
5. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
6. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.

C. 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 as specified in Section 013300 "Submittal Procedures."

D. Manufacturer's Technical Services: Where indicated, engage a manufacturer's technical representative to observe and inspect the Work. Manufacturer's technical representative's services include participation in preinstallation conferences, examination of substrates and conditions, verification of materials, observation of Installer activities, inspection of completed portions of the Work, and submittal of written reports.

E. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.

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

1. Notify Architect and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
2. Determine the location from which test samples will be taken and in which in-situ tests are conducted.
3. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.

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

G. 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.

H. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and -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.

I. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents and as a component of Contractor's quality-control plan. Coordinate and submit concurrently with Contractor's construction schedule. Update as the Work progresses.

1. Distribution: Distribute schedule to Owner, Architect, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

1.11 SPECIAL TESTS AND INSPECTIONS

A. Special Tests and Inspections: Conducted by a qualified testing agency or special inspector as required by authorities having jurisdiction, as indicated in individual Specification Sections, and as follows:

1. Verifying that manufacturer maintains detailed fabrication and quality-control procedures and reviews the completeness and adequacy of those procedures to perform the Work.
2. Notifying Architect and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
3. Submitting a certified written report of each test, inspection, and similar quality-control service to Architect with copy to Contractor and to authorities having jurisdiction.
4. Submitting a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.

5. Interpreting tests and inspections and stating in each report whether tested and inspected work complies with or deviates from the Contract Documents.
6. Retesting and reinspecting corrected work.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 TEST AND INSPECTION LOG

A. Test and Inspection Log: Prepare a record of tests and inspections. Include the following:

1. Date test or inspection was conducted.
2. Description of the Work tested or inspected.
3. Date test or inspection results were transmitted to Architect.
4. Identification of testing agency or special inspector conducting test or inspection.

B. Maintain log at Project site. Post changes and revisions as they occur. Provide access to test and inspection log for Architect's reference during normal working hours.

3.2 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 Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Section 017300 "Execution."

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 014000

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SECTION 014200 - REFERENCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 DEFINITIONS

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

B. "Approved": When used to convey Architect's action on Contractor's submittals, applications, and requests, "approved" is limited to Architect's duties and responsibilities as stated in the Conditions of the Contract.

C. "Reviewed": When used in conjunction with 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.

D. "Directed": A command or instruction by Architect. Other terms including "requested," "authorized," "selected," "required," and "permitted" have the same meaning as "directed."

E. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."

F. "Regulations": 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.

G. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.

H. "Install": Operations at Project site including unloading, temporarily storing, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.

I. "Installer": An installer is General Contractor or another entity engaged by General Contractor, as an employee, subcontractor, or contractor of lower tier, to perform a particular construction operation, including installation, erection, application, and similar operations.

J. "Provide": Furnish and install, complete and ready for the intended use.

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

1.3 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 standards in effect as of date of the Contract Documents unless otherwise indicated.

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

1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source.

1.4 ABBREVIATIONS AND ACRONYMS

A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities indicated in Thomson Gale's "Encyclopedia of Associations" or in Columbia Books' "National Trade & Professional Associations of the U.S."

B. Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

IAPMO	International Association of Plumbing and Mechanical Officials www.iapmo.org	(909) 472-4100
ICC	International Code Council www.iccsafe.org	(888) 422-7233
ICC-ES	ICC Evaluation Service, Inc. www.icc-es.org	(800) 423-6587 (562) 699-0543
UBC	Uniform Building Code (See ICC)	

C. Federal Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

CE	Army Corps of Engineers www.usace.army.mil	(202) 761-0011
CPSC	Consumer Product Safety Commission www.cpsc.gov	(800) 638-2772 (301) 504-7923

DOC	Department of Commerce www.commerce.gov	(202) 482-2000
DOD	Department of Defense http://.dodssp.daps.dla.mil	(215) 697-6257
DOE	Department of Energy www.energy.gov	(202) 586-9220
EPA	Environmental Protection Agency www.epa.gov	(202) 272-0167
FAA	Federal Aviation Administration www.faa.gov	(866) 835-5322
FCC	Federal Communications Commission www.fcc.gov	(888) 225-5322
FDA	Food and Drug Administration www.fda.gov	(888) 463-6332
GSA	General Services Administration www.gsa.gov	(800) 488-3111
HUD	Department of Housing and Urban Development www.hud.gov	(202) 708-1112
LBL	Lawrence Berkeley National Laboratory www.lbl.gov	(510) 486-4000
NCHRP	National Cooperative Highway Research Program (See TRB)	
NIST	National Institute of Standards and Technology www.nist.gov	(301) 975-6478
OSHA	Occupational Safety & Health Administration www.osha.gov	(800) 321-6742 (202) 693-1999
PBS	Public Buildings Service (See GSA)	
PHS	Office of Public Health and Science www.osophs.dhhs.gov/ophs	(202) 690-7694
RUS	Rural Utilities Service (See USDA)	(202) 720-9540
SD	State Department www.state.gov	(202) 647-4000
TRB	Transportation Research Board	(202) 334-2934

http://gulliver.trb.org

USDA	Department of Agriculture www.usda.gov	(202) 720-2791
USPS	Postal Service www.usps.com	(202) 268-2000

D. Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the standards and regulations in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

ADAAG	Americans with Disabilities Act (ADA) Architectural Barriers Act (ABA) Accessibility Guidelines for Buildings and Facilities Available from U.S. Access Board www.access-board.gov	(800) 872-2253 (202) 272-0080
CFR	Code of Federal Regulations Available from Government Printing Office www.gpoaccess.gov/cfr/index.html	(866) 512-1800 (202) 512-1800
DOD	Department of Defense Military Specifications and Standards Available from Department of Defense Single Stock Point http://dodssp.daps.dla.mil	(215) 697-2664
FED-STD	Federal Standard (See FS)	
FS	Federal Specification Available from Department of Defense Single Stock Point http://dodssp.daps.dla.mil	(215) 697-2664
	Available from Defense Standardization Program www.dps.dla.mil	
	Available from General Services Administration www.gsa.gov	(202) 619-8925
	Available from National Institute of Building Sciences www.wbdg.org/ccb	(202) 289-7800
FTMS	Federal Test Method Standard (See FS)	
UFAS	Uniform Federal Accessibility Standards Available from Access Board www.access-board.gov	(800) 872-2253 (202) 272-0080

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 014200

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SECTION 015000 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes requirements for temporary utilities, support facilities, and security and protection facilities.
   1. All temporary facilities are subject to Owner’s approval.

B. Related Requirements:

   1. Section 011000 "Summary" for work restrictions and limitations on utility interruptions.

1.3 USE CHARGES

A. General: Installation and removal of and use charges for temporary facilities shall be included in the Contract Sum unless otherwise indicated. Allow other entities to use temporary services and facilities without cost, including, but not limited to, Owner's construction forces, Architect, testing agencies, and authorities having jurisdiction.

B. Water and Sewer Service from Existing System: Water from Owner's existing water system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.

C. Electric Power Service from Existing System: Electric power from Owner's existing system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.

E. Water, Electric Power, and Heat: For construction purposes, use water, electric power, and heat from Owner's existing systems without metering and without payment of use charges. General Contractor is responsible for making all connections, subject to approval by Owner, and for removing the connections at the completion of the Work. Do not interrupt service without prior approval of the Owner.

1.4 INFORMATIONAL SUBMITTALS

A. Site Plan: Show temporary facilities, utility hookups, staging areas, and parking areas for construction personnel.

B. Infection Risk Control Plan: Submit coordination drawing and narrative that indicates the dust- and HVAC-control measures proposed for use, proposed locations, and proposed time frame

for their operation. Identify further options if proposed measures are later determined to be inadequate. Include the following:

1. Locations of dust-control partitions at each phase of work.
2. HVAC system isolation and protection schematic drawing.
3. Location of proposed air-filtration system discharge.
4. Methods for control and documentation of negative air pressure relationship of construction areas to adjacent spaces.
5. Waste handling procedures.
6. Other dust-control measures.

C. 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.

D. Dust- and HVAC-Control Plan: Submit coordination drawing and narrative that indicates the dust- and HVAC-control measures proposed for use, proposed locations, and proposed time frame for their operation. Identify further options if proposed measures are later determined to be inadequate. Include the following:

1. Locations of dust-control partitions at each phase of work.
2. HVAC system isolation schematic drawing.
3. Location of proposed air-filtration system discharge.
4. Waste handling procedures.
5. Other dust-control measures.

1.5 QUALITY ASSURANCE

A. 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. Trade Jurisdictions: Assigned responsibilities for installation and operation of temporary utilities are not intended to interfere with trade regulations and union jurisdictions.

1.6 PROJECT CONDITIONS

A. Temporary Use of Permanent Facilities: Engage Installer of each permanent service to 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.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Provide Temporary partitions as noted on the drawings.

B. "Dust-Control Adhesive-Surface Walk-off Mats" Paragraph below for dust control at entries to dust-controlled work areas.

C. Dust-Control Adhesive-Surface Walk-off Mats: Provide mats minimum 36 by 60 inches (914 by 1624 mm).

2.2 EQUIPMENT

A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.

B. Air-Filtration Units: Primary and secondary HEPA-filter-equipped portable units with four-stage filtration. Provide single switch for emergency shutoff. Configure to run continuously.

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.

1. Locate facilities to limit site disturbance as specified in Section 011000 "Summary."

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 TEMPORARY UTILITY INSTALLATION

A. General: Install temporary service or connect to existing service.

1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.

B. Water Service: Connect to Owner's existing water service facilities. Clean and maintain water service facilities in a condition acceptable to Owner. At Substantial Completion, restore these facilities to condition existing before initial use.

C. 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.

1. Toilets: Use of Owner's existing toilet facilities will not be permitted.

D. Isolation of Work Areas in Occupied Facilities: Prevent dust, fumes, and odors from entering occupied areas.

1. Prior to commencing work, isolate the HVAC system in area where work is to be performed according to coordination drawings.

a. Disconnect supply and return ductwork in work area from HVAC systems servicing occupied areas.
b. Maintain negative air pressure within work area using HEPA-equipped air-filtration units, starting with commencement of temporary partition construction, and continuing until removal of temporary partitions is complete.

2. Maintain dust partitions during the Work. Use vacuum collection attachments on dust-producing equipment. Isolate limited work within occupied areas using portable dust-containment devices.
3. Perform daily construction cleanup and final cleanup using approved, HEPA-filter-equipped vacuum equipment.

E. Ventilation and Humidity Control: Provide temporary ventilation required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity. Select equipment 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.

1. Provide dehumidification systems when required to reduce substrate moisture levels to level required to allow installation or application of finishes.

F. Electric Power Service: Connect to Owner's existing electric power service. Maintain equipment in a condition acceptable to Owner.

3.3 INFECTION CONTROL PROCEDURES AND FACILITIES INSTALLATION

A. General: Prevent dust, debris, fumes, and odors generated by construction activities from contaminating adjacent areas. Build perimeter barriers, control air pressure, and institute procedures so that airborne pathogens that are proven to cause potentially deadly infections and that are associated with construction dust and debris can be confined and not be spread to adjacent areas.

B. Negative Air Pressure: Provide negative air pressure within enclosed construction areas in relation to occupied spaces.

1. Prior to commencing work, isolate the HVAC system in area where work is to be performed according to coordination drawings.

a. Disconnect supply and return ductwork in work area from HVAC systems servicing occupied areas. Block all supply and return ductwork and grilles.

2. Where possible install fans to discharge air from construction areas directly to the exterior.
3. Maintain negative air pressure within work area starting with commencement of temporary partition construction, and continuing until removal of temporary partitions is complete.

4. Maintain dust partitions during the Work. Use vacuum collection attachments on dust-producing equipment. Isolate limited work within occupied areas using portable dust-containment devices.

5. Where conditions do not permit direct exhaust to the exterior and where the exhaust system is not available or does not provide sufficient capacity to maintain negative air pressure, the Owner will provide fans equipped with HEPA-equipped air-filtration units. These fans allow exhaust from construction areas to be blown into corridor areas directly. The Owner will take responsibility for maintenance of fans and filters.

6. Test air pressure daily in each construction and adjacent areas and maintain an air pressure log to show that negative air pressure is being maintained.

C. Temporary Barriers: Erect and maintain partitions and temporary enclosures between construction areas and occupied areas to limit dust and dirt migration, to provide a barrier for maintaining negative air pressure within the construction area, to separate areas from fumes and noise, and to provide a fire-resistive and security barrier around construction activities. Any construction activity that has the potential to generate of circulate dust must be separated from areas used by anyone other than construction personnel by dustproof barriers

1. Retain or delete subparagraph below as required. Revise construction to a fire-rated partition if necessary.
2. Construct dustproof partitions of not less than nominal 4-inch (100-mm) studs, 5/8-inch (16-mm) Type X gypsum wallboard with joints taped on occupied side, and 1/2-inch (13-mm) fire-retardant plywood or 5/8-inch (16-mm) Type X gypsum wallboard on construction side.
3. Insulate partitions with flexible batts to provide noise protection to occupied areas.
4. Seal panel joints and perimeter of partition.
5. Paint occupied side of temporary partitions to match surrounding construction.
6. Where temporary barriers will be in place for less than 56 hours provide a “ZipWall’ temporary construction barrier or equivalent temporary dustproof barrier.
7. Before removing any temporary barrier or enclosure and/or opening blocked ductwork and grilles, vacuum all surfaces – wall, floors, and ceilings – with a HEPA vacuum and wipe down all surfaces with disposable towels and appropriate disinfectant cleaner.

D. Construction Access: Limit the number of access points into enclosed construction areas and provide doors in temporary partitions that close tightly to control migration of dust.

1. Install walk-off mats inside construction access doors and clean mats daily.
2. Immediately outside construction access doors provide ‘sticky mats’ with layers of adhesive paper that can be peeled off when saturated with dust.
3. Install carpet protectors for high traffic pathways during construction.
4. Provide gaskets at perimeter of access doors.
5. Seal the perimeter of doors not being used for access with duct tape.
6. Provide security locks at access doors.

E. Waste Disposal: Do not allow dust and dirt to accumulate within construction area. Remove trash and debris within the construction area on a daily basis.

1. Perform daily construction cleanup and final cleanup using approved, HEPA-filter-equipped vacuum equipment.
2. Cover trash carts while transporting within building areas.

F. Protection of HVAC Systems: Protect existing air-handling equipment and ductwork from contamination by construction activities.

1. Disconnect construction areas from HVAC systems, blocking all supply and return ductwork and grilles.
2. Protect ventilation system outside air intake grilles from intake of construction dust and fumes. Identify all system outside air intake grilles and maximize distance to construction equipment. Take precautions to minimize construction dust in exterior construction areas.
3. Where newly installed air-handling equipment will be used to provide ambient conditions for construction activities do not use return air portion of system. Seal and isolate all return air ductwork from construction activities. Provide temporary filters in filter sections. Before occupancy clean coils, supply ductwork, plenums, and air devices. Reference 'Jobsite Conditions' sections of the Mechanical Specifications.
4. Coordinate ventilation requirements to produce ambient condition required for construction activities.

3.4 SUPPORT FACILITIES INSTALLATION

A. Parking: Parking is permitted only in specific areas agreed upon in writing by Owner.

B. Loading and Unloading: Delivery and/or construction vehicles are not permitted to remain in Owner's delivery area after unloading. Coordinate with Owner for extended deliveries and use of loading facilities to prevent interruption of Owner's operations.

C. Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations. Comply with requirements of authorities having jurisdiction. Comply with progress cleaning requirements in Section 017300 "Execution."

D. Lifts and Hoists: Provide facilities necessary for hoisting materials and personnel.

1. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.

E. Existing Elevator Use: Use of Owner's existing elevators is not permitted.

F. Existing Stair Usage: Use of Owner's existing stairs will be permitted, provided stairs are cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore stairs to condition existing before initial use.

1. Provide protective coverings, barriers, devices, signs, or other procedures to protect stairs and to maintain means of egress. If stairs become damaged, restore damaged areas so no evidence remains of correction work.

G. Temporary Use of Permanent Stairs: Use of new stairs for construction traffic will be permitted, provided stairs are protected and finishes restored to new condition at time of Substantial Completion.

H. Housekeeping Carpets: Provide housekeeping carpets at all entrance doors which provide access to the project area from completed and occupied construction. Maintain in safe and clean condition.

3.5 SECURITY AND PROTECTION FACILITIES INSTALLATION

A. Protection of Existing Facilities: Protect existing vegetation, equipment, structures, utilities, and other improvements at Project site and on adjacent properties, except those indicated to be removed or altered. Repair damage to existing facilities.

B. 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.

1. Comply with work restrictions specified in Section 011000 "Summary."

C. Temporary Egress: Maintain temporary egress from existing occupied facilities as indicated and as required by authorities having jurisdiction.

D. Temporary Partitions: Provide floor-to-ceiling dustproof partitions to limit dust and dirt migration and to separate areas occupied by Owner from fumes and noise.

1. Construct dustproof partitions with gypsum wallboard with joints taped on occupied side, and fire-retardant-treated plywood on construction operations side.

2. Where fire-resistance-rated temporary partitions are indicated or are required by authorities having jurisdiction, construct partitions according to the rated assemblies.
3. Insulate partitions to control noise transmission to occupied areas.
4. Seal joints and perimeter. Equip partitions with gasketed dustproof doors and security locks where openings are required.
5. Protect air-handling equipment.
6. Provide walk-off mats at each entrance through temporary partition.

E. 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; manage fire-prevention program.

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.

3.6 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 readings beginning at time of exposure and continuing daily for **48** hours. 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.

3.7 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.

1. Maintain operation of temporary enclosures, 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.

C. Operate Project-identification-sign lighting daily from dusk until 12:00 midnight.

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

E. 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. Owner reserves right to take possession of Project identification signs.
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 017700 "Closeout Procedures."

END OF SECTION 015000

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SECTION 016000 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

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

B. Related Requirements:

1. Section 012100 "Allowances" for products selected under an allowance.
2. Section 012300 "Alternates" for products selected under an alternate.
3. Section 012500 "Substitution Procedures" for requests for substitutions.
4. Section 014200 "References" for applicable industry standards for products specified.
5. Other Sections for specific requirements for warranties on products and installations specified to be warranted and for certifications and other commitments and agreements for continuing services to Owner.

1.3 DEFINITIONS

A. Products: Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.

1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature, that is current as of date of the Contract Documents.
2. New Products: Items that have not previously been incorporated into another project or facility. Products salvaged or recycled from other projects are not considered new products.
3. Comparable Product: Product that is demonstrated and approved through submittal process to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.

B. Basis-of-Design Product Specification: A specification in which a specific manufacturer's product is named and accompanied by the words "basis-of-design product," including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other character-

istics for purposes of evaluating comparable products of additional manufacturers named in the specification.

1.4 ACTION SUBMITTALS

A. Comparable Product Requests: Submit request for consideration of each comparable product. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

1. Include data to indicate compliance with the requirements specified in "Comparable Products" Article.
2. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within one week of receipt of a comparable product request. Architect will notify Contractor of approval or rejection of proposed comparable product request within **10** days of receipt of request, or **five** days of receipt of additional information or documentation, whichever is later.

a. Form of Approval: As specified in Section 013300 "Submittal Procedures."
b. Use product specified if Architect does not issue a decision on use of a comparable product request within time allocated.

B. Basis-of-Design Product Specification Submittal: Comply with requirements in Section 013300 "Submittal Procedures." Show compliance with requirements.

1.5 QUALITY ASSURANCE

A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, select product compatible with products previously selected, even if previously selected products were also options.

1. Each contractor is responsible for providing products and construction methods compatible with products and construction methods of other contractors.
2. If a dispute arises between contractors over concurrently selectable but incompatible products, Architect will determine which products shall be used.

B. Nameplates: Except for required labels and operating data, do not attach manufacturer’s nameplates or trademarks on surfaces exposed to view in occupied spaces or on the exterior.

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. 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 Project 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 Project 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 the 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 weather-tight enclosure above ground, with ventilation adequate to prevent condensation.
4. Protect 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.
7. Provide a secure location and enclosure at Project site for storage of materials and equipment by Owner's construction forces. Coordinate location with Owner.

1.7 PRODUCT WARRANTIES

A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.

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 the Contract Documents to provide specific rights for Owner.

B. Special Warranties: Prepare a 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 the Specifications, prepare a written document using indicated form properly executed.
3. See other Sections for specific content requirements and particular requirements for submitting special warranties.

C. Submittal Time: Comply with requirements in Section 017700 "Closeout Procedures."

1.8 WARRANTY REQUIREMENTS

A. Related Damages and Losses: When correcting failed or damaged warranted construction, remove and replace construction that has been damaged as a result of such failure or must be removed and replaced to provide access for correction of warranted construction.

B. Reinstatement of Warranty: When Work covered by a warranty has failed and been corrected by replacement or rebuilding, reinstate the warranty by written endorsement. The reinstated warranty shall be equal to the original warranty with an equitable adjustment for depreciation.

C. Replacement Cost: Upon determination that Work covered by a warranty has failed, replace or rebuild the Work to an acceptable condition complying with requirements of the Contract Documents. The Contractor is responsible for the cost of replacing or rebuilding defective Work regardless of whether the Owner has benefited from use of the Work through a portion of its anticipated useful service life.

D. Owner's Recourse: Expressed warranties made to the Owner are in addition to implied warranties and shall not limit the duties, obligations, rights, and remedies otherwise available under the law. Expressed warranty periods shall not be interpreted as limitations on the time in which the Owner can enforce such other duties, obligations, rights, or remedies.

1. Rejection of Warranties: The Owner reserves the right to reject warranties and to limit selection to products with warranties not in conflict with requirements of the Contract Documents.

E. Where the Contract Documents require a special warranty, or similar commitment on the Work or part of the Work, the Owner reserves the right to refuse to accept the Work, until the Contractor presents evidence that entities required to countersign such commitments are willing to do so.

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

A. General Product Requirements: Provide products that comply with the 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. Standard Products: If 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 the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
4. Where products are accompanied by the term "as selected," Architect will make selection.
5. Where products are accompanied by the term "match sample," sample to be matched is Architect's.

6. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.
7. Or Equal: For products specified by name and accompanied by the term "or equal," or "or approved equal," or "or approved," comply with requirements in "Comparable Products" Article to obtain approval for use of an unnamed product.

B. Product Selection Procedures:

1. Product: Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
2. Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
   a. Source Limitations: To the fullest extent possible, provide products of the same kind, from a single source. When the Contractor has the option of selecting between two or more products, the product selected shall be compatible with products previously selected.
3. Products:

   a. Restricted List: Where Specifications include a list of names of both manufacturers and products, provide one of the products listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will be considered unless otherwise indicated, as prescribed in Section 012500 “Substitution Procedures.”

4. Manufacturers:

   a. Restricted List: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will be considered, unless otherwise indicated, as prescribed in Section 012500 “Substitution Procedures.”

5. Basis-of-Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers.

C. Visual Matching Specification: Where Specifications require "match Architect's sample", provide a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.

1. If no product available within specified category matches and complies with other specified requirements, comply with requirements in Section 012500 "Substitution Procedures" for proposal of product.

D. Visual Selection Specification: Where Specifications include the phrase "as selected by Architect from manufacturer's full range" or similar phrase, select a product that complies with re-

quirements. Architect will select color, gloss, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

2.2 COMPARABLE PRODUCTS

A. Conditions for Consideration: Architect will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect may return requests without action, except to record noncompliance with these requirements:

1. Evidence that the proposed product does not require revisions to the Contract Documents, that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
3. Evidence that proposed product provides specified warranty.
4. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
5. Samples, if requested.

PART 3 - EXECUTION (Not Used)

END OF SECTION 016000

SECTION 017300 – EXECUTION REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes general administrative and procedural requirements governing execution of the Work including, but not limited to, the following:

1. Construction layout.
2. Field engineering and surveying.
3. Installation of the Work.
4. Cutting and patching.
5. Coordination of Owner-installed products.
6. Progress cleaning.
7. Starting and adjusting.
8. Protection of installed construction.

B. Related Requirements:

1. Section 011000 "Summary" for limits on use of Project site.
2. Section 013300 "Submittal Procedures" for submitting surveys.
3. Section 017700 "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, and final cleaning.
4. Section 024119 "Selective Demolition" for demolition and removal of selected portions of the building.
5. Section 078413 "Penetration Firestopping" for patching penetrations in fire-rated construction.

1.3 DEFINITIONS

A. Cutting: Removal of in-place construction necessary to permit installation or performance of other work.

B. Patching: Fitting and repair work required to restore construction to original conditions after installation of other work.

1.4 INFORMATIONAL SUBMITTALS

A. Cutting and Patching Plan: Submit plan describing procedures at least **10** days prior to the time cutting and patching will be performed. Include the following information:

1. Extent: Describe reason for and extent of each occurrence of cutting and patching.
2. Changes to In-Place Construction: Describe anticipated results. Include changes to structural elements and operating components as well as changes in building appearance and other significant visual elements.
3. Products: List products to be used for patching and firms or entities that will perform patching work.
4. Dates: Indicate when cutting and patching will be performed.
5. Utilities and Mechanical and Electrical Systems: List services and systems that cutting and patching procedures will disturb or affect. List services and systems that will be relocated and those that will be temporarily out of service. Indicate length of time permanent services and systems will be disrupted.

    a. Include description of provisions for temporary services and systems during interruption of permanent services and systems.

1.5 QUALITY ASSURANCE

A. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.

1. Structural Elements: When cutting and patching structural elements, notify Architect of locations and details of cutting and await directions from Architect before proceeding. Shore, brace, and support structural elements during cutting and patching. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection

2. 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. Operational elements include the following:

    a. Primary operational systems and equipment.
    b. Fire separation assemblies.
    c. Air or smoke barriers.
    d. Fire-suppression systems.
    e. Mechanical systems piping and ducts.
    f. Control systems.
    g. Communication systems.
    h. Fire-detection and -alarm systems.
    i. Conveying systems.
    j. Electrical wiring systems.
    k. Operating systems of special construction.

3. Other Construction Elements: Do not cut and patch other construction elements or components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that result in increased maintenance or decreased operational life or safety.

    a. Water, moisture, or vapor barriers.
    b. Membranes and flashings.
    c. Exterior curtain-wall construction.
    d. Sprayed fire-resistive material.

e. Equipment supports.
f. Piping, ductwork, vessels, and equipment.
g. Noise- and vibration-control elements and systems.

4. Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

B. Cutting and Patching Conference: Before proceeding, meet at Project site with parties involved in cutting and patching, including mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

C. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of products and equipment.

PART 2 - PRODUCTS

2.1 MATERIALS

A. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.

1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to Architect for the visual and functional performance of in-place materials.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Existing Conditions: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities, mechanical and electrical systems, and other construction affecting the Work.

1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; underground electrical services, and other utilities.
2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.

B. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.

1. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
2. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
3. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

C. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:

1. Description of the Work.
2. List of detrimental conditions, including substrates.
3. List of unacceptable installation tolerances.
4. Recommended corrections.

D. 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: Furnish information to Owner 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. Coordinate with authorities having jurisdiction.

B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.

D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents caused by differing field conditions outside the control of Contractor, submit a request for information to Architect according to requirements in Section 013100 "Project Management and Coordination."

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.

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 limits on use of Project site.
3. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
4. Inform installers of lines and levels to which they must comply.
5. Check the location, level and plumb, of every major element as the Work progresses.

6. Notify Architect when deviations from required lines and levels exceed allowable tolerances.
7. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.

B. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and rim and invert elevations.

C. Building Lines and Levels: 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. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.

D. Record Log: Maintain a log of layout control work. 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. Make the log available for reference by Architect.

3.4 FIELD ENGINEERING

A. Identification: Owner will identify existing benchmarks, control points, and property corners.

B. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.

1. Do not change or relocate existing benchmarks or control points without prior written approval of Architect. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to Architect before proceeding.
2. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.

C. Benchmarks: Establish and maintain a minimum of two permanent benchmarks on Project site, referenced to data established by survey control points. Comply with authorities having jurisdiction for type and size of benchmark.

1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.
2. Where the actual location or elevation of layout points cannot be marked, provide temporary reference points sufficient to locate the Work.
3. Remove temporary reference points when no longer needed. Restore marked construction to its original condition.

D. Certified Survey: On completion of foundation 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.

3.5 INSTALLATION

A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.

1. Make vertical work plumb and make horizontal work level.
2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
3. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.
4. Maintain minimum headroom clearance of **96 inches (2440 mm)**.

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. Sequence the Work and allow adequate clearances to accommodate movement of construction items on site and placement in permanent locations.

F. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.

G. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.

H. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions.

1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
2. Allow for building movement, including thermal expansion and contraction.
3. Coordinate installation of anchorages. 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.

I. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.

J. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

3.6 CUTTING AND PATCHING

A. Cutting and Patching, General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.

1. Cut in-place 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. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods and with materials so as not to void existing warranties.

C. Temporary Support: Provide temporary support of work to be cut.

D. Protection: Protect in-place 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.

E. Adjacent Occupied Areas: Where interference with use of adjoining areas or interruption of free passage to adjoining areas is unavoidable, coordinate cutting and patching according to requirements in Section 011000 "Summary."

F. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to prevent interruption to occupied areas.

G. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.

1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
4. Excavating and Backfilling: Comply with requirements in applicable Sections where required by cutting and patching operations.
5. Mechanical and Electrical Services: 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.
6. Proceed with patching after construction operations requiring cutting are complete.

H. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other work. Patch with durable seams that are as invisible as practicable. Provide materials and comply with installation requirements specified in other Sections, where applicable.

1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.
2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will minimize evidence of patching and refinishing.

    a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
    b. Restore damaged pipe covering to its original condition.

3. Floors and Walls: 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 in-place 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, prepare substrate and apply primer and intermediate paint coats appropriate for substrate over the patch, and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.

4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition and ensures thermal and moisture integrity of building enclosure.

I. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

3.7 OWNER-INSTALLED PRODUCTS

A. Site Access: Provide access to Project site for Owner's construction personnel.

B. Coordination: Coordinate construction and operations of the Work with work performed by Owner's construction personnel.

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 personnel at preinstallation conferences covering portions of the Work that are to receive Owner's work. Attend preinstallation conferences conducted by Owner's construction personnel if portions of the Work depend on Owner's construction.

3.8 PROGRESS CLEANING

A. General: Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.

1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
2. Do not hold waste materials more than seven days during normal weather or three days if the temperature is expected to rise above 80 deg F (27 deg C).
3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.

    a. Use containers intended for holding waste materials of type to be stored.

4. Coordinate progress cleaning for joint-use areas where Contractor and other contractors are working concurrently.

B. Site: Maintain Project site free of waste materials and debris.

C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.

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

D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. 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 in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

G. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways. Comply with waste disposal requirements in Section 015000 "Temporary Facilities and Controls."

H. 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.

I. 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.

J. 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.

3.9 STARTING AND ADJUSTING

A. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.

B. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.

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: Comply with qualification requirements in Section 014000 "Quality Requirements."

3.10 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.

END OF SECTION 017300

SECTION 017700 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:

1. Substantial Completion procedures.
2. Final completion procedures.
3. Warranties.
4. Final cleaning.
5. Repair of the Work.

B. Related Requirements:

1. Section 013100 “Project Management and Coordination” for project closeout conference.
2. Section 017300 "Execution Requirements" for progress cleaning of Project site.
3. Section 017823 "Operation and Maintenance Data" for operation and maintenance manual requirements.
4. Section 017839 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
5. Section 017900 "Demonstration and Training" for requirements for instructing Owner's personnel.
6. Other Sections for specific closeout and special cleaning requirements for the Work in those Sections.

1.3 ACTION SUBMITTALS

A. Product Data: For cleaning agents.

B. Contractor's List of Incomplete Items: Initial submittal at Substantial Completion.

C. Certified List of Incomplete Items: Final submittal at Final Completion.

1.4 CLOSEOUT SUBMITTALS

A. Certificates of Release: From authorities having jurisdiction.

B. Certificate of Insurance: For continuing coverage.

C. Field Report: For pest control inspection.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Schedule of Maintenance Material Items: For maintenance material submittal items specified in other Sections.

1.6 SUBSTANTIAL COMPLETION PROCEDURES

A. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's punch list), indicating the value of each item on the list and reasons why the Work is incomplete.

B. Submittals Prior to Substantial Completion: Submit the following prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.

1. Certificates of Release: Obtain and submit releases from authorities having jurisdiction permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
2. Submit closeout submittals specified in other Division 01 Sections, including project record documents, operation and maintenance manuals, final completion construction photographic documentation, damage or settlement surveys, property surveys, and similar final record information.
3. Submit closeout submittals specified in individual Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
4. Submit maintenance material submittals specified in individual Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by Architect. Label with manufacturer's name and model number where applicable.

    a. Schedule of Maintenance Material Items: Prepare and submit schedule of maintenance material submittal items, including name and quantity of each item and name and number of related Specification Section. Obtain Architect's signature for receipt of submittals.

5. Submit test/adjust/balance records.
6. Submit sustainable design submittals required in other Sections.
7. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.

C. Procedures Prior to Substantial Completion: Complete the following prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.

1. Advise Owner of pending insurance changeover requirements.
2. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
3. Complete startup and testing of systems and equipment.

4. Perform preventive maintenance on equipment used prior to Substantial Completion.
5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training video recordings specified in Section 017900 "Demonstration and Training."
6. Advise Owner of changeover in heat and other utilities.
7. Participate with Owner in conducting inspection and walkthrough with local emergency responders.
8. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
9. Complete final cleaning requirements, including touchup painting.
10. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.

D. Inspection: Submit a written request for inspection to determine Substantial Completion. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.

1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
2. Results of completed inspection will form the basis of requirements for final completion.

E. Following inspection, the Date of Substantial Completion shall be established as the date upon which the Owner accepts the Work, or portion of the Work covered by that particular Certificate of Substantial Completion, as completed sufficiently enough to permit Owner to occupy and utilize the Work for its intended purpose.
1. If Punch List items interfere with Owner occupancy and use of the Work for its intended purposes, the Work will not be accepted as substantially complete.
2. If Punch List items, regardless of their impact on the Owner’s use of the Work, cannot or will not be completed within **30** calendar days of the date proposed for Substantial Completion, the Work will not be accepted as substantially complete.

1.7 FINAL COMPLETION PROCEDURES

A. Submittals Prior to Final Completion: Before requesting final inspection for determining final completion, complete the following:

1. Submit a final Application for Payment according to Section 012900 "Payment Procedures."
   a. Include a final summary statement delineating any changes to the Contract Sum.
2. Certified List of Incomplete Items: Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. Certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
3. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.
4. Submit pest-control final inspection report.
5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training video recordings required by other Specification Sections.

B. Inspection: Submit a written request for final inspection for acceptance. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.

1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.8 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.

1. Organize list of spaces in sequential order, starting with exterior areas first and then proceeding from lowest floor to highest floor and according to room numbers used on Architectural Plans.
2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
3. Include the following information at the top of each page:

    a. Project name.
    b. Date.
    c. Name of Architect.
    d. Name of Contractor.
    e. Page number.

4. Submit list of incomplete items in the following format:
    a. PDF electronic file. Architect will return annotated file.
    b. **Three** paper copies. Architect will return **two** copies.

1.9 SUBMITTAL OF PROJECT WARRANTIES

A. Time of Submittal: 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, or when delay in submittal of warranties might limit Owner's rights under warranty.

B. Partial Occupancy: Submit properly executed warranties within **15** days of completion of designated portions of the Work that are completed and occupied or used by Owner during construction period by separate agreement with Contractor.

C. Organize warranty documents into an orderly sequence based on the table of contents of Project Manual.

1. Bind warranties and bonds in heavy-duty, three-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch (215-by-280-mm) 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.
4. Warranty Electronic File: Scan warranties and bonds and assemble complete warranty and bond submittal package into a single indexed electronic PDF file with links enabling navigation to each item. Provide bookmarked table of contents at beginning of document.

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.

1. Use cleaning products that comply with Green Seal's GS-37, or if GS-37 is not applicable, use products that comply with the California Code of Regulations maximum allowable VOC levels.

PART 3 - EXECUTION

3.1 FINAL CLEANING

A. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.

B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.

1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a designated 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. Remove snow and ice to provide safe access to building.
f. 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.

g. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
h. Sweep concrete floors broom clean in unoccupied spaces.
i. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean according to manufacturer's recommendations if visible soil or stains remain.
j. 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.
k. Remove labels that are not permanent.
l. Wipe surfaces of mechanical and electrical equipment, elevator equipment if any, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
m. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
n. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
o. Clean ducts, blowers, and coils if units were operated without filters during construction or that display contamination with particulate matter on inspection.

1) Clean HVAC system in compliance with NADCA Standard 1992-01. Provide written report on completion of cleaning.

p. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency.
q. Leave Project clean and ready for occupancy.

C. Pest Control: Comply with pest control requirements in Section 015000 "Temporary Facilities and Controls." Prepare written report.

D. Construction Waste Disposal: Comply with safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on Owner's property. Do not discharge volatile, harmful, or dangerous materials into drainage systems. Remove waste materials from Project site and dispose of lawfully.

3.2 REPAIR OF THE WORK

A. Complete repair and restoration operations before requesting inspection for determination of Substantial Completion.

B. Repair or remove and replace defective construction. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment. Where damaged or worn items cannot be repaired or restored, provide replacements. Remove and replace operating components that cannot be repaired. Restore damaged construction and permanent facilities used during construction to specified condition.

1. Remove and replace chipped, scratched, and broken glass, reflective surfaces, and other damaged transparent materials.
2. Touch up and otherwise repair and restore marred or exposed finishes and surfaces. Replace finishes and surfaces that that already show evidence of repair or restoration.

a. Do not paint over "UL" and other required labels and identification, including mechanical and electrical nameplates. Remove paint applied to required labels and identification.

3. Replace parts subject to operating conditions during construction that may impede operation or reduce longevity.
4. Replace burned-out bulbs, bulbs noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.

END OF SECTION 017700

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SECTION 017823 - OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:

1. Operation and maintenance documentation directory.
2. Emergency manuals.
3. Operation manuals for systems, subsystems, and equipment.
4. Product maintenance manuals.
5. Systems and equipment maintenance manuals.

B. Related Requirements:
1. Section 013300 "Submittal Procedures" for submitting copies of submittals for operation and maintenance manuals.
2. Other Sections for specific operation and maintenance manual requirements for the Work in those Sections.

1.3 DEFINITIONS

A. System: An organized collection of parts, equipment, or subsystems united by regular interaction.

B. Subsystem: A portion of a system with characteristics similar to a system.

1.4 CLOSEOUT SUBMITTALS

A. Manual Content: Operations and maintenance manual content is specified in individual Specification Sections to be reviewed at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.
1. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.

B. Format: Submit operations and maintenance manuals in the following formats:

1. PDF electronic file. Assemble each manual into a composite electronically indexed file. Submit on digital media acceptable to Architect.

a. Name each indexed document file in composite electronic index with applicable item name. Include a complete electronically linked operation and maintenance directory.
b. Enable inserted reviewer comments on draft submittals.

2. **Three** paper copies. Include a complete operation and maintenance directory. Enclose title pages and directories in clear plastic sleeves.
   1) Dan Evans's Office
   2) Elevator Equipment Room
   3) Ted Baker's Office

C. Final Manual Submittal: Submit **one** copy of each manual in final form prior to requesting inspection for Substantial Completion and at least **15** days before commencing demonstration and training. Architect will return copy with comments.

1. Correct or revise each manual to comply with Architect's comments. Submit **3** paper copies and one PDF electronic file of each corrected manual within **15** days of receipt of Architect's comments and prior to commencing demonstration and training.

PART 2 - PRODUCTS

2.1 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY

A. Directory: Prepare a single, comprehensive directory of emergency, operation, and maintenance data and materials, listing items and their location to facilitate ready access to desired information. Include a section in the directory for each of the following:

1. List of documents.
2. List of systems.
3. List of equipment.
4. Table of contents.

B. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.

C. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.

D. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.

E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

2.2 REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS

A. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:

1. Title page.
2. Table of contents.
3. Manual contents.

B. Title Page: 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 and contact information for Contractor.
6. Name and contact information for Architect.
7. Names and contact information for major consultants to the Architect that designed the systems contained in the manuals.
8. Cross-reference to related systems in other operation and maintenance manuals.

C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.

1. If operation or maintenance documentation requires more than one volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.

D. 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.

E. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.

1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
2. File Names and Bookmarks: Enable bookmarking of individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel on opening file.

F. Manuals, Paper Copy: Submit manuals in the form of hard copy, bound and labeled volumes.

1. Binders: Heavy-duty, three-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch (215-by-280-mm) paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.

    a. If two or more binders are necessary to accommodate data of a system, organize data in each binder into groupings by subsystem and related components. Cross-reference other binders if necessary to provide essential information for proper operation or maintenance of equipment or system.
    b. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter of contents, and indicate Specification Section number on bottom of spine. Indicate volume number for multiple-volume sets.

2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section of the manual. 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.
3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software storage media for computerized electronic equipment.
4. Supplementary Text: Prepared on 8-1/2-by-11-inch (215-by-280-mm) white bond paper.
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.

2.3 EMERGENCY MANUALS

A. Content: Organize manual into a separate section for each of the following:

1. Type of emergency.
2. Emergency instructions.
3. Emergency procedures.

B. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:

1. Fire.
2. Flood.
3. Gas leak.
4. Water leak.
5. Power failure.
6. Water outage.
7. System, subsystem, or equipment failure.
8. Chemical release or spill.

C. 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.

D. Emergency Procedures: Include the following, as applicable:

1. Instructions on stopping.
2. Shutdown instructions for each type of emergency.
3. Operating instructions for conditions outside normal operating limits.
4. Required sequences for electric or electronic systems.
5. Special operating instructions and procedures.

2.4 OPERATION MANUALS

A. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:

1. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.
2. Performance and design criteria if Contractor has delegated design responsibility.
3. Operating standards.
4. Operating procedures.
5. Operating logs.
6. Wiring diagrams.
7. Control diagrams.
8. Piped system diagrams.
9. Precautions against improper use.
10. License requirements including inspection and renewal dates.

B. Descriptions: Include the following:

1. Product name and model number. Use designations for products indicated on Contract Documents.
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 the following, as applicable:

1. Startup procedures.
2. Equipment or system break-in procedures.
3. Routine and normal operating instructions.
4. Regulation and control procedures.
5. Instructions on stopping.
6. Normal shutdown instructions.
7. Seasonal and weekend operating instructions.
8. Required sequences for electric or electronic systems.

9. Special operating instructions and procedures.

D. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.

E. Piped Systems: Diagram piping as installed, and identify color-coding where required for identification.

2.5 PRODUCT MAINTENANCE MANUALS

A. 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.

B. 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 and drawing or schedule designation or identifier where applicable.

C. 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.

D. Maintenance Procedures: Include manufacturer's written recommendations and the following:

1. Inspection procedures.
2. Types of cleaning agents to be used and methods of cleaning.
3. List of cleaning agents and methods of cleaning detrimental to product.
4. Schedule for routine cleaning and maintenance.
5. Repair instructions.

E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.

F. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

1. Include procedures to follow and required notifications for warranty claims.

2.6 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

A. 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.

B. Source Information: List each system, subsystem, and piece of equipment 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 and drawing or schedule designation or identifier where applicable.

C. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:

1. Standard maintenance instructions and bulletins.
2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
3. Identification and nomenclature of parts and components.
4. List of items recommended to be stocked as spare parts.

D. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:

1. Test and inspection instructions.
2. Troubleshooting guide.
3. Precautions against improper maintenance.
4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
5. Aligning, adjusting, and checking instructions.
6. Demonstration and training video recording, if available.

E. 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.

1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.

F. 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.

G. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.

H. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

1. Include procedures to follow and required notifications for warranty claims.

PART 3 - EXECUTION

3.1 MANUAL PREPARATION

A. Operation and Maintenance Documentation Directory: Prepare a separate manual that provides an organized reference to emergency, operation, and maintenance manuals.

B. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.

C. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.

D. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.

1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.

E. 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 a 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.

1. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.

F. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the 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.

1. Do not use original project record documents as part of operation and maintenance manuals.
2. Comply with requirements of newly prepared record Drawings in Section 017839 "Project Record Documents."

G. Comply with Section 017700 "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

END OF SECTION 017823

SECTION 017839 - PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for project record documents, including the following:

1. Record Drawings.
2. Record Specifications.
3. Record Product Data.
4. Miscellaneous record submittals.

B. Related Requirements:
1. Section 017700 "Closeout Procedures" for general closeout procedures.
2. Section 017823 "Operation and Maintenance Data" for operation and maintenance manual requirements.
3. Other Sections for specific requirements for project record documents of the Work in those Sections.

1.3 CLOSEOUT SUBMITTALS

A. Record Drawings: Comply with the following:
1. Number of Copies: Submit copies of record Drawings as follows:

a. Initial Submittal:

1) Submit **one** paper-copy set of marked-up record prints.
2) Architect will indicate whether general scope of changes, additional information recorded, and quality of drafting are acceptable.

b. Final Submittal:

1) Submit **one** paper-copy set **and one complete set of PDF electronic files** of marked-up record prints.
2) Plot/print each drawing file, whether or not changes and additional information were recorded.

B. Record Specifications: Submit **annotated PDF electronic files** of Project's Specifications, including addenda and contract modifications.

C. Record Product Data: Submit **annotated PDF electronic files and directories** of each submittal.

1. Where record Product Data are required as part of operation and maintenance manuals, submit duplicate marked-up Product Data as a component of manual.

D. Miscellaneous Record Submittals: See other Specification Sections for miscellaneous record-keeping requirements and submittals in connection with various construction activities. Submit **annotated PDF electronic files and directories** of each submittal.

PART 2 - PRODUCTS

2.1 RECORD DRAWINGS

A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings, incorporating new and revised drawings as modifications are issued.

1. Preparation: Mark record prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.

a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
b. Accurately record information in an acceptable drawing technique.
c. Record data as soon as possible after obtaining it.
d. Record and check the markup before enclosing concealed installations.
e. Cross-reference record prints to corresponding archive photographic documentation.

2. Content: Types of items requiring marking include, but are not limited to, the following:

a. Dimensional changes to Drawings.
b. Revisions to details shown on Drawings.
c. Depths of foundations below first floor.
d. Locations and depths of underground utilities.
e. Revisions to routing of piping and conduits.
f. Revisions to electrical circuitry.
g. Actual equipment locations.
h. Duct size and routing.
i. Locations of concealed internal utilities.
j. Changes made by Change Order or Construction Change Directive.
k. Changes made following Architect's written orders.
l. Details not on the original Contract Drawings.
m. Field records for variable and concealed conditions.
n. Record information on the Work that is shown only schematically.

3. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.

4. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
5. Mark important additional information that was either shown schematically or omitted from original Drawings.
6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

B. Format: Identify and date each record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.

1. Record Prints: Organize record prints into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
2. Record Digital Data Files:
   a. Format: Annotated PDF electronic file.
   b. Organize digital data information into separate electronic files that correspond to each sheet of the Contract Drawings. Name each file with the sheet identification. Include identification in each digital data file.
3. Identification: As follows:

   a. Project name.
   b. Date.
   c. Designation "PROJECT RECORD DRAWINGS."
   d. Name of Architect.
   e. Name of Contractor.

2.2 RECORD SPECIFICATIONS

A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
4. For each principal product, indicate whether record Product Data has been submitted in operation and maintenance manuals instead of submitted as record Product Data.
5. Note related Change Orders, record Product Data, and record Drawings where applicable.

B. Format: Submit record Specifications as **annotated PDF electronic file**.

2.3 RECORD PRODUCT DATA

A. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data 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 the product delivered to Project site and changes in manufacturer's written instructions for installation.
3. Note related Change Orders, record Specifications, and record Drawings where applicable.

B. Format: Submit record Product Data as **annotated PDF electronic file**.

1. Include record Product Data directory organized by Specification Section number and title, electronically linked to each item of record Product Data.

2.4 MISCELLANEOUS RECORD SUBMITTALS

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

B. Format: Submit miscellaneous record submittals as **PDF electronic file**.

1. Include miscellaneous record submittals directory organized by Specification Section number and title, electronically linked to each item of miscellaneous record submittals.

PART 3 - EXECUTION

3.1 RECORDING AND MAINTENANCE

A. Recording: Maintain one copy of each submittal during the construction period for project record document purposes. Post changes and revisions to project record documents as they occur; do not wait until end of Project.

B. Maintenance of Record Documents and Samples: Store record documents and Samples in the field office apart from the Contract Documents used for construction. Do not use project record documents for construction purposes. Maintain record documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to project record documents for Architect's reference during normal working hours.

END OF SECTION 017839

SECTION 017900 - DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 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.

B. Related Requirements:

1. Section 012100 "Allowances," if any, for administrative and procedural requirements for demonstration and training allowances.
2. Section 013100 "Project Management and Coordination" for requirements for preinstruction conferences.
3. Other Sections for specific requirements for demonstration and training for products in those Sections.

1.3 INFORMATIONAL SUBMITTALS

A. Instruction Program: Submit outline of instructional program for demonstration and training, including a list of training modules and a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.

1. Indicate proposed training modules using manufacturer-produced demonstration and training video recordings for systems, equipment, and products in lieu of video recording of live instructional module.

B. Qualification Data: For facilitator and instructor.

C. Attendance Record: For each training module, submit list of participants and length of instruction time.

D. Evaluations: For each participant and for each training module, submit results and documentation of performance-based test.

1.4 CLOSEOUT SUBMITTALS

A. At completion of training, submit complete training manuals for Owner's use prepared and bound in format matching operation and maintenance manuals.

1.5 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 014000 "Quality Requirements," experienced in operation and maintenance procedures and training.

C. Preinstruction Conference: Conduct conference at Project site to comply with requirements in Section 013100 "Project Management and Coordination." Review methods and procedures related to demonstration and training including, but not limited to, the following:

1. Inspect and discuss locations and other facilities required for instruction.
2. Review and finalize instruction schedule and verify availability of educational materials, instructors' personnel, audiovisual equipment, and facilities needed to avoid delays.
3. Review required content of instruction.
4. For instruction that must occur outside, review weather and forecasted weather conditions and procedures to follow if conditions are unfavorable.

1.6 COORDINATION

A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations and to ensure availability of Owner's personnel.

B. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.

C. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data has 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 for equipment not part of a system, as required by individual Specification Sections and as recommended by system or equipment manufacturer or installer.

B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following as applicable to the system, equipment, or component:

1. Basis of System Design, Operational Requirements, and Criteria: Include the following:

   a. System, subsystem, and equipment descriptions.
   b. Performance and design criteria if Contractor is delegated design responsibility.
   c. Operating standards.
   d. Regulatory requirements.
   e. Equipment function.
   f. Operating characteristics.
   g. Limiting conditions.
   h. Performance curves.

2. Documentation: Review the following items in detail:

   a. Emergency manuals.
   b. Operations manuals.
   c. Maintenance manuals.
   d. Project record documents.
   e. Identification systems.
   f. Warranties and bonds.
   g. Maintenance service agreements and similar continuing commitments.

3. Emergencies: Include the following, as applicable:

   a. Instructions on meaning of warnings, trouble indications, and error messages.
   b. Instructions on stopping.
   c. Shutdown instructions for each type of emergency.
   d. Operating instructions for conditions outside of normal operating limits.
   e. Sequences for electric or electronic systems.
   f. Special operating instructions and procedures.

4. Operations: Include the following, as applicable:

   a. Startup procedures.
   b. Equipment or system break-in procedures.
   c. Routine and normal operating instructions.
   d. Regulation and control procedures.
   e. Control sequences.
   f. Safety procedures.
   g. Instructions on stopping.
   h. Normal shutdown instructions.
   i. Operating procedures for emergencies.
   j. Operating procedures for system, subsystem, or equipment failure.
   k. Seasonal and weekend operating instructions.
   l. Required sequences for electric or electronic systems.
   m. Special operating instructions and procedures.

5. Adjustments: Include the following:

a. Alignments.
b. Checking adjustments.
c. Noise and vibration adjustments.
d. Economy and efficiency adjustments.

6. Troubleshooting: Include the following:

a. Diagnostic instructions.
b. Test and inspection procedures.

7. Maintenance: Include the following:

a. Inspection procedures.
b. Types of cleaning agents to be used and methods of cleaning.
c. List of cleaning agents and methods of cleaning detrimental to product.
d. Procedures for routine cleaning
e. Procedures for preventive maintenance.
f. Procedures for routine maintenance.
g. Instruction on use of special tools.

8. Repairs: Include the following:

a. Diagnosis instructions.
b. Repair instructions.
c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
d. Instructions for identifying parts and components.
e. Review of spare parts needed for operation and maintenance.

PART 3 - EXECUTION

3.1 PREPARATION

A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a training manual organized in coordination with requirements in Section 017823 "Operation and Maintenance Data."

B. Set up instructional equipment at instruction location.

3.2 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.
1. Owner will furnish Contractor with names and positions of participants.

C. Scheduling: Provide instruction at mutually agreed on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.

1. Schedule training with Owner with at least **seven** days' advance notice.

D. Training Location and Reference Material: Conduct training on-site in the completed and fully operational facility using the actual equipment in-place. Conduct training using final operation and maintenance data submittals.

E. Evaluation: At conclusion of each training module, assess and document each participant's mastery of module by use of an oral, written, or demonstration performance-based test.

F. Cleanup: Collect used and leftover educational materials and remove from Project site. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

END OF SECTION 017900

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SECTION 024119 - SELECTIVE DEMOLITION

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. Demolition and removal of selected portions of building or structure.

B. Related Requirements:

1. Section 011000 "Summary" for restrictions on the use of the premises, Owner-occupancy requirements, and phasing requirements.
2. Section 017300 "Execution" for cutting and patching procedures.
3. Section 075323 “Ethylene-Propylene-Diene-Monomer (EPDM) Roofing” for coordinating new roofing work with existing roofing and warranties.

1.3 DEFINITIONS

A. Remove: Detach items from existing construction and legally dispose of them off-site unless indicated to be removed and salvaged or removed and reinstalled.

B. Remove and Salvage: Carefully detach from existing construction, in a manner to prevent damage and deliver to Owner.

C. Remove and Reinstall: Detach items from existing construction, prepare for reuse and reinstall where indicated.

D. Existing to Remain: Existing items of construction that are not to be permanently removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

1.4 MATERIALS OWNERSHIP

A. Unless otherwise indicated, demolition waste becomes property of Contractor.

1.5 PREINSTALLATION MEETINGS

A. Pre-demolition Conference: Conduct conference at Project site.

1. Inspect and discuss condition of construction to be selectively demolished.
2. Review structural load limitations of existing structure.
3. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
4. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
5. Review areas where existing construction is to remain and requires protection.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For refrigerant recovery technician.

B. Proposed Protection Measures: Submit report, including drawings, that indicates the measures proposed for protecting individuals and property for environmental protection, for dust control and for noise control. Indicate proposed locations and construction of barriers.

C. Schedule of Selective Demolition Activities: Indicate the following:

1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure Owner's and other tenants' on-site operations are uninterrupted.
2. Interruption of utility services. Indicate how long utility services will be interrupted.
3. Coordination for shutoff, capping, and continuation of utility services.
4. Use of elevator and stairs.
5. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.

D. Inventory: Submit a list of items to be removed and salvaged and deliver to Owner prior to start of demolition.

E. Predemolition Photographs or Video: Submit before Work begins.

F. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.

G. Warranties: Documentation indicated that existing warranties are still in effect after completion of selective demolition.

1.7 CLOSEOUT SUBMITTALS

A. Inventory: Submit a list of items that have been removed and salvaged.

1.8 QUALITY ASSURANCE

A. Refrigerant Recovery Technician Qualifications: Certified by an EPA-approved certification program.

1.9 FIELD CONDITIONS

A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.

B. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.

C. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.

1. Hazardous materials will be removed by Owner before start of the Work.
2. If suspected hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.

D. Hazardous Materials: Hazardous materials are present in buildings and structures to be selectively demolished. A report on the presence of hazardous materials is on file for review and use. Examine report to become aware of locations where hazardous materials are present.

1. Hazardous material remediation is specified elsewhere in the Contract Documents.
2. Do not disturb hazardous materials or items suspected of containing hazardous materials except under procedures specified elsewhere in the Contract Documents.
3. Owner will provide material safety data sheets for suspected hazardous materials that are known to be present in buildings and structures to be selectively demolished because of building operations or processes performed there.

E. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.

1. Maintain fire-protection facilities in service during selective demolition operations.

1.10 WARRANTY

A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials so as not to void existing warranties. Notify warrantor before proceeding.

B. Notify warrantor on completion of selective demolition, and obtain documentation verifying that existing system has been inspected and warranty remains in effect. Submit documentation at Project closeout.

PART 2 - PRODUCTS

2.1 PEFORMANCE REQUIREMENTS

A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

B. Standards: Comply with ANSI/ASSE A10.6 and NFPA 241.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that utilities have been disconnected and capped before starting selective demolition operations.

B. Review record documents of existing construction provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in record documents.

C. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.

D. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Architect.

3.2 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.

1. Comply with requirements for existing services/systems interruptions specified in Section 011000 "Summary."

B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off indicated utility services and mechanical/electrical systems serving areas to be selectively demolished.

1. Owner will arrange to shut off indicated services/systems when requested by Contractor.
2. Arrange to shut off indicated utilities with utility companies.
3. If services/systems are required to be removed, relocated, or abandoned, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
4. Disconnect, demolish, and remove fire-suppression systems, plumbing, and HVAC systems, equipment, and components indicated to be removed.

a. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
b. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
c. Equipment to Be Removed: Disconnect and cap services and remove equipment.
d. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
e. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
f. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
g. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material.

C. Refrigerant: Remove refrigerant from mechanical equipment to be selectively demolished according to 40 CFR 82 and regulations of authorities having jurisdiction.

3.3 PREPARATION

A. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

1. Comply with requirements for access and protection specified in Section 015000 "Temporary Facilities and Controls."

B. Temporary Facilities: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.

1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
4. Cover and protect furniture, furnishings, and equipment that have not been removed.
5. Comply with requirements for temporary enclosures, dust control, heating, and cooling specified in Section 015000 "Temporary Facilities and Controls."

C. Temporary Shoring: Provide and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.

1. Strengthen or add new supports when required during progress of selective demolition.

3.4 SELECTIVE DEMOLITION, GENERAL

A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:

1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.
3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain fire watch and portable fire-suppression devices during flame-cutting operations.
5. Maintain adequate ventilation when using cutting torches.
6. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
7. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
8. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.

B. Reuse of Building Elements: Project has been designed to result in end-of-Project rates for reuse of building elements as follows. Do not demolish building elements beyond what is indicated on Drawings without Architect's approval.

C. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.

3.5 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

A. Concrete: Demolish in small sections. Using power-driven saw, cut concrete to a depth of at least 3/4 inch (19 mm) at junctures with construction to remain. Dislodge concrete from reinforcement at perimeter of areas being demolished, cut reinforcement, and then remove remainder of concrete. Neatly trim openings to dimensions indicated.

B. Concrete: Demolish in sections. Cut concrete full depth at junctures with construction to remain and at regular intervals using power-driven saw, then remove concrete between saw cuts.

C. Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using power-driven saw, then remove masonry between saw cuts.

D. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished, then break up and remove.

E. Resilient Floor Coverings: Remove floor coverings and adhesive according to recommendations in RFCI's "Recommended Work Practices for the Removal of Resilient Floor Coverings." Do not use methods requiring solvent-based adhesive strippers.

3.6 DISPOSAL OF DEMOLISHED MATERIALS

A. General: Except for items or materials indicated to be recycled, reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, remove demolished materials from Project site and legally dispose of them in an EPA-approved landfill.

1. Do not allow demolished materials to accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.

B. Burning: Do not burn demolished materials.

C. Burning: Burning of demolished materials will not be permitted.

D. Disposal: Transport demolished materials and dispose of at designated spoil areas on Owner's property.

E. Disposal: Transport demolished materials off Owner's property and legally dispose of them.

3.7 CLEANING

A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

END OF SECTION 024119

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SECTION 033000 - CONCRETE & REINFORCING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 DESCRIPTION

A. Under this Section, furnish all material, labor, equipment and services required to complete the Cast-In-Place Concrete Work as shown on the drawings and/or specified.

1.3 QUALITY ASSURANCE

A. A competent Engineer or Foreman, familiar with the class of work and approved by the Architect shall be employed by the Contractor to superintend the placing of all forms and reinforcement, and concrete in all parts of the work included under this heading.

B. Comply with the following codes and provisions:
1. ACI 301 "Specifications for Structural Concrete for Buildings".
2. ACI 318 "Building Code Requirements for Reinforced Concrete".
3. ASTM C33, Standard Specification for Concrete Aggregates.
4. ASTM C330, Standard Specification for Light Weight Aggregate for Structural Concrete.
5. ASTM C39, Standard Test Method for compressive Strength of Cylindrical Specimens.
6. ASTM C94, Standard Specification for Ready-Mixed Concrete.
7. ASTM C138, Standard Test Method for Unit Weight, Yield, and Air Content (Gravimetric) of Concrete.
8. ASTM C143, Standard Test Method for Slump of Portland Cement Concrete.
9. ASTM C150, Standard Specification for Portland Cement.
10. ASTM C171, Standard Specification for Sheet Materials for Curing Concrete.
11. ASTM C173, Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.
12. ASTM C231, Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
13. ASTM C260, Standard Specification for Air-Entraining Admixtures for Concrete.
14. ASTM C494, Standard Specification for Chemical Admixtures for Concrete.
15. ASTM C309, Specification for Liquid Membrane Forming Compounds for Curing Concrete.

1.4 SUBMITTALS

A. The contractor shall submit shop drawings in accordance with the General Conditions and Supplementary General Conditions to the Architect for approval before fabrication. Shop

drawings shall be prepared immediately on award of contract and shall be promptly submitted for approval.

B. Shop drawings shall be in accordance with these contract drawings and in general shall be detailed per the "Manual of Standard Practice for Detailing Reinforced Concrete Structures" (ACI 315). The drawings shall show the placing of all bars with appropriate plans, dimensions, sections, details, and required accessories and support bars. Include special reinforcement required for openings through concrete structures.
   1. No Contract Document in any form shall be used as a background for a Shop Drawing unless approved by Engineer.

C. Test Reports shall be sent directly to the Architect in triplicate.

D. Certified mill test reports shall be sent directly to the Architect in triplicate

E. Concrete Mix Designs per ACI 318-02, Section 5.3. Include alternate mix designs when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

F. Product Data: For each type of manufactured material and product indicated.

G. Construction joint locations and details.

H. Hot weather procedures.

I. Cold weather procedures.

J. Material Certificates: Signed by manufacturers certifying that each of the following items complies with requirements:
   1. Cementitious materials and aggregates.
   2. Form materials and form-release agents.
   3. Steel reinforcement and reinforcement accessories.
   4. Fiber reinforcement.
   5. Admixtures.
   6. Waterstops.
   7. Curing materials, including application rate.
   8. Bonding agents.
   9. Adhesives.
   10. Vapor Retarders.
   11. Epoxy joint fillers.
   12. Joint-filler strips.
   13. Repair materials.

1.5 JOB CONDITIONS ENVIRONMENTAL

A. COLD WEATHER:
   1. During cold weather, protection and curing shall comply with "Recommended Practice for Winter Concreting" (ACI 306).
   2. Concrete shall be maintained at 50 degrees F. for the full length of time required for protection. Consideration shall be given to the natural heat of hydration of concrete for the first three days after pouring and external heat shall be taken daily during the

protected period by placing thermometers on concrete surface under the insulating blankets.

3. Minimum length of concrete protection at 50 degrees F.
   a. Formed floor construction - seven days
   b. Footings and foundations below grade - two days
   c. All other concrete - five days.
4. When the average daily temperature at the job site falls generally below 40 degrees F. the following procedure should be followed:
   a. Minimum temperature of fresh concrete as mixed at the plant:
      1) 60 degrees F.: outside temperature above 30 degrees F.
      2) 65 degrees F.: outside temperature 0 to 30 degrees F.
      3) 70 degrees F.: outside temperature below to 0 degrees F.
5. Concrete as placed to be at 50 degrees F. to 60 degrees F. Concrete temperatures above 80 degrees F. will not be acceptable.
6. Proper procedures for placement and finishing concrete shall be used to expedite initial setting of concrete. The use of calcium chloride to accelerate initial concrete set will not be permitted. Approved water reducing additives are recommended to reduce slump, and minimize bleed water which can delay finishing after flatwork.
7. Form temperature shall be raised to a minimum of 50 degrees F. thru the application of artificial heat with approved methods before placement of concrete.
8. Arrangements for heating, covering or housing newly placed concrete should be made in advance of placement and should be adequate to maintain the curing temperatures noted herein.
9. Slabs shall be covered for the length of the protected period with a two-inch thickness of commercial insulating blanket or equivalent approved coverage. Vertically formed surfaces e.g. columns and walls should be protected with a 2" insulating blanket on all sides.
10. After removal of protection, the maximum allowable drop in concrete temperature shall be 40 degrees F. in 24 hours.
11. Additional precautions for slabs on grade:
    a. Provide enclosure with heat to raise subgrade temperature to minimum 40 degrees F.
    b. Maintain enclosure temperature as required to provide 50 degrees F. concrete temperature for required protected period.

B. HOT WEATHER:
1. During hot weather, protection and curing shall comply with "Recommended Practice for Hot Weather Concreting" (ACI 305).
2. Forms and reinforcing steel are to be cooled by fogging prior to placing concrete. Fogging nozzle should produce fog blanket and not an excessive washing spray.
3. Maximum temperature of concrete as placed should be less than 90 degrees F. The use of cold mixing water, cement at temperature less than 70 degrees F. and of cooled aggregate are recommended to reduce concrete temperature.
4. Approved retarding admixtures and water reducers are recommended to retard setting time and minimize water requirements.
5. Mixing and delivery times should be minimized, and concrete placement, consolidation and finishing should be done at the fastest possible rate in coordination with delivery.
6. For slabs on grade the subgrade should be moistened with a fogging spray but should be free of standing water and soft spots at the time of concreting.
7. Curing water should not be much cooler than the concrete and alternate cycles of wetting and drying should be avoided.

8. During conditions of low humidity and moderate wind, special care should be taken to keep concrete flatwork moist for the prescribed period of time.

C. PROTECTION
1. In general, protection and curing shall comply with "Specifications for Structural Concrete for Buildings" (ACI-301).
2. Curing operations shall start as soon as possible without marring the surface after screeding and finishing.
3. During the curing period, concrete shall be protected from damage by action of wind, rain, flowing water and from damaging mechanical disturbances such as load stress, heavy shock and excessive vibration. All finished concrete surfaces shall be protected from damage by construction equipment, materials or defacement of any nature during the construction period.
4. Concrete shall be protected from premature drying and shall be covered with burlap or any approved waterproof paper conforming to ASTM C171 and sprayed as frequently as conditions require to maintain moisture in the concrete for at least seven days after placement. In lieu of the above, the contractor may apply an approved curing compound conforming to "Specifications for Liquid Membrane Forming Compounds for Curing Concrete" (ASTM C-309). The compound shall be applied in accordance with the recommendations of the manufacturer immediately after any water sheen which may develop after finishing has disappeared from the concrete surface. If the liquid membrane is used, the ponding or sprinkling of the concrete surface may be terminated after one day. Should have tint for ease in getting uniform coverage. Curing compound must not be used where subsequent bonding is required. Approval of the above product to be used as a Liquid Membrane Forming Compound for Curing Concrete must be obtained, in writing, from the Subcontractor (s) and manufacturer' (s) for flooring materials.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Concrete Water Vapor Transmission Inhibiting Admixture: Comply with manufacturer's written instructions for delivery, storage and handling.
1. Store materials in their original, undamaged packages and containers, protected from weather, moisture, soiling, extreme temperatures, and humidity and inside a temperature controlled area maintained at above 36 deg F (2 deg C).

PART 2 - PRODUCTS

2.1 MATERIALS

A. ASTM Standards: Reference to ASTM Standard Specifications in the following shall be assumed to refer to the latest revision in all cases.

B. Portland Cement: ASTM C-150 type 1. For all concrete the brand of cement shall be approved by the Architect and this one brand shall be used thru out the work. Air entrained cement will not be permitted. Certified mill test reports of the chemical and physical properties of all cement used in work shall be submitted to the Architect for approval.

C. Coarse Aggregate: Clean, hard, durable, uncoated crushed limestone or gravel conforming to ASTM C 33. Use size 57' (1") or 67' (3/4") thru-out.

D. Coarse Aggregate: Light weight concrete. Light weight aggregate conforming to ASTM C 330, sizes 3/4" to #4.

E. Fine aggregate shall be clean, hard, durable uncoated grains conforming to ASTM C-33. Sand for exposed concrete shall be Meramec River or other approved lignite free sand.

F. Fly Ash: Produced from lignite or subbituminous coal conforming to ASTM C-618, Class C.

G. Mixing Water: Shall be clean and free from all oil, acid, and injurious amounts of vegetable matter, alkalis, salts, or other detrimental impurities.

H. Air-entraining admixture: Conform to ASTM C260 Standard "Specifications for Air-Entraining Admixtures for Concrete".
   1. Approved Products:
      a. Darex AEA by Grace Construction Products.
      b. MB AE 90 by Master Builders Technologies
      c. Any approved equivalent product

I. Water Reducing Admixtures: Conform to ASTM C494, Type A, "Specification for Chemical Admixtures for Concrete".
   1. Approved Products:
      a. Daracem by Grace Construction Products
      b. Pozzolith by Master Builders Technologies
      c. Any approved equivalent product.

J. Accelerating or Retarding Admixtures: May be used only with specific approval of Structural Engineer.

K. Concrete Water Vapor Transmission Inhibiting Admixture: Admixture designed for use at concrete slabs on grade and providing hydraulic conductivity (coefficient of permeability) less than 6.0 E-08 cm/sec when tested in accordance with ASTM D5084.
   1. Basis-of-Design Product: Subject to compliance with requirements, provide "Barrier-1 High Performance Concrete Admixture" by Barrier-1, Inc.; 1901 Tumblewater Blvd., Ocoee, Florida 34761; Contact for Manufacturer's representative: T (877) 224-5850, F (866) 594-3490; email info@barrier-1.com, or one of the following comparable products:
      a. "MOXIE 1800 SUPER-ADMIX" by Moxie International; T (800) 356-3476.
      b. "Concure Admixture" by Concure Products Inc.; T (610) 497-0198.
   2. Non-toxic, liquid admixture for concrete designed to react with water and portlandite filling the capillary system with calcium silicate hydrate (CSH) to eliminate the route for moisture migration. Once the admixture is added to the mix design, the admixture shall react with the water to allow the concrete to be flexible, even at low slump.
      a. Concrete water vapor transmission inhibiting admixture shall be a complex formula that is free of all volatile organic compounds (VOC). It shall be specifically designed to have a natural chemical reaction with pre-existing elements inside the concrete to eliminate the route of moisture vapor emission through concrete by closing down the integral capillary system. The chemical reaction shall form a permanent barrier (capillary break) which is integral to the concrete and irremovable.
         1) Water Vapor Transmission: E-08 cm/sec per ASTM D 5084
         2) Appearance: Colorless

3) Odor: None
4) Toxicity: None
5) Flammability: None
6) Ph: 11.3
7) Shelf Life: Indefinite
8) Weight: 11.2 lbs per gallon
9) Freeze Temp: 32°F
10) Storage Temp: Above 36°F
11) Solvent: Water
12) Acid Resistance: Excellent
13) Hazardous Vapors: None
14) Capillary Break: Calcium Silicate Hydrate Gel
15) Installation: All concrete
16) VOC Levels: Zero

b. Concrete water vapor transmission inhibiting admixture shall contain an anti-microbial biocide to inhibit mold and bacteria growth.

L. Reinforcing Steel: Shall be deformed bars conforming to ASTM 615 (grade 60). Mill Test reports in triplicate shall be furnished to the Architect for each 10 tons furnished.

M. Post-installed Anchors: Shall only be used where specified on the drawings. Contractor shall obtain approval from Engineer of Record (EOR) prior to using post-installed anchors for missing or misplaced cast-in-place anchors.

1. Care shall be given to avoid conflicts with existing rebar when drilling holes. Holes shall be drilled and cleaned per manufacturer's instructions. Anchors shall be installed per the manufacturer's installation instructions at not less than the minimum edge distance and/or spacings indicated on the manufacturer's literature.
2. Special Inspection shall be provided for all adhesive and mechanical anchor installations as required by the building code.
3. Substitution requests, for products other than those listed in the structural drawings, shall be submitted to the EOR with calculations that are prepared and sealed by a Registered Professional Engineer licensed in the state of construction showing that the substituted product will achieve an equivalent capacity using the appropriate design procedure required by the building code. Product ICC-ES code reports shall be included with the submittal package.

N. Welded Wire Fabric: Shall comply with ASTM 185 with size as shown on drawings.

O. Metal reinforcement accessories: Conform to C.R.S.I. requirements for accurate placement of accessories. Accessories in contact with formwork shall be hot-dipped galvanized or plastic coated, after fabrication, with legs turned up for exposed surfaces only.

P. Vapor Retarder (Also referred to as 'Vapor Barrier'): Conform to ASTM E 1745 Class A (15 mil) where called out on drawings and under interior floor slabs.

1. Materials:

a. Permeance of less than 0.01 Perms [grains/(ft^2 * hr * in.Hg)] per ASTM F 1249 or ASTM E 96.
b. Maintain permeance of less than 0.01 Perms [grains/(ft^2 * hr * in.Hg)] after mandatory conditioning tests per ASTM E 154 Sections 8,11,12, and 13.

c. ASTM E 1745 Class A

2. Accessories:

a. Seam Tape: Permeance less than 0.3 perms per ASTM F 1249 or ASTM E 96.
b. Vapor Proofing Mastic: Permeance less than 0.3 perms per ASTM F 1249 or ASTM E 96.
c. Pipe Boots: Construct pipe boots from vapor barrier material, pressure sensitive tape and/or mastic per manufacturer's instructions.

Q. Curing-Sealing compound: Conform to ASTM C-309, Type 1. Submit specific brand for architect's approval.

R. Isolation joint and expansion joint materials: Conforming to ASTM D-1751. Preformed, non-extruding, resilient bituminous type.

S. Waterstops: Shall be a cube shaped, flexible strip of bentonite impregnated material, minimum 1/2 inch thick. Volclay Waterstop RX by American Colloid Company or equal.

T. Non-shrink grout: Factory, pre-mixed. Metallic or non-metallic subject to architects approval.

U. Concrete Formwork: Conform to ACI 347, latest version.

V. Form ties at exposed surfaces: Removable or snap-off ties. Removable ties shall be coated with lacquer or similar material to facilitate removal, pulled from unexposed side. Wire ties will not be permitted.

W. Abrasive Aggregate: Non-slip, non-staining. Submit specific brand for architect's approval.

X. Concrete Mixes - 28 day strengths (Normal weight & Light weight)

1.	3500 psi:	5-1/2 sack/yard minimum	w/c=0.45 MAX
2.	4000 psi:	6 sack/yard minimum	w/c=0.45 MAX

3. ALL CONCRETE shall be type (1) unless noted.

Y. REFER TO PLANS FOR LOCATION OF LIGHT WEIGHT CONCRETE (dry weight 112 PCF +/-).

Z. All concrete shall have a plasticizing admixture in accordance with manufacturer's recommendation with only enough water added to the mix to produce a concrete with the lowest slump compatible with proper placing. At Contractor's option the plasticizing admixture may be omitted for non-exposed foundation work.

AA. An approved superplasticizer may be added to flatwork concrete at the jobsite only, according to the manufacturer's recommendations and with specific approval of the engineer. ASTM C494 Type F or G.

BB. All exterior exposed concrete shall be air-entrained with 6% air content.

CC. In general the proportion of ingredients shall be such as to produce a mixture which will readily work into corners and angles of the forms and around reinforcement by the methods of placing and consolidating employed on the work, but without permitting the materials to segregate or excessive free water to collect on the surface. Any concrete that is to be pumped shall be proportioned specifically for that purpose.

DD. The permissible slump may vary between 2 and 4 inches prior to addition of plasticizer.

EE. Water shall not be added to the concrete after initial plant mix has been executed unless said addition of water is approved by the Architect.

2.2 FABRICATION OF REINFORCING STEEL

A. Reinforcing steel shall be fabricated and placed in accordance with the applicable provisions of the ACI 315, "Manual of Standard Practice for Detailing Reinforced Concrete Structures: and the C.R.S.I. "Specifications and Recommended Practice for Placing Reinforcing Steel", latest Edition.

PART 3 - EXECUTION

3.1 ERECTION OF FORMS

A. In general the construction of forms shall be in accordance with "Recommended Practice for Concrete Formwork" (ACI 347).

B. Construct forms to lines, shapes and dimensions indicated on the drawings. They shall be plumb, straight, properly aligned and sufficiently tight to prevent leakage. Take all possible care in the formwork to produce surfaces free from projections, indentations, and other defects.

C. Tolerances for formed surfaces shall be within limits set by the noted standards which include but are not limited to the following.
   1. Variation from plumbness for wall and columns:
      a. in any 10 feet of height - 1/4"
      b. maximum in entire height - 1"
   2. Variation from the level or from elevations specified in the contract documents slab and beam soffit forms:
      a. in any 10 ft. of length - 1/4"
      b. in any bay or 20 ft. of length - 3/8"
      c. maximum entire length - 3/4"

D. Provide access openings to clean and inspect forms and reinforcing prior to depositing concrete.

E. The design and engineering of the formwork, as well as its construction shall be the responsibility of the contractor and shall be designed, erected, supported, braced and maintained so that it will safely support all vertical and lateral loads that may be applied until such loads can be supported by the concrete structure.

F. Foundations for formwork shall be provided with proper support on ground or mudsills without appreciable settlement it should be stabilized by adequate means. Mudsills should never be placed on frozen ground.

G. Positive means of adjustment (wedges or jacks) of shores shall be provided and all settlement shall be taken up during concrete placement operations. Forms shall be securely braced against lateral deflection.

H. Ties for forms shall be adjustable in length to permit tightening of forms. Locate ties level and plumb in horizontal rows and vertical tiers.

I. Chamfer corner strips shall be placed at all exposed external corners. All exposed external column corners shall be chamfered.

J. Before placing reinforcing, coat all contact surfaces and forms and form liners with a non-staining concrete releasing agent which will not injure concrete surface when forms are removed. Do not coat forms at concrete surface to be plastered.

3.2 REINFORCING:

A. All reinforcing shall have fabricating and placing tolerances in accordance with "Specification for Structural Concrete for Buildings" (ACI-301).

B. Bars may be moved as necessary to avoid interference with other reinforcing steel, conduits, or embedded items. If bars are moved more than one bar diameter, or enough to exceed the allowed tolerances, the resulting arrangement of bars shall be subject to approval.

C. Reinforcing shall be supported and wired together at intersections so that it will be secured and accurately held in place to prevent displacement at construction loads of placement of concrete. Particular care shall be exercised to maintain proper concrete coverage in surfaces to remain exposed to view. At these exposed surfaces the contractor is to furnish noncorrosive accessories for support of bars.

D. Bottom reinforcing in footings and slabs on grade shall be supported on precast concrete blocks of proper depth with embedded wires to secure reinforcing in place. See structural drawings for required clearances.

E. All reinforcement, at the time concrete is placed shall be free of mud, oil or other material that may adversely affect or reduce the bond.

F. Unless permitted by the Architect, reinforcement shall not be bent after being embedded in hardened concrete.

G. All reinforcement shall be securely fastened in forms and approved by the Architect before the concrete is placed.

3.3 MIXING AND TRANSPORTING:

A. All concrete thru out shall be batched, plant mixed and transported in accordance with "Specifications for Ready-Mixed Concrete" (ASTM C94).

B. A sufficient number of trucks shall be provided to continually carry on the work.

C. In general, only one type of concrete shall be poured at a time. Trucks shall be prominently marked in an approved manner to be readily recognized by workman on the job for each type of concrete being used on this project.

D. All drivers of trucks conveying ready-mixed concrete shall furnish duplicate delivery tickets with each load of concrete. These tickets shall indicate type of concrete and date and time dispatched from mixing plant. Concrete from trucks bearing tickets with an elapsed time in excess of one hour, will be rejected for use on this job.

E. Concrete which has partially hardened or has been contaminated by foreign material shall not be deposited.

3.4 PLACING

A. In general concrete shall be placed in accordance with "Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete (ACI-304) and "Standard Specifications for Structural Concrete for Buildings (ACI-301).

B. Before beginning a pour of concrete, all mixing and conveying equipment must be thoroughly cleaned, all debris and foreign matter removed from the forms, the forms wetted, and reinforcing secured and approval of the Architect obtained.

C. Concrete shall be handled from the mixer to the place of final deposit as rapidly as practicable by methods which will prevent segregation or loss of ingredients and in a manner which will assure that the required quality of the concrete is maintained.

D. Concrete shall be deposited continuously, or in layers of such thickness that no concrete will be deposited on concrete which has hardened sufficiently to cause the formation of seams or planes of weakness within the concrete. Concrete should be placed in horizontal layers, avoiding inclined layers and cold joints.

E. On sloping surfaces concrete should be placed at the lower end of the slope first.

F. Equipment should be arranged so that the concrete has an unrestricted vertical drop into the center of the placement receiving it. The stream of concrete should not be separated by permitting it to fall freely over reinforcement. If forms are sufficiently open and clear so that concrete is not disturbed in a vertical fall into place, direct discharge without use of hoppers or chutes is acceptable.

G. Before placing concrete on or against concrete which has already set, the surface of the concrete shall be thoroughly cleaned of all laitance and loose materials and roughened.

H. Concrete shall be vibrated by the use of "Spud" type vibrators with flexible shafts and shall be operated by competent workmen. The largest and most powerful vibrator that can be effectively operated in the given work should be used for best results.

I. Vibration shall begin as soon as one batch of concrete has been placed and shall proceed continuously until the entire section being poured is completely vibrated. Use of vibrators to transport concrete within forms shall not be allowed.

J. Insert vibrators in a vertical position at 18" intervals to bottom of pour. Where concrete is placed in layers, extend vibrator into previous pour if still in a plastic state.

K. At each insertion, the duration shall be sufficient to consolidate the concrete but not sufficient to cause segregation; generally 5 to 15 seconds in one spot is considered sufficient.

L. On exposed vertical surfaces where air void holes are objectionable, extra vibration may be used to minimize these voids but a mix with less water might be required to prevent segregation. A full surface of mortar shall be brought against the form by the vibration process, supplement if necessary by spading to work the coarse aggregate back from the formed surface.

M. The hardened concrete at construction joints between footings and walls or between joints in unexposed walls shall be dampened, (but not saturated) immediately prior to placing of fresh concrete.

N. The hardened concrete of joints in exposed work, joints to be water tight, and construction joints in formed floor construction shall be dampened (but not saturated) and then thoroughly covered with a coat of cement grout of similar proportions to the mortar in the concrete. This grout should be scrubbed into the surface of the joint with wire brooms and shall be approximately 1/2" high on surfaces. The fresh concrete shall be placed before the grout has attained its initial set.

3.5 FINISHING

A. Floors indicated or scheduled, unless specified otherwise, to have cement, waterproofing, tile, resilient, and carpet finish, shall be screeded off accurately and full up to screeds, then given a float finish. When the concrete has reached the proper consistency it shall be troweled to a smooth, even, hard, dense surface. Cement shall not be used to absorb surface moisture.
   1. Finish surfaces shall meet or exceed the following tolerances, according to ASTM E 1155
      (ASTM E 1155M), for randomly trafficked floor surface:

      a. Specified overall values of flatness, F_F25; and of levelness, F_L25; with minimum local values of flatness, F_F17; and of levelness, F_L17.

B. Walls indicated or scheduled to have cement (exposed) rubbed finish or painted finish shall be smoothed finished as follows:
   1. Immediately after removing the forms the ties are to be snapped off and recesses filled with cement and sand mortar and finished smooth to match adjoining wall.
   2. Any ragged or irregular places in the concrete face shall be worked off to a true and uniform surface. Any voids wider or deeper than 1/8" shall be filled. The exposed surface to be rubbed smooth with carborundum stone and water immediately after the forms are removed.
   3. Exterior walk surfaces, stairs, and parking slabs should have a broomed finish. Finish texture to be subject to architect's approval.

C. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces occurring 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.

D. Exterior walk surfaces, stairs, and parking slabs should have a broomed finish. Finish texture to be subject to architect's approval.

3.6 PATCHING

A. All other concrete surfaces shall have form tie holes, any voids wider than 1/2" and deeper than 1/4" patched with cement and sand mortar.

3.7 CURING

A. All interior concrete slabs shall be cured with curing compound (unless otherwise noted) as soon as slab finish has set sufficiently hard to permit application. Refer to Part 1, Protection Section, for curing requirements.

3.8 FLOOR SLABS ON GRADE

A. Slabs, in general, shall be placed in accordance with ACI 302, "Recommended Practice for Concrete Floor and Slab Construction".
   1. Provide concrete water vapor transmission inhibiting admixture in accordance with manufacturer's written instructions.

B. Welded wire fabric shall be located 1 inch from top of slab and shall be 6 x 6 - W1.4 x W1.4 flat sheets unless otherwise indicated.

C. Welded wire fabric shall be supported on metal chairs, or precast concrete blocks 36 inches on center, each way, and lapped 1'-0 at ends and sides.

D. Place vapor barrier under all floor slabs on grades and lap all edges 6 inches.
   1. Inspect installed vapor barrier and correct any deficiencies prior to placement of concrete.
   2. Photographic Documentation: After completion of installation of vapor barrier and reinforcing, but prior to installation of concrete at slabs-on-grade, take photographs in sufficient quantity to document entire area of vapor barrier installation, but no fewer than one photograph for every 500 square feet of vapor barrier. Select vantage points to show vapor barrier, seams, edges and penetrations.

E. Clean sand shall be tamped into voids of surface of sub-base, before vapor barrier is installed, to prevent puncturing of membrane by aggregate.

F. Provide control joints on centers of columns in both directions, but not greater than 15 feet on center in each direction, unless otherwise indicated.

G. Diamond shaped isolation joints shall be provided around all columns, using 1/4 inch thick by full slab depth preformed joint filler.

H. Provide isolation joints around perimeter where concrete slab abuts vertical wall, using 1/4 inch thick preformed joint filler.

I. Control joints shall be an approved plastic tee with depth approx. one-third the slab thickness. Top flange of tee shall be removed prior to finishing the concrete. W.W.F. to run continuously across joints with alternate wires being cut at joint.

J. Construction joints are to be built at control joints and are to be formed with a tongue and groove metal screed joint with dowels.

3.9 WATERSTOPS

A. Set waterstops at joints of removable knock out panels occurring in concrete walls.

B. Set waterstops at all vertical construction joints and expansion joints in concrete basement walls below grade, at juncture of concrete retaining walls and the building and at horizontal construction joints in basement walls at juncture of wall and footing.

C. Waterstops shall be continuous at all joints with ends butted. Install per recommendations of manufacturer. Approved manufacturer is Volclay Waterstop RX by American Colloid Co.

3.10 CONSTRUCTION JOINTS

A. Joints shall be perpendicular to the main reinforcement. All reinforcement and welded wire fabric is to run continuously thru the construction joint.

B. Longitudinal keys at least 1-1/2" deep shall be provided in all joints in walls and beams. Waterstops in exterior walls shall be provided as indicated in this specification.

C. Construction joints are to be located so as to allow a continuous monolith placement of concrete between joints in one operation.

3.11 INSERTS, FASTENING DEVICES, SLOTS, HOLES AND SLEEVES FOR OTHER WORK

A. Install inserts, hangers, metal ties, anchors, bolts, angle guards, stair nosing, metal edge strips, expansion joints, floor plates, nailing strips, blocking, grounds, and other fastening devices occurring in concrete for attachment of other work. Properly locate in cooperation with other trades and secure accurately in position before concrete is poured.

B. All inserts and dovetailed anchors shall be set flush with surface, perfectly aligned and kept free of concrete. Provide all slots, holes and sleeves for pipes and ducts where shown or required and if not shown on plans, obtain size and location from other sub-contractors before pouring concrete work.

C. Sleeves and conduits thru beams shall be only as indicated on structural drawings, and in such position as not to impair the strength of the structure. Any opening thru beam other than shown on structural drawings must be specifically approved by the Structural Engineer. All sleeves thru beams shall be formed with standard weight steel pipe.

D. Openings in slabs shall be as indicated on structural drawings. Openings in slabs larger than eight inches in any direction, not shown on structural drawings must be specifically approved by the Structural Engineer. In addition in flat slab construction, no openings shall be placed within 1'-6 of the face of a column unless approved as noted.

E. The concrete covering of the pipes and fittings shall not be less than 1-1/2" for concrete surfaces exposed to the weather or in contact with the ground nor 3/4" for all other pipes and sleeves. Pipes or conduits of aluminum shall not be embedded in structural concrete unless coated or covered to prevent electrolytic action.

3.12 REMOVAL OF FORMS

A. Remove forms and shoring in such a manner as to insure complete safety of the structure. In no case shall supporting forms or shoring be removed until members have acquired sufficient strength to safely support their weight and such additional loads as may come upon them. Temporary reshores shall be placed under horizontal formed surfaces where necessary.

B. Time of removal of forms will be determined by weather and other conditions prevailing at the time. It should be understood that the contractor shall be responsible for the safety and security of his work. In general the following may be used as a guide for removal of forms under optimum conditions.

C. Forms for vertical form surfaces may be removed a minimum of 48 hours after concrete pour.

D. Forms for horizontal formed surfaces may be removed a minimum of 7 days after concrete pour but not before concrete has attained a minimum of 2/3 of its concrete design strength as determined from field cured cylinders.

3.13 FIELD QUALITY CONTROL

A. The Owner shall engage and pay a qualified independent testing laboratory to provide services pertaining to control and testing for all concrete used on this project.

B. Test aggregates proposed to be used to verify compliance with specified requirements.

C. Verify preparation of mix design for each type of concrete specified.

D. Make and test proof cylinders for each type of concrete to verify design mix; proof cylinders conform to ACI 318-89 Table 5.3.2.2 for 28 day strength or 56 day strength.

E. Verify use of approved additives in proportions specified or as recommended by the manufacturer.

F. Slump tests shall be made not less than twice during each days placing.

G. Cylinder tests shall be made for each 100 cu. yds. of concrete, nor less than once for each 5000 sq. feet of surface area for floors and walls, but not less than one test for each days pour.

H. A cylinder test for 28 day strength concrete shall consist of the following:
   1. Three cylinders of each test shall be laboratory cured and tested one at seven days and two at twenty-eight days.
   2. One cylinder of each test shall be field cured under the same conditions as concrete incorporated into the project and laboratory tested at seven days.
   3. Additional cylinders are to be incorporated into each test as required by the contractor for early removal of forms or post- tensioning.

I. Test procedures shall conform to:
   1. Sampling Fresh Concrete: ASTM C172
   2. Slump: ASTM C143
   3. Air Content: ASTM C173 or C231
   4. Unit Weight for lightweight concrete: ASTM C567
   5. Compression Test Specimen: ASTM C31
   6. Compressive Strength Tests: ASTM C39

7. Hydraulic Conductivity Tests: ASTM D5084 and as recommended by water vapor transmission admixture manufacturer.

J. Additional Tests:
1. The testing service will make additional tests of in-place concrete when test results indicate specified strengths and other characteristics have not been met. As directed by the Architect, cored cylinders complying with ASTM C42, along with any other tests as necessary, will be paid for by the contractor.

END OF SECTION 033000

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SECTION 042000 - UNIT MASONRY

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. Concrete masonry units.
2. Face brick.
3. Mortar and grout.
4. Steel reinforcing bars.
5. Masonry joint reinforcement.
6. Ties and anchors.
7. Embedded flashing.
8. Miscellaneous masonry accessories.

B. Related Sections:

1. Section 012100 “Allowances.”
2. Section 033000 "Concrete & Reinforcement" for dovetail slots for masonry anchors.
3. Section 047200 "Cast Stone Masonry" for furnishing cast stone trim.
4. Section 055000 "Metal Fabrications" for furnishing steel lintels and shelf angles.

1.3 DEFINITIONS

A. CMU(s): Concrete masonry unit(s).

B. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.4 ACTION SUBMITTALS

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

B. Shop Drawings: For the following:

1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.
2. Stone Trim Units: Show sizes, profiles, and locations of each stone trim unit required.

C. Samples for Initial Selection:
1. Face brick**.**

2. Stone trim.
3. Colored mortar.

D. Samples for Verification: For each type and color of the following:
1. Face brick, in the form of straps of five or more bricks.
2. Stone trim.
3. Pigmented mortar. Make Samples using same sand and mortar ingredients to be used on Project.

1.5 INFORMATIONAL SUBMITTALS

A. List of Materials Used in Constructing Mockups: List generic product names together with manufacturers, manufacturers' product names, model numbers, lot numbers, batch numbers, source of supply, and other information as required to identify materials used. Include mix proportions for mortar and grout and source of aggregates.

1. Submittal is for information only. Neither receipt of list nor approval of mockup constitutes approval of deviations from the Contract Documents unless such deviations are specifically brought to the attention of Architect and approved in writing.

B. Qualification Data: For testing agency.

C. Material Certificates: For each type and size of the following:

1. Masonry units.

a. Include data on material properties.
b. For brick, include size-variation data verifying that actual range of sizes falls within specified tolerances.
c. For exposed brick, include test report for efflorescence according to ASTM C 67.

2. Cementitious materials. Include brand, type, and name of manufacturer.
3. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
4. Grout mixes. Include description of type and proportions of ingredients.
5. Reinforcing bars.
6. Joint reinforcement.
7. Anchors, ties, and metal accessories.

D. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.

1. Include test reports for mortar mixes required to comply with property specification. Test according to ASTM C 109/C 109M for compressive strength, ASTM C 1506 for water retention, and ASTM C 91 for air content.
2. Include test reports, according to ASTM C 1019, for grout mixes required to comply with compressive strength requirement.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM C 1093 for testing indicated.

B. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from single source from single manufacturer for each product required.

C. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from single manufacturer for each cementitious component and from single source or producer for each aggregate.

D. Masonry Standard: Comply with ACI 530.1/ASCE 6/TMS 602 unless modified by requirements in the Contract Documents.

E. Sample Panels: Build sample panels to verify selections made under sample submittals and to demonstrate aesthetic effects. Comply with requirements in Section 014000 "Quality Requirements" for mockups.

1. Build sample panels for typical exterior walls in sizes approximately 48 inches (1200 mm) long by 36 inches (900 mm) high.
2. Where masonry is to match existing, erect panels adjacent and parallel to existing surface.
3. Clean one-half of exposed faces of panels with masonry cleaner indicated.
4. Protect approved sample panels from the elements with weather-resistant membrane.
5. Approval of sample panels is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; aesthetic qualities of workmanship; and other material and construction qualities specifically approved by Architect in writing.

    a. Approval of sample panels does not constitute approval of deviations from the Contract Documents contained in sample panels unless such deviations are specifically approved by Architect in writing.

F. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Build mockups for each type of exposed unit masonry construction typical exterior walls in sizes approximately 48 inches (1200 mm)] long by 36 inches (900 mm) high by full thickness, including face and backup wythes and accessories.

2. Where masonry is to match existing, erect mockups adjacent and parallel to existing surface.
3. Clean one-half of exposed faces of mockups with masonry cleaner as indicated.
4. Protect accepted mockups from the elements with weather-resistant membrane.
5. Approval of mockups is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; and aesthetic qualities of workmanship.

    a. Approval of mockups is also for other material and construction qualities specifically approved by Architect in writing.
    b. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless such deviations are specifically approved by Architect in writing.

G. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Section 013100 "Project Management and Coordination."

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store masonry units 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.

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 aggregates where grading and other required characteristics can be maintained and contamination avoided.

D. Deliver preblended, dry mortar mix in moisture-resistant containers designed for use with dispensing silos. Store preblended, dry mortar mix in delivery containers on elevated platforms, under cover, and in a dry location or in covered weatherproof dispensing silos.

E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.8 PROJECT CONDITIONS

A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.

1. Extend cover a minimum of 24 inches (600 mm) down both sides of walls and hold cover securely in place.
2. Where one wythe of multiwythe masonry walls is completed in advance of other wythes, secure cover a minimum of 24 inches (600 mm) down face next to unconstructed wythe and hold cover in place.

B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least three days after building masonry walls or columns.

C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.

1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
2. Protect sills, ledges, and projections from mortar droppings.
3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.

D. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F (4 deg C) and higher and will remain so until masonry has dried, but not less than seven days after completing cleaning.

E. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

PART 2 - PRODUCTS

2.1 MASONRY UNITS, GENERAL

A. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated in the standard. Do not use units where such defects will be exposed in the completed Work.

B. Fire-Resistance Ratings: Where indicated, provide units that comply with requirements for fire-resistance ratings indicated as determined by testing according to ASTM E 119, by equivalent masonry thickness, or by other means, as acceptable to authorities having jurisdiction.

2.2 CONCRETE MASONRY UNITS

A. CMUs: ASTM C 90.

1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2150 psi (14.8 MPa).
2. Density Classification: Lightweight.
3. Size (Width): Manufactured to dimensions 3/8 inch less than nominal dimensions.

2.3 BRICK

A. General: Provide shapes indicated and as follows, with exposed surfaces matching finish and color of exposed faces of adjacent units:

1. For ends of sills and caps and for similar applications that would otherwise expose unfinished brick surfaces, provide units without cores or frogs and with exposed surfaces finished.
2. Provide special shapes for applications where stretcher units cannot accommodate special conditions, including those at corners, movement joints, bond beams, sashes, and lintels.
3. Provide special shapes for applications requiring brick of size, form, color, and texture on exposed surfaces that cannot be produced by sawing.

B. Face Brick: Facing brick complying with ASTM C 216.

1. Products: Subject to compliance with requirements, provide the following.
2. Grade: SW.
3. Type: FBX.

4. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 3350 psi (23.10 MPa).
5. Initial Rate of Absorption: Less than 30 g/30 sq. in. (30 g/194 sq. cm) per minute when tested per ASTM C 67.
6. Efflorescence: Provide brick that has been tested according to ASTM C 67 and is rated "not effloresced.
7. Size (Actual Dimensions): 3-5/8 inches (92 mm) wide by 2-1/4 inches (57 mm) high by 7-5/8 inches (194 mm) long.
8. Color and Texture: Match existing adjacent brick.

2.4 MORTAR AND GROUT MATERIALS

A. Portland Cement: ASTM C 150, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.

B. Hydrated Lime: ASTM C 207, Type S.

C. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.

D. Masonry Cement: ASTM C 91.

E. Mortar Cement: ASTM C 1329.

F. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes and complying with ASTM C 979. Use only pigments with a record of satisfactory performance in masonry mortar.

1. Products: Subject to compliance with requirements provide one of the following:

a. Davis Colors; True Tone Mortar Colors.
b. Lanxess Corporation; Bayferrox Iron Oxide Pigments.
c. Solomon Colors, Inc.; SGS Mortar Colors.

G. Colored Cement Product: Packaged blend made from portland cement and hydrated lime and mortar pigments, all complying with specified requirements, and containing no other ingredients.

1. Colored Portland Cement-Lime Mix:

a. Products: Subject to compliance with requirements, provide one of the following:

1) Capital Materials Corporation; Riverton Portland Cement Lime Custom Color.
2) Holcim (US) Inc.; Rainbow Mortamix Custom Color Cement/Lime.
3) Lafarge North America Inc.; Eaglebond Portland & Lime.
4) Lehigh Cement Company; Lehigh Custom Color Portland/Lime Cement.

2. Colored Masonry Cement:

a. Products: Subject to compliance with requirements, provide one of the following:

1) Capital Materials Corporation; Flamingo Color Masonry Cement.
2) Cemex S.A.B. de C.V.; Richcolor Masonry Cement.
3) Essroc, Italcementi Group; Brixment-in-Color.
4) Holcim (US) Inc.; Rainbow Mortamix Custom Color Masonry Cement.
5) Lafarge North America Inc.; U.S. Cement Custom Color Masonry Cement.
6) Lehigh Cement Company; Lehigh Custom Color Masonry Cement.
7) National Cement Company, Inc.; Coosa Masonry Cement.

3. Formulate blend as required to produce color indicated or, if not indicated, as selected from manufacturer's standard colors.
4. Pigments shall not exceed 10 percent of portland cement by weight.
5. Pigments shall not exceed 5 percent of masonry cement or mortar cement by weight.

H. Aggregate for Mortar: ASTM C 144.

1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
2. Colored-Mortar Aggregates: Natural sand or crushed stone of color necessary to produce required mortar color.

I. Aggregate for Grout: ASTM C 404.

J. Epoxy Pointing Mortar: ASTM C 395, epoxy-resin-based material formulated for use as pointing mortar for structural-clay tile facing units (and approved for such use by manufacturer of units); in color indicated or, if not otherwise indicated, as selected by Architect from manufacturer's colors.

K. Refractory Mortar Mix: Ground fireclay or non-water-soluble, calcium aluminate, medium-duty refractory mortar that passes ASTM C 199 test; or an equivalent product acceptable to authorities having jurisdiction.

L. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C 494/C 494M, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.

1. Products: Subject to compliance with requirements provide one of the following:

a. Euclid Chemical Company (The); Accelguard 80.
b. Grace Construction Products, W. R. Grace & Co. - Conn.; Morset.
c. Sonneborn Products, BASF Aktiengesellschaft; Trimix-NCA.

M. Water: Potable.

2.5 REINFORCEMENT

A. Uncoated Steel Reinforcing Bars: ASTM A 615/A 615M or ASTM A 996/A 996M, Grade 60 (Grade 420).

B. Masonry Joint Reinforcement, General: ASTM A 951/A 951M.
1. Exterior Walls: Hot-dip galvanized, carbon, Stainless steel.
2. Wire Size for Side Rods: 0.187-inch (4.76-mm) diameter.
3. Wire Size for Cross Rods: 0.187-inch (4.76-mm) diameter.

4. Wire Size for Veneer Ties: 0.187-inch (4.76-mm) diameter.
5. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 inches (407 mm) o.c.
6. Provide in lengths of not less than 10 feet (3 m).

C. Masonry Joint Reinforcement for Single-Wythe Masonry: Either ladder or truss type with single pair of side rods.

D. Masonry Joint Reinforcement for Multiwythe Masonry:

1. Adjustable (two-piece) type, either ladder or truss design, with one side rod at each face shell of backing wythe and with separate adjustable ties with pintle-and-eye connections having a maximum adjustment of 1-1/4 inches (32 mm). Size ties to extend at least halfway through facing wythe but with at least 5/8-inch (16-mm) cover on outside face. Ties have hooks or clips to engage a continuous horizontal wire in the facing wythe.

E. Masonry Joint Reinforcement for Veneers Anchored with Seismic Masonry-Veneer Anchors: Single 0.187-inch- (4.76-mm-) diameter, hot-dip galvanized, carbon steel continuous wire.

2.6 TIES AND ANCHORS

A. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated.
1. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A 82/A 82M; with ASTM A 153/A 153M, Class B-2 coating.
2. Steel Sheet, Galvanized after Fabrication: ASTM A 1008/A 1008M, Commercial Steel, with ASTM A 153/A 153M, Class B coating.
3. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

B. Wire Ties, General: Unless otherwise indicated, size wire ties to extend at least halfway through veneer but with at least 5/8-inch (16-mm) cover on outside face. Outer ends of wires are bent 90 degrees and extend 2 inches (50 mm) parallel to face of veneer.

C. Adjustable Masonry-Veneer Anchors:

1. General: Provide anchors that allow vertical adjustment but resist tension and compression forces perpendicular to plane of wall, for attachment over sheathing to wood or metal studs, and as follows:

a. Structural Performance Characteristics: Capable of withstanding a 100-lbf (445-N) load in both tension and compression without deforming or developing play in excess of 0.05 inch (1.3 mm).

2. Seismic Masonry-Veneer Anchors: Units consisting of a metal anchor section and a connector section designed to engage a continuous wire embedded in the veneer mortar joint.

a. Products: Subject to compliance with requirements one of the following:

1) Dayton Superior Corporation, Dur-O-Wal Division; D/A 213S.
2) Wire-Bond; RJ-711 with Wire-Bond clip.
3) Hohmann & Barnard, Inc.; DW-10-X-Seismiclip.

3. Polymer-Coated, Steel Drill Screws for Steel Studs: ASTM C 954 except manufactured with hex washer head and neoprene or EPDM washer, No. 10 (4.83-mm) diameter by length required to penetrate steel stud flange with not less than three exposed threads, and with organic polymer coating with salt-spray resistance to red rust of more than 800 hours per ASTM B 117.

    a. Products: Subject to compliance with requirements, provide one of the following:

        1) ITW Buildex; Teks Maxiseal with Climaseal finish.
        2) Textron Inc., Textron Fastening Systems; Elco Dril-Flex with Stalgard finish.

2.7 MISCELLANEOUS ANCHORS

A. Unit Type Inserts in Concrete: Cast-iron or malleable-iron wedge-type inserts.

B. Dovetail Slots in Concrete: Furnish dovetail slots with filler strips, of slot size indicated, fabricated from 0.034-inch (0.86-mm), galvanized steel sheet.

C. Anchor Bolts: Headed steel bolts complying with ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with ASTM A 563 (ASTM A 563M) hex nuts and, where indicated, flat washers; hot-dip galvanized to comply with ASTM A 153/A 153M, Class C; of dimensions indicated.

2.8 EMBEDDED FLASHING MATERIALS

A. Metal Flashing: Provide metal flashing complying with SMACNA's "Architectural Sheet Metal Manual" and as follows:

1. Stainless Steel: ASTM A 240/A 240M, Type 304, 0.016 inch (0.40 mm) thick.
2. Fabricate continuous flashings in sections 96 inches (2400 mm) long minimum, but not exceeding 12 feet (3.7 m). Provide splice plates at joints of formed, smooth metal flashing.
3. Fabricate through-wall metal flashing embedded in masonry from stainless steel, with ribs at 3-inch (76-mm) intervals along length of flashing to provide an integral mortar bond.

    a. Products: Subject to compliance with requirements, provide one of the following:

        1) Cheney Flashing Company; Cheney Flashing (Dovetail).
        2) Keystone Flashing Company, Inc.; Keystone 3-Way Interlocking Thruwall Flashing.
        3) Sandell Manufacturing Co., Inc.; Mechanically Keyed Flashing.
4. Fabricate through-wall flashing with drip edge where indicated. Fabricate by extending flashing 1/2 inch (13 mm) out from wall, with outer edge bent down 30 degrees and hemmed.
5. Metal Drip Edge: Fabricate from stainless steel. Extend at least 3 inches (76 mm) into wall and 1/2 inch (13 mm) out from wall, with outer edge bent down 30 degrees and hemmed.

B. Flexible Flashing: Use one of the following unless otherwise indicated:

1. Copper-Laminated Flashing: 5-oz./sq. ft. (1.5-kg/sq. m) copper sheet bonded between 2 layers of glass-fiber cloth. Use only where flashing is fully concealed in masonry.

   a. Products: Subject to compliance with requirements, provide one of the following:

      1) Advanced Building Products Inc.; Copper Fabric Flashing or Copper Sealtite 2000.
      2) Dayton Superior Corporation, Dur-O-Wal Division; Copper Fabric Thru-Wall Flashing.
      3) Hohmann & Barnard, Inc.; H & B C-Fab Flashing.
      4) Phoenix Building Products; Type FCC-Fabric Covered Copper.
      5) Sandell Manufacturing Co., Inc.; Copper Fabric Flashing.
      6) York Manufacturing, Inc.; Multi-Flash 500.

2. Asphalt-Coated Copper Flashing: 5-oz./sq. ft. (1.5-kg/sq. m) copper sheet coated with flexible asphalt. Use only where flashing is fully concealed in masonry.

   a. Products: Subject to compliance with requirements, provide one of the following:

      1) Advanced Building Products Inc.; Cop-R-Cote.
      2) Dayton Superior Corporation, Dur-O-Wal Division; Copper Coated Thru-Wall Flashing.
      3) Hohmann & Barnard, Inc.; H & B C-Coat Flashing.
      4) Phoenix Building Products; Type ACC-Asphalt Bituminous Coated.
      5) Sandell Manufacturing Co., Inc.; Coated Copper Flashing.

3. Rubberized-Asphalt Flashing: Composite flashing product consisting of a pliable, adhesive rubberized-asphalt compound, bonded to a high-density, cross-laminated polyethylene film to produce an overall thickness of not less than 0.040 inch (1.02 mm).

   a. Products: Subject to compliance with requirements, provide one of the following:

      1) Advanced Building Products Inc.; Peel-N-Seal.
      2) Carlisle Coatings & Waterproofing; CCW-705-TWF Thru-Wall Flashing.
      3) Dayton Superior Corporation, Dur-O-Wal Division; Dur-O-Barrier Thru-Wall Flashing.
      4) Fiberweb, Clark Hammerbeam Corp.; Aquaflash 500.
      5) Grace Construction Products, W. R. Grace & Co. - Conn.; Perm-A-Barrier Wall Flashing.
      6) Heckmann Building Products Inc.; No. 82 Rubberized-Asphalt Thru-Wall Flashing.
      7) Hohmann & Barnard, Inc.; Textroflash.
      8) W. R. Meadows, Inc.; Air-Shield Thru-Wall Flashing.
      9) Polyguard Products, Inc.; Polyguard 400.
      10) Sandell Manufacturing Co., Inc.; Sando-Seal.
      11) Williams Products, Inc.; Everlastic MF-40.

   b. Accessories: Provide preformed corners, end dams, other special shapes, and seaming materials produced by flashing manufacturer.

C. Solder and Sealants for Sheet Metal Flashings:

1. Solder for Stainless Steel: ASTM B 32, Grade Sn60, with acid flux of type recommended by stainless-steel sheet manufacturer.
2. Solder for Copper: ASTM B 32, Grade Sn50, 50 percent tin and 50 percent lead.
3. Elastomeric Sealant: ASTM C 920, chemically curing sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

D. Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer for bonding flashing sheets to each other and to substrates.

2.9 MISCELLANEOUS MASONRY ACCESSORIES

A. Compressible Filler: Premolded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene.

B. Preformed Control-Joint Gaskets: Made from styrene-butadiene-rubber compound, complying with ASTM D 2000, Designation M2AA-805 and designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.

C. Bond-Breaker Strips: Asphalt-saturated, organic roofing felt complying with ASTM D 226, Type I (No. 15 asphalt felt).

D. Weep/Vent Products: Use one of the following unless otherwise indicated:

1. Wicking Material: Absorbent rope, made from cotton1/4 to 3/8 inch (6 to 10 mm) in diameter, in length required to produce 2-inch (50-mm) exposure on exterior and 18 inches (450 mm) in cavity. Use only for weeps.

E. Cavity Drainage Material: Free-draining mesh, made from polymer strands that will not degrade within the wall cavity.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Advanced Building Products Inc.; Mortar Break or Mortar Break II.
b. Archovations, Inc.; CavClear Masonry Mat.
c. Dayton Superior Corporation, Dur-O-Wal Division; Polytite MortarStop.
d. Mortar Net USA, Ltd.; Mortar Net.

2. Provide one of the following configurations:

a. Strips, full-depth of cavity and 10 inches (250 mm) high, with dovetail shaped notches 7 inches (175 mm) deep that prevent clogging with mortar droppings.
b. Strips, not less than 1-1/2 inches (38 mm) thick and 10 inches (250 mm) high, with dimpled surface designed to catch mortar droppings and prevent weep holes from clogging with mortar.

F. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells and hold reinforcing bars in center of cells. Units are formed from 0.148-inch (3.77-mm) steel wire, hot-dip galvanized after fabrication. Provide units designed for number of bars indicated.

1. Products: Subject to compliance with requirements, provide one of the following:

    a. Dayton Superior Corporation, Dur-O-Wal Division; D/A 810, D/A 812 or D/A 817.
    b. Heckmann Building Products Inc.; No. 376 Rebar Positioner.
    c. Hohmann & Barnard, Inc.; #RB or #RB-Twin Rebar Positioner.
    d. Wire-Bond; O-Ring or Double O-Ring Rebar Positioner.

2.10 MASONRY CLEANERS

A. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Diedrich Technologies, Inc.
    b. EaCo Chem, Inc.
    c. ProSoCo, Inc.

2.11 MORTAR AND GROUT MIXES

A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated.

1. Do not use calcium chloride in mortar or grout.
2. Use portland cement-lime, masonry cement or mortar cement mortar unless otherwise indicated.
3. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.

B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.

C. Mortar for Unit Masonry: Comply with ASTM C 270. Provide the following types of mortar for applications stated unless another type is indicated.

1. For masonry below grade or in contact with earth, use Type S.
2. For reinforced masonry, use Type S.
3. For exterior, above-grade, load-bearing and non-load-bearing walls and parapet walls; for interior load-bearing walls; for interior non-load-bearing partitions; and for other applications where another type is not indicated, use Type N.
4. For interior non-load-bearing partitions, Type O may be used instead of Type N.

D. Pigmented Mortar: Use colored cement product or select and proportion pigments with other ingredients to produce color required. Do not add pigments to colored cement products.

1. Pigments shall not exceed 10 percent of portland cement by weight.

2. Pigments shall not exceed 5 percent of masonry cement or mortar cement by weight.
3. Mix to match Architect's sample.
4. Application: Use pigmented mortar for exposed mortar joints with the following units:
   a. Face brick.
   b. Cast stone trim units.

E. Grout for Unit Masonry: Comply with ASTM C 476.

1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with Table 1.15.1 in ACI 530.1/ASCE 6/TMS 602 for dimensions of grout spaces and pour height.
2. Proportion grout in accordance with ASTM C 476, Table 1 or paragraph 4.2.2 for specified 28-day compressive strength indicated, but not less than 2000 psi (14 MPa).
3. Provide grout with a slump of 8 to 11 inches (203 to 279 mm) as measured according to ASTM C 143/C 143M.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.
2. Verify that foundations are within tolerances specified.
3. Verify that reinforcing dowels are properly placed.

B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping connections.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Thickness: Build cavity and composite walls and other masonry construction to full thickness shown. Build single-wythe walls to actual widths of masonry units, using units of widths indicated.

B. Build chases and recesses to accommodate items specified in this and other Sections.

C. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to opening.

D. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

E. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures.

1. Mix units from several pallets or cubes as they are placed.

F. Matching Existing Masonry: Match coursing, bonding, color, and texture of existing masonry.

G. Wetting of Brick: Wet brick before laying if initial rate of absorption exceeds 30 g/30 sq. in. (30 g/194 sq. cm) per minute when tested per ASTM C 67. Allow units to absorb water so they are damp but not wet at time of laying.

3.3 TOLERANCES

A. Dimensions and Locations of Elements:

1. For dimensions in cross section or elevation do not vary by more than plus 1/2 inch (12 mm) or minus 1/4 inch (6 mm).
2. For location of elements in plan do not vary from that indicated by more than plus or minus 1/2 inch (12 mm).
3. For location of elements in elevation do not vary from that indicated by more than plus or minus 1/4 inch (6 mm) in a story height or 1/2 inch (12 mm) total.

B. Lines and Levels:

1. For bed joints and top surfaces of bearing walls do not vary from level by more than 1/4 inch in 10 feet (6 mm in 3 m), or 1/2 inch (12 mm) maximum.
2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet (3 mm in 3 m), 1/4 inch in 20 feet (6 mm in 6 m), or 1/2 inch (12 mm) maximum.
3. For vertical lines and surfaces do not vary from plumb by more than 1/4 inch in 10 feet (6 mm in 3 m), 3/8 inch in 20 feet (9 mm in 6 m), or 1/2 inch (12 mm) maximum.
4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet (3 mm in 3 m), 1/4 inch in 20 feet (6 mm in 6 m), or 1/2 inch (12 mm) maximum.
5. For lines and surfaces do not vary from straight by more than 1/4 inch in 10 feet (6 mm in 3 m), 3/8 inch in 20 feet (9 mm in 6 m), or 1/2 inch (12 mm) maximum.
6. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet (6 mm in 3 m), or 1/2 inch (12 mm) maximum.
7. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16 inch (1.5 mm) except due to warpage of masonry units within tolerances specified for warpage of units.

C. Joints:

1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch (3 mm), with a maximum thickness limited to 1/2 inch (12 mm).
2. For exposed bed joints, do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch (3 mm).
3. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch (9 mm) or minus 1/4 inch (6 mm).

4. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch (3 mm). Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8 inch (3 mm).
5. For exposed bed joints and head joints of stacked bond, do not vary from a straight line by more than 1/16 inch (1.5 mm) from one masonry unit to the next.

3.4 LAYING MASONRY WALLS

A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.

B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond do not use units with less than nominal 4-inch (100-mm) horizontal face dimensions at corners or jambs.

C. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 4-inches (100-mm). Bond and interlock each course of each wythe at corners. Do not use units with less than nominal 4-inch (100-mm) horizontal face dimensions at corners or jambs.

D. Stopping and Resuming Work: Stop work by racking back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.

E. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.

F. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.

G. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below and rod mortar or grout into core.

H. Fill cores in hollow CMUs with grout 24 inches (600 mm) under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.

3.5 MORTAR BEDDING AND JOINTING

A. Lay hollow CMUs as follows:

1. With face shells fully bedded in mortar and with head joints of depth equal to bed joints.
2. With webs fully bedded in mortar in all courses of piers, columns, and pilasters.
3. With webs fully bedded in mortar in grouted masonry, including starting course on footings.
4. With entire units, including areas under cells, fully bedded in mortar at starting course on footings where cells are not grouted.

B. Lay solid masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.
   1. Maintain joint thicknesses indicated except for minor variations required to maintain bond alignment. If not indicated, lay walls with 1/4- to 3/8-inch- (6- to 10-mm-) thick joints.

3.6 CAVITY WALLS

   1. Masonry Joint Reinforcement: Installed in horizontal mortar joints.
      a. Where one wythe is of clay masonry and the other of concrete masonry, use adjustable (two-piece) type reinforcement with continuous horizontal wire in facing wythe attached to ties to allow for differential movement regardless of whether bed joints align.
   2. Masonry Veneer Anchors: Comply with requirements for anchoring masonry veneers.

B. Bond wythes of cavity walls together using bonding system indicated on Drawings.

C. Keep cavities clean of mortar droppings and other materials during construction. Bevel beds away from cavity, to minimize mortar protrusions into cavity. Do not attempt to trowel or remove mortar fins protruding into cavity.

3.7 MASONRY JOINT REINFORCEMENT

A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch (16 mm) on exterior side of walls, 1/2 inch (13 mm) elsewhere. Lap reinforcement a minimum of 6 inches (150 mm).

   1. Space reinforcement not more than 16 inches (406 mm) o.c.
   2. Space reinforcement not more than 8 inches (203 mm) o.c. in foundation walls and parapet walls.
   3. Provide reinforcement not more than 8 inches (203 mm) above and below wall openings and extending 12 inches (305 mm) beyond openings in addition to continuous reinforcement.

B. Interrupt joint reinforcement at control and expansion joints unless otherwise indicated.

C. Cut and bend reinforcing units as directed by manufacturer for continuity at corners, returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

3.8 ANCHORING MASONRY VENEERS

A. Anchor masonry veneers to wall framing and concrete and masonry backup with seismic masonry-veneer anchors to comply with the following requirements:

   1. Fasten seismic anchors through sheathing to wall framing with metal fasteners of type indicated. Use two fasteners unless anchor design only uses one fastener.
   2. Insert slip-in anchors in metal studs as sheathing is installed. Provide one anchor at each stud in each horizontal joint between sheathing boards.

3. Embed connector sections in masonry joints. Provide not less than 2 inches (50 mm) of air space between back of masonry veneer and face of sheathing.
4. Locate anchor sections to allow maximum vertical differential movement of ties up and down.
5. Space anchors as indicated, but not more than 18 inches (458 mm) o.c. vertically and 24 inches (610 mm) o.c. horizontally, with not less than 1 anchor for each 2 sq. ft. (0.2 sq. m) of wall area. Install additional anchors within 12 inches (305 mm) of openings and at intervals, not exceeding 8 inches (203 mm), around perimeter.

3.9 CONTROL AND EXPANSION JOINTS

A. General: Install control and expansion joint materials in unit masonry as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.

B. Form control joints in concrete masonry using one of the following methods:

1. Fit bond-breaker strips into hollow contour in ends of CMUs on one side of control joint. Fill resultant core with grout and rake out joints in exposed faces for application of sealant.
2. Install preformed control-joint gaskets designed to fit standard sash block.
3. Install interlocking units designed for control joints. Install bond-breaker strips at joint. Keep head joints free and clear of mortar or rake out joint for application of sealant.
4. Install temporary foam-plastic filler in head joints and remove filler when unit masonry is complete for application of sealant.

C. Form expansion joints in brick as follows:
1. Form open joint full depth of brick wythe and of width indicated, but not less than 3/8 inch (10 mm) for installation of sealant and backer rod specified in Section 079200 "Joint Sealants."

D. Provide horizontal, pressure-relieving joints by either leaving an air space or inserting a compressible filler of width required for installing sealant and backer rod specified in Section 079200 "Joint Sealants," but not less than 3/8 inch (10 mm).

1. Locate horizontal, pressure-relieving joints beneath shelf angles supporting masonry.

3.10 LINTELS

A. Install steel lintels where indicated.

B. Provide minimum bearing of 8 inches (200 mm) at each jamb unless otherwise indicated.

3.11 FLASHING, WEEP HOLES, CAVITY DRAINAGE, AND VENTS

A. General: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated. Install vents at shelf angles, ledges, and other obstructions to upward flow of air in cavities, and where indicated.

B. Install flashing as follows unless otherwise indicated:

1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.
2. At multiwythe masonry walls, including cavity walls, extend flashing through outer wythe, turned up a minimum of 8 inches (200 mm), and 1-1/2 inches (38 mm) into the inner wythe. Form 1/4-inch (6-mm) hook in edge of flashing embedded in inner wythe.
3. At masonry-veneer walls, extend flashing through veneer, across air space behind veneer, and up face of sheathing at least 8 inches (200 mm); with upper edge tucked under building paper or building wrap, lapping at least 4 inches (100 mm).
4. At lintels and shelf angles, extend flashing a minimum of 6 inches (150 mm) into masonry at each end. At heads and sills, extend flashing 6 inches (150 mm) at ends and turn up not less than 2 inches (50 mm) to form end dams.
5. Install metal drip edges beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch (13 mm) back from outside face of wall and adhere flexible flashing to top of metal drip edge.

C. Install reglets and nailers for flashing and other related construction where they are shown to be built into masonry.

D. Install weep holes in head joints in exterior wythes of first course of masonry immediately above embedded flashing and as follows:

1. Use specified weep/vent products to form weep holes.
2. Use wicking material to form weep holes above flashing under brick sills. Turn wicking down at lip of sill to be as inconspicuous as possible.
3. Space weep holes 16 inches (400 mm) o.c. unless otherwise indicated.
4. Trim wicking material flush with outside face of wall after mortar has set.

E. Place pea gravel in cavities as soon as practical to a height equal to height of first course above top of flashing, but not less than 2 inches (50 mm), to maintain drainage.

1. Fill cavities full height by placing pea gravel in cavities as masonry is laid so that at any point masonry does not extend more than 24 inches (600 mm) above top of pea gravel.

F. Place cavity drainage material in cavities to comply with configuration requirements for cavity drainage material in "Miscellaneous Masonry Accessories" Article.

3.12 REINFORCED UNIT MASONRY INSTALLATION

A. Placing Reinforcement: Comply with requirements in ACI 530.1/ASCE 6/TMS 602.

B. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.

1. Comply with requirements in ACI 530.1/ASCE 6/TMS 602 for cleanouts and for grout placement, including minimum grout space and maximum pour height.

3.13 REPAIRING, POINTING, AND CLEANING

A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.

B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.

C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.

D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:

1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
3. Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
5. Clean brick by bucket-and-brush hand-cleaning method described in BIA Technical Notes 20.
6. Clean stone trim to comply with stone supplier's written instructions.

3.14 MASONRY WASTE DISPOSAL

A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.

B. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION 042000

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SECTION 047200 - CAST STONE MASONRY

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. Cast stone trim.

B. Related Sections:

1. Section 042000 "Unit Masonry" for installing cast stone units in unit masonry.

1.3 ACTION SUBMITTALS

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

1. For cast stone units, include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: Show fabrication and installation details for cast stone units. Include dimensions, details of reinforcement and anchorages if any, and indication of finished faces.

1. Include building elevations showing layout of units and locations of joints and anchors.

C. Samples for Verification:

1. For each color and texture of cast stone required, 10 inches (250 mm) square in size.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer.

1. Include copies of material test reports for completed projects, indicating compliance of cast stone with ASTM C 1364.

B. Material Test Reports: For each mix required to produce cast stone, based on testing according to ASTM C 1364, including test for resistance to freezing and thawing.

1. Provide test reports based on testing within previous two years.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer of cast stone units similar to those indicated for this Project, that has sufficient production capacity to manufacture required units, and is a plant certified by the Cast Stone Institute or the Architectural Precast Association.

B. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.

C. Source Limitations for Cast Stone: Obtain cast stone units through single source from single manufacturer.

D. Mockups: Furnish cast stone for installation in mockups specified in Section 042000 "Unit Masonry."

1.6 DELIVERY, STORAGE, AND HANDLING

A. Coordinate delivery of cast stone with unit masonry work to avoid delaying the Work.

B. 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.

PART 2 - PRODUCTS

2.1 CAST STONE MATERIALS

A. General: Comply with ASTM C 1364 and the following:

B. 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.

C. Coarse Aggregates: Granite, quartz, or limestone complying with ASTM C 33; gradation and colors as needed to produce required cast stone textures and colors.

D. 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.

E. Color Pigment: ASTM C 979, synthetic mineral-oxide pigments or colored water-reducing admixtures; color stable, free of carbon black, nonfading, and resistant to lime and other alkalis.

F. 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 Admixture: ASTM C 494/C 494M, Type A.
5. Water-Reducing, Retarding Admixture: ASTM C 494/C 494M, Type D.
6. Water-Reducing, Accelerating Admixture: ASTM C 494/C 494M, Type E.

G. Reinforcement: Deformed steel bars complying with ASTM A 615/A 615M, Grade 60 (Grade 420). Use galvanized or epoxy-coated reinforcement when covered with less than 1-1/2 inches (38 mm) of cast stone material.

1. Epoxy Coating: ASTM A 775/A 775M.
2. Galvanized Coating: ASTM A 767/A 767M.

H. Embedded Anchors and Other Inserts: Fabricated from stainless steel complying with ASTM A 240/A 240M, ASTM A 276, or ASTM A 666, Type 304 or steel complying with ASTM A 36/A 36M, and hot-dip galvanized to comply with ASTM A 123/A 123M.

2.2 CAST STONE UNITS

A. Provide cast stone units complying with ASTM C 1364 using either the vibrant dry tamp or wet-cast method.

1. Provide units that are resistant to freezing and thawing as determined by laboratory testing according to ASTM C 666/C 666M, Procedure A, as modified by ASTM C 1364.

B. 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 inch (3 mm).
2. Variation in Length: Do not vary from indicated dimensions by more than 1/360 of the length of unit or 1/8 inch (3 mm), whichever is greater, but in no case by more than 1/4 inch (6 mm).
3. Warp, Bow, and Twist: Not to exceed 1/360 of the length of unit or 1/8 inch (3 mm), 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 inch (3 mm) on formed surfaces of units and 3/8 inch (10 mm) on unformed surfaces.

D. Cure units as follows:

1. Cure units in enclosed moist curing room at 95 to 100 percent relative humidity and temperature of 100 deg F (38 deg C) for 12 hours or 70 deg F (21 deg C) for 16 hours.
2. Keep units damp and continue curing to comply with one of the following:

a. No fewer than five days at mean daily temperature of 70 deg F (21 deg C) or above.
b. No fewer than six days at mean daily temperature of 60 deg F (16 deg C) or above.
c. No fewer than seven days at mean daily temperature of 50 deg F (10 deg C) or above.
d. No fewer than eight days at mean daily temperature of 45 deg F (7 deg C) or above.

E. Acid etch units after curing to remove cement film from surfaces to be exposed to view.

F. Colors and Textures: As selected by Architect from manufacturer's full range.

2.3 ACCESSORIES

A. Anchors: Type and size indicated, fabricated from Type 304 stainless steel complying with ASTM A 240/A 240M, ASTM A 276, or ASTM A 666 or steel complying with ASTM A 36/A 36M, and hot-dip galvanized to comply with ASTM A 123/A 123M.

B. Dowels: 1/2-inch- (12-mm-) diameter, round bars, fabricated from Type 304 stainless steel complying with ASTM A 240/A 240M, ASTM A 276, or ASTM A 666 or steel complying with ASTM A 36/A 36M, and hot-dip galvanized to comply with ASTM A 123/A 123M.

2.4 SOURCE QUALITY CONTROL

A. Engage a qualified independent testing agency to sample and test cast stone units according to ASTM C 1364.

1. Include one test for resistance to freezing and thawing.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SETTING CAST STONE IN MORTAR

A. Install cast stone units to comply with requirements in Section 042000 "Unit Masonry."

B. Set cast stone as indicated on Drawings. Set units accurately in locations indicated with edges and faces aligned according to established relationships and indicated tolerances.

1. Install anchors, supports, fasteners, and other attachments indicated or necessary to secure units in place.

2. Coordinate installation of cast stone with installation of flashing specified in other Sections.

C. Wet joint surfaces thoroughly before applying mortar or setting in mortar.

D. Set units in full bed of mortar with full head joints unless otherwise indicated.

1. Set units with joints 3/8 to 1/2 inch (10 to 13 mm) wide unless otherwise indicated.
2. Build anchors and ties into mortar joints as units are set.
3. Fill dowel holes and anchor slots with mortar.
4. Fill collar joints solid as units are set.
5. Build concealed flashing into mortar joints as units are set.
6. Keep head joints in coping and other units with exposed horizontal surfaces open to receive sealant.
7. Keep joints at shelf angles open to receive sealant.

E. Rake out joints for pointing with mortar to depths of not less than 3/4 inch (19 mm). Rake joints to uniform depths with square bottoms and clean sides. Scrub faces of units to remove excess mortar as joints are raked.

F. Point mortar joints by placing and compacting mortar in layers not greater than 3/8 inch (10 mm). Compact each layer thoroughly and allow it to become thumbprint hard before applying next layer.

G. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.

3.3 INSTALLATION TOLERANCES

A. Variation from Plumb: Do not exceed 1/8 inch in 10 feet (3 mm in 3 m), 1/4 inch in 20 feet (6 mm in 6 m), or 1/2 inch (12 mm) maximum.

B. Variation from Level: Do not exceed 1/8 inch in 10 feet (3 mm in 3 m), 1/4 inch in 20 feet (6 mm in 6 m), or 1/2 inch (12 mm) maximum.

C. Variation in Joint Width: Do not vary joint thickness more than 1/8 inch in 36 inches (3 mm in 900 mm) or one-fourth of nominal joint width, whichever is less.

D. 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 inch (1.5 mm), except where variation is due to warpage of units within tolerances specified.

3.4 ADJUSTING AND CLEANING

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.

C. In-Progress Cleaning: Clean cast stone as work progresses.

1. Remove mortar fins and smears before tooling joints.
2. Remove excess sealant immediately, including spills, smears, and spatter.

D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed cast stone as follows:

1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
2. Test cleaning methods on sample; leave one sample uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of cast stone.
3. Clean cast stone by bucket-and-brush hand-cleaning method described in BIA Technical Notes 20.

END OF SECTION 047200

SECTION 051200 - STRUCTURAL STEEL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 DESCRIPTION

A. Furnish labor, materials, operations, equipment and services necessary for and incidental to complete structural steel.

B. Structural steel is that work defined in American Institute of Steel Construction (AISC) "Code of Standard Practice" and as otherwise shown on drawings.

C. Furnish to other trades, for setting in concrete or masonry, all necessary angles, anchors, clips, plates, bolts, etc., for attachment of structural and miscellaneous items.

D. Include all miscellaneous angles, plates, channels and other structural shapes including all related bolts and nuts; include shear connectors for composite steel beams.

E. The following miscellaneous metal items are specified under other divisions of specification; anchors, ceiling inserts, plates, bolts, sleeves and supports required for installation of heating, ventilating, air conditioning, plumbing, electrical, masonry, stone, granite, windows, entrances, aluminum work, etc.

1.3 QUALITY ASSURANCE

A. Codes and Standards: Comply with provisions of following, except as otherwise indicated:
   1. AISC "Code of Standard Practice for Steel Buildings and Bridges."
   2. Paragraph 4.2.1 of the above code is hereby modified by deletion of the following sentence: "This approval constitutes the owner's acceptance of all responsibility for the design adequacy of any connections designed by the fabricator as a part of his preparation of these shop drawings."
   3. AISC "Specifications for the Design, Fabrication, and Erection of Structural Steel for Buildings", including "Commentary" and Supplements thereto as issued.
   4. AISC "Specifications for Architecturally Exposed Structural Steel".
   5. AISC "Specifications for Structural Joints using ASTM A 325 or A 490 Bolts" approved by the Research Council on Riveted and Bolted Structural Joints of the Engineering Foundation.
   6. American Welding Society (AWS) D1.1 "Structural Welding Code - Steel".

7. ASTM A 6 "General Requirements for Delivery of Rolled Steel Plates, Shapes, Sheet Piling and Bars for Structural Use".

1.4 SUBMITTALS

A. Shop Drawings:
1. Before any fabrication is begun, shop drawings shall be submitted in accordance with the General Conditions and Supplementary General Conditions to Architect for approval. Shop drawings shall be prepared immediately on award of the contract and shall be promptly submitted for approval. Verify all conditions at the job and promptly report any variations affecting this work. Shop drawings are to include layout for placement of shear studs.

B. PRODUCT DATA:
1. Submit producer's or manufacturers specifications or indicated substantiating data for the following products:
a. Certified mill tests for each grade of structural steel used on this project.
b. High strength bolts (A325) with or without twist off spline.
c. Expansion and adhesive anchor devices.
d. Shear connector studs (ASTM A108).
e. Shrinkage resistant grout.

1.5 PRODUCT HANDLING

A. Deliver and handle structural steel in manner to prevent damage. Structural steel members shall be stored above ground on platforms or other supports and shall be protected from corrosion. Other materials shall be stored in a weather tight, dry place. Packaged materials shall be stored in their original undamaged containers.

PART 2 - PRODUCTS

2.1 MATERIALS

A. All metals shall be free from defects impairing strength, durability or appearance, and of the best Commercial Quality for the purpose specified.

B. Channel shapes, plates, angles and bars - ASTM A36.

C. Wide flange shapes – ASTM A992, Grade 50.

D. Steel tube (rectangular or square) - ASTM A500, Grade B.

E. Steel pipe (round) - ASTM A53, Type E or S

F. Anchor rods - ASTM F1554, Grade 55 with Supplement S1.

G. Threaded Rod – ASTM A36

H. Steel studs - ASTM A108, solid fluxed shear connector studs as manufactured by TRW/Nelson Stud Welding Company (or equal).

I. High Strength Thread Fasteners - ASTM A325, (Type N) with hardened washer under element turned in tightening. Load indicator bolts with twist off spline may be used.

J. Filler Metal for Welds – Use the appropriate electrode for the combination of base metal specification and grade and welding process per latest "AWS Specification." Weld metal with a tensile strength of F_{EXX} = 70-ksi is the minimum. See drawings for specific connections requiring minimum Charpy V-Notch (CVN) values.

K. Non shrink grout - Pre-mixed, factory packaged, non-metallic, non-corrosive, non-staining grout.

L. Galvanizing - ASTM A123.

M. Shop Paint Primer - standard rust-inhibitive paint of manufacturer.

2.2 FABRICATION

A. All workmanship shall be equal to the best shop practice in modern structural and miscellaneous metal shops. The work shall be complete in all detail, parts in as far as possible shall be fitted and shop assembled ready for erection in accordance with design drawings, details and approved shop drawings.

B. Splices in structural members will not be allowed unless approved in advance by engineer and detailed on shop drawings.

C. All work shall be well formed to shape and size with sharp lines or angles. Shearing and punching shall leave clean, true lines and surfaces. Curved work shall be evenly sprung. Accurately miter and cope joints. Grind smooth all welds in all exposed miscellaneous metals.

D. Castings shall be sound and free from warp, holes and other defects that impair their strength or appearance. Exposed surfaces shall have a smooth finish and sharp, well-defined lines and arises. Machine joints, where required, shall be milled to a close fit. Provide necessary rabbets, lugs and brackets so that work can be assembled in neat and substantial manner.

E. Exposed fastenings shall be concealed where practicable. Thickness of metal and details of assembly and supports shall give ample strength and stiffness. Joints exposed to weather shall be formed to exclude water. Provide holes and connections for the work of other trades.

F. Connections shall be as follows:
   1. Shop and field connections not specifically shown on the drawings may, at the Contractor's option, be welded or bolted with high strength bolts.

2. High strength bolts (Type N) shall be installed in compliance with AISC Specifications and ASTM A325 requirements using equipment complying with these specifications.
3. All welding procedures shall be in accordance with AWS Standards except minimum weld size shall be 1/4" unless material thicknesses do not permit. All welding shall be performed by certified welders.

G. All work shall be in compliance with the latest editions of the following codes and specifications which are listed in the order in which they take precedence:
1. These specifications.
2. AISC Specifications for the Design, Fabrication and Erection of Structural Steel for Buildings.
3. AISC Code of Standard Practice for Steel Buildings and Bridges.
4. AWS Code for Arc and Gas Welding in Building Construction.
5. Connections shall be sized per AISC "Uniform Load Constant" table for end reactions = Wc/2L or reactions shown on drawings. Minimum 2 bolt connection. One-sided connections will not be permitted without specific permission of Structural Engineer.

H. Bearing ends of columns and stiffener plates shall be sawed or milled for true bearing.

I. Burning will not be permitted for forming holes, enlarging holes or matching unfair holes. No member shall be altered in the field unless approved by the Structural Engineer.

2.3 Shop Welds

A. Owner will provide and pay for the services of a qualified, independent testing lab for all of the applicable inspection services listed below:
1. Certify welders and conduct inspections and tests as required. Record types and locations of defects found in work. Record work required and performed to correct deficiencies.
2. Perform visual inspection of all welds.
3. Perform non-destructive tests, by a method appropriate for the joint to be tested, of all groove welds.
4. Perform non-destructive tests, by a method appropriate for the joint to be tested, of any other welds failing visual inspection.

B. Rejected welds are to be reworked and in general should be cut out by arc weld or ground out. Repeated rewelding of a joint should be avoided as this can result in crystallization of the base metal.

C. Testing Agency shall conduct and interpret tests and state in each report whether test specimens comply with requirements, and specifically state and deviations therefrom.

2.4 PROTECTIVE COATINGS

A. All steelwork shall be thoroughly cleaned of all mill scale, oil, grease, and rust.

B. All steelwork, except galvanized or steel encased in concrete, shall be shop primed painted to provide a dry film thickness of 2.0 mills. Do not paint steel to receive sprayed on fireproofing.

C. Anchors built into masonry or concrete exposed to the weather shall be coated with asphalt paint, unless anchors are indicated to be galvanized or of non-corrosive metal.

D. Field applied bolts, field welds, and abrasions to shop coat, shall be spot painted with the material used for the shop coat after being cleaned.

E. Abrasions to galvanized surfaces shall be spot painted with galvanized metal touch-up paint.

PART 3 - EXECUTION

3.1 PREPARATION

A. Cooperate with other trades doing work in connection with structural steel and give reasonable assistance in placing their work. Additional holes or cutting of structural steel shall not be permitted on structural members without approval of Architect. Verify all measurements before starting erection.

3.2 ERECTION

A. Erect structural steel in accordance with the AISC Specifications and Code of Standard Practice for Steel Buildings and Bridges, including the modifications and additions listed below.

B. Erect structural steel in accordance with the A.I.S.C. specifications with the modifications and additional requirements specified in this section.

C. Erect temporary bracing and shoring, whenever necessary, to safely support construction until it is complete and floor slabs are in place.

D. Erect temporary bracing to safely support piles of materials, erection equipment and other temporary loads placed upon the structure.

E. Column bases and bearing plates shall be accurately aligned with steel wedges or shims and then grouted solid with non-shrink grout. Bases and plates less than sixteen inches in dimensions shall be shimmed one inch. Bases and plates sixteen inches and greater in dimensions shall be shimmed 1-1/2 inches.

F. Verify location of all members required to support mechanical equipment to assure proper location required for equipment actually to be installed.

G. Field touch-up painting: after the erection of structural steel, touch-up paint all field applied bolt heads and nuts and field welds and abrasions to the shop coating with the same paint used for the shop painting.

3.3 FIELD QUALITY CONTROL

A. Owner will provide and pay for the services of a qualified, independent testing lab for all of the applicable inspection services listed below:
   1. Testing and inspection of A325 (N) bolts:
      a. The inspector shall verify that all provisions of the installation of the bolts conform to AISC specification, "Structural Joints Using ASTM A325 or A490 Bolts".
      b. The inspector shall determine that the requirements of Sections 8 and 9 of this specification are met in the work. Bolts in connections identified to be tightened only to the snug-tight condition need not be inspected for bolt tension other than to ensure that the plies of the connected elements have been brought into snug contact.
      c. If the bolts are to be other than snug-tight, the inspector shall observe the installation and follow the remainder of paragraph 6 of this specification.
      d. Unless noted otherwise, all bolts are to be snug-tight.
   2. Testing and inspection of bolts with twist off spline.
      a. The inspector shall verify that all provisions of the installations of the bolts conform to AISC specification, "Structural Joints using ASTM A325 or A490 Bolts".
      b. Visually inspect the bolts to verify that the splines have been twisted off.
   3. Field Welding: Inspect and test during erection of structural steel as follows:
      a. Certify welders and conduct inspections and tests as required. Record types and locations of defects found in work. Record work required and performed to correct deficiencies.
      b. Perform visual inspection of all welds.
      c. Perform non-destructive tests, by a method appropriate for the joint to be tested, of all groove welds.
      d. Perform non-destructive tests, by a method appropriate for the joint to be tested, of any other welds failing visual inspection.
      e. Rejected welds are to be reworked and in general should be cut out by arc weld or ground out. Repeated rewelding of a joint should be avoided as this can result in crystallization of the base metal.
   4. Testing Agency shall conduct and interpret tests and state in each report whether test specimens comply with requirements, and specifically state any deviations therefrom.
   5. Contractor shall notify Testing agency when work as described above, is ready for inspection and shall provide access in shop or field as required.
   6. Architect reserves right at any time before final acceptance, to reject material not complying with specified requirements.
   7. Contractor to correct deficiencies in structural steel work which inspections and laboratory test reports have indicated to be not in compliance with requirements.

All remedial work and all additional tests as may be necessary to show compliance of corrected work will be at Contractor's expense.

END OF SECTION

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SECTION 053123 - METAL ROOF DECK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. The extent of metal decking is shown on the drawings, including basic layout and type of deck units required.

1.3 QUALITY ASSURANCE

A. Codes and Standards: Comply with provisions of the following codes and standards, except as otherwise indicated or specified.
   1. AISI "Specification for the Design of Cold-Formed Steel Structural Members".
   2. AWS "Structural Welding Code".
   3. SDI "Design Manual for Floor Decks and Roof Decks".
   4. Qualification of Field Welding: Qualify welding processes and welding operators in accordance with AWS "Standard Qualification Procedure".

1.4 SUBMITTALS

A. Product Data: Submit manufacturer's specifications and installation instructions for each type of decking and accessories. Include manufacturer's certification as may be required to show compliance with these specifications.

B. Shop Drawings: Submit detailed drawings showing layout and types of deck panels, anchorage details, and conditions requiring closure panels, supplementary framing, sump pans, cant strips, cut openings, special jointing or other accessories.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Steel for Painted Metal Deck Units: ASTM A611, Grade C.

B. Miscellaneous Steel Shapes: ASTM A 36.

C. Sheet Metal Accessories: ASTM A 526, commercial quality, galvanized.

D. Paint: Manufacturer's baked-on, rust-inhibitive paint, for application to metal surfaces which have been chemically cleaned and phosphate chemical treated.

2.2 FABRICATION

A. General: Form deck units in lengths to span 3 or more supports, with flush, telescoped or nested 2" laps at ends and interlocking or nested side laps, unless otherwise indicated.

B. Roof Deck Units: Provide deck configurations complying with SDI "Roof Deck Specifications", of metal thickness, depth and width as shown, with paint finish. Minimum deck unless noted shall be 1 1/2" x 22 GA wide rib. Provide acoustical deck where indicated on drawings with perforations located in the vertical webs (with insulation in rib openings) where load carrying properties are reduced less than 5 percent to be used as indicated on plans. See Architectural drawings for acoustical requirements.

PART 3 - EXECUTION

3.1 INSPECTION

A. Installer must examine areas and conditions under which metal decking is to be installed and notify Contractor in writing of conditions detrimental to proper and timely completion of work. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to Installer.

3.2 INSTALLATION

A. General: Install deck units and accessories in accordance with manufacturer's recommendations and final shop drawings, and as specified herein.

B. Place deck units on supporting steel framework and adjust to final position with ends accurately aligned and bearing on supporting members before being permanently fastened. Do not stretch or contract side lap interlocks. Place deck units flat and square, secured to adjacent framing without warp or excessive deflection.

C. Coordinate and cooperate with structural steel erector in locating decking bundles to prevent overloading of structural members.

D. Fastening Deck Units
1. Fasten roof deck units to steel supporting members by one of the following two methods:

a. Use not less than 5/8" diameter fusion welds or elongated welds of equal strength, spaced not more than 12" o.c. at every support, and at closer spacing where required for lateral force resistance.
b. Use not less than NO. 12 TEK screws, spaced not more than 6" o.c. at every support and at closer spacing where required for lateral force resistance.

2. In addition, secure deck to each supporting member in ribs where side laps occur.
3. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work.
4. Use welding washers where recommended by deck manufacturer.
5. Mechanically fasten side laps of adjacent deck units between supports, at intervals not exceeding 24" o.c., using NO. 10 TEK screws.
6. Uplift Loading: Install and anchor roof deck units to resist gross uplift loading of 45 lbs. per sq. ft. at eave overhang and 30 lbs. per sq. ft. at other roof areas.

E. Cutting and Fitting: Cut and neatly fit deck units and accessories around other work projecting through or adjacent to the decking, as shown.

F. Reinforcement at Openings: Provide additional metal reinforcement and closure pieces as required for strength, continuity of decking and support of other work shown.
1. Reinforce roof decking around unframed openings greater than 6 inches and less than 12 inches in any direction by means of a flat steel sheet placed over the opening and fusion welded to the top surface of the deck. Provide a steel sheet of the same quality as the deck units, not less than 20 gauge, and at least 12 inches wider and longer than the opening. Provide welds at each corner and spaced not more than 12 inches o.c. along each side.
2. Openings larger than 12 inches shall be framed with auxiliary supports as shown on the drawings.

G. Closure Strips: Provide metal closure strips at open uncovered ends and edges of roof decking, and in voids between decking and other construction. Weld into position to provide a complete decking installation.

END OF SECTION

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SECTION 054000 - LIGHT STEEL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 DESCRIPTION

A. Work under this Section includes, but is not necessarily limited to metal studs, runners, for use in curtain wall systems, and interior non-load bearing systems. Structural notes indicated on drawings regarding cold-formed metal framing system shall be considered a part of this specification.

1.3 QUALITY ASSURANCE

A. Work under this Section shall be performed by workmen who are thoroughly trained and experienced in the skills required, and who are completely familiar with the manufacturer's recommended methods of installation.
   1. Comply with AISI's "Specification for the Design of Cold-Formed Steel structural Members" for calculating structural characteristics of cold-formed metal framing.
   2. Mill certificates signed by steel sheet producer (or test reports from a qualified independent testing agency).
   3. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code—Steel," and AWS D1.3, "Structural Welding Code—Sheet Steel."
   4. Fire-Test-Response Characteristics: Where metal framing is part of a fire-resistance-rated assembly, provide framing identical to that of assemblies tested for fire resistance per ASTM E 119 by a testing agency acceptable to authorities having jurisdiction.
      a. Fire-Resistance Ratings: Indicated by GA File Numbers in GA-600, "Fire Resistance Design Manual," or by design designations from UL's "Fire Resistance Directory" or from the listings of another testing agency.
   5. Comply with HUD's "Prescriptive Method for Residential Cold-Formed Steel Framing."

1.4 SUBMITTALS

A. Shop drawings shall be submitted in accordance with the general conditions. For all load bearing and non-load bearing studs, sills, jambs and deep leg runners shop drawings shall be prepared and sealed by an engineer registered in the state of the construction.

1.5 PRODUCT HANDLING

A. Use all means necessary to protect the work under this Section before, during and after installation and to protect the installed work and materials of all other trades.

1.6 STRUCTURAL PERFORMANCE

A. Exterior studs shall be designed for a minimum wind load of 20 psf.

B. Exterior stud walls with brick veneer shall have a maximum horizontal deflection of l/600 of the wall height.

C. Exterior stud walls without brick veneer shall have a maximum horizontal deflection of l/360 of the wall height.

PART 2 - PRODUCTS

2.1 MATERIALS

A. All studs and/or joists and accessories shall be of the type, size, gauge and spacing shown on the drawings. Minimum thickness for studs used as back-up for brick veneer and/or exterior walls shall be 18 gage. Minimum thickness of all runners shall be 18 gage. Physical properties shall be equal to those manufactured by Clark Dietrich Building Systems.

B. All structural members shall be designed in accordance with American Iron and Steel Institute (AISI) "Specification for design of Cold-Formed Steel Structural Members," 1996 edition.

C. All structural members shall be formed from corrosion-resistant steel, corresponding to the requirements of ASTM A653-94.

D. All structural members shall be zinc coated meeting ASTM A924.

E. Deep leg runners shall be provided for at all non-loadbearing studs and shall be designed to accommodate a minimum of 1/2" vertical deflection and a lateral load of 225 lb. per stud. Studs shall not be anchored to deep leg runners.

2.2 ACCEPTABLE MANUFACTURERS

A. Clark Dietrich Building Systems of West Chester, OH or an approved equal.

2.3 FABRICATION

A. Prior to fabrication of framing, the contractor shall submit fabrication and erection drawings to the architect or engineer to obtain approval.

B. Prefabricated panels shall be square, with components attached in a manner as to prevent racking and to minimize distortion while lifting and transporting.

C. All framing components shall be cut squarely for attachment to perpendicular members, or, as required, for an angular fit against abutting members.

D. Axially loaded studs shall be installed in a manner which will assure that their ends are positioned against the inside of runner web prior to fastening.

E. All framing components shall be plumbed, aligned and leveled.

F. Non-load bearing studs shall be installed in a manner which will insure that they are capable of supporting the wall for lateral loads while allowing the structure to deflect vertically by use of a deep leg runner at the top.

G. Fastening of components shall be with self-drilling screws or welding. Screws shall be of sufficient size to insure the strength of the connection. Wire tying of components will not be permitted. All welds shall be touched up with zinc-rich paint.

H. Splices in framing components, other than runner track shall not be permitted.

I. Abutting lengths of runner shall be butt-welded, spliced or each length securely anchored to a common structural element. Runners shall be securely anchored to the supporting structure as shown on the drawings.

PART 3 - EXECUTION

3.1 INSPECTION

A. Prior to commencement of work under this Section, carefully inspect the work of other trades and verify that all such work is complete to a point where this installation may properly commence.

3.2 INSTALLATION (NON-LOAD BEARING CURTAIN WALLS)

A. Runners shall be securely anchored to the supporting structure as shown on the drawings. Use deep leg runners to support the top of the stud.

B. Complete, uniform and level bearing support shall be provided for the bottom runner.

C. Abutting lengths of runner shall each be securely anchored to a common structural element, butt-welded or spliced.

D. Studs shall be plumbed, aligned and securely attached to flanges of the lower runners. Do not attach studs to the deep leg runner at the top.

E. Framing of wall openings shall include headers and supporting studs as shown on the drawings.

F. Temporary bracing, where required, shall be provided until erection is completed.

G. Resistance to bending and rotation about the minor axis shall be provided by horizontal strap or cold-rolled channel bracing as shown on the drawings, with a maximum vertical spacing of 36".

H. Splices in studs will not be permitted.

3.3 TOUCH UP

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed metal framing with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

3.4 CLEANING

A. Do not allow the accumulation of scraps and debris arising from the work in the Section.

B. Maintain the premises in a neat and orderly condition at all times.

END OF SECTION

SECTION 055000 - 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 countertops.
2. Steel tube reinforcement for low partitions.
3. Steel framing and supports for mechanical and electrical equipment.
4. Steel framing and supports for applications where framing and supports are not specified in other Sections.
5. Miscellaneous steel trim.
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 include the following:

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 Requirements:

1. Section 033000 "Concrete & Reinforcing" for installing anchor bolts, steel pipe sleeves, slotted-channel inserts, wedge-type inserts, and other items cast into concrete.
2. Section 042000 "Unit Masonry" for installing loose lintels, anchor bolts, and other items built into unit masonry.
3. Section 051200 "Structural Steel."
4. Section 055213 “Pipe and Tube Railings” for aluminum handrails.

1.3 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 metal fabrications that are anchored to or that receive other work. 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.

1.4 ACTION SUBMITTALS

A. Product Data: For the following:

1. Paint products.
2. Grout.

B. Shop Drawings: Show fabrication and installation details. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items. Provide Shop Drawings for the following:
1. Steel framing and supports for countertops.
2. Steel tube reinforcement for low partitions.
3. Steel framing and supports for mechanical and electrical equipment.
4. Steel framing and supports for applications where framing and supports are not specified in other Sections.
5. Miscellaneous steel trim.
6. Loose steel lintels.

1.5 INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

C. Research/Evaluation Reports: For post-installed anchors, from ICC-ES.

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."

1.7 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 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 (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

2.2 METALS

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.

B. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

C. Steel Tubing: ASTM A 500/A 500M, cold-formed steel tubing.

D. Steel Pipe: ASTM A 53/A 53M, Standard Weight (Schedule 40) unless otherwise indicated.

E. Slotted Channel Framing: Cold-formed metal box channels (struts) complying with MFMA-4.

1. Size of Channels: 1-5/8 by 1-5/8 inches (41 by 41 mm).
2. Material: Cold-rolled steel, ASTM A 1008/A 1008M, structural steel, Grade 33 (Grade 230); 0.0966-inch (2.5-mm) minimum thickness; coated with rust-inhibitive, baked-on, acrylic enamel.
3. Basis-of-Design: Subject to compliance with requirements, provide slotted channel framing, inserts and fastener products by **Unistrut Corporation** or comparable products by another manufacturer.

2.3 FASTENERS

A. General: Unless otherwise indicated, provide Type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941 (ASTM F 1941M), Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.

1. Provide stainless-steel fasteners for fastening stainless steel.

B. 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.

C. Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed stainless-steel bolts, ASTM F 593 (ASTM F 738M); with hex nuts, ASTM F 594 (ASTM F 836M); and, where indicated, flat washers; Alloy Group 1 (A1).

D. Anchor Bolts: ASTM F 1554, Grade 36, of dimensions indicated; with nuts, ASTM A 563 (ASTM A 563M); and, where indicated, flat washers.

1. Hot-dip galvanize or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.

E. 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/E 488M, conducted by a qualified independent testing agency.

F. 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.

G. Post-Installed Anchors: Torque-controlled expansion 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. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 (A1) stainless-steel bolts, ASTM F 593 (ASTM F 738M), and nuts, ASTM F 594 (ASTM F 836M).

2.4 MISCELLANEOUS MATERIALS

A. Shop Primers, General: Provide primers that comply with painting sections.

B. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated.

C. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

D. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.

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

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 (1 mm) 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 are 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.

J. 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 (3.2 by 38 mm), with a minimum 6-inch (150-mm) embedment and 2-inch (50-mm) hook, not less than 8 inches (200 mm) from ends and corners of units and 24 inches (600 mm) 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 where indicated.

2.7 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 indicated.

2.8 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 (200 mm) unless otherwise indicated.

C. Galvanize loose steel lintels located in exterior walls.

2.9 FINISHES, GENERAL

A. Finish metal fabrications after assembly.

B. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

2.10 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. Preparation for Shop Priming Galvanized Items: After galvanizing, thoroughly clean surfaces of grease, dirt, oil, flux, and other foreign matter, and treat with metallic phosphate process.

C. Shop prime iron and steel items unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.

D. 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. Other Items: SSPC-SP 3, "Power Tool Cleaning."

E. 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.

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.

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 securely to, and rigidly brace from, building structure.

3.3 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 (0.05-mm) dry film thickness.

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780/A 780M.

END OF SECTION 055000

SECTION 055213 - PIPE AND TUBE RAILINGS

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. Aluminum pipe and tube railings.

1.3 COORDINATION

A. Coordinate installation of anchorages for railings. Furnish setting drawings, templates, and directions for installing anchorages, including 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.

B. Schedule installation so wall attachments are made only to completed walls. Do not support railings temporarily by any means that do not satisfy structural performance requirements.

1.4 ACTION SUBMITTALS

A. Product Data: For the following:
1. Railing brackets.
2. Grout and anchoring cement.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

C. Samples: For each type of exposed finish required.
1. Fittings and brackets.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

B. Welding certificates.

C. Product Test Reports: For pipe and tube railings, for tests performed by a qualified testing agency, according to ASTM E 894 and ASTM E 935.

D. Evaluation Reports: For post-installed anchors , from ICC-ES.

1.6 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to the following:
1. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

1.8 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Aluminum Pipe and Tube Railings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. ATR Technologies, Inc.
b. Blum, Julius & Co., Inc.
c. Braun, J. G., Company.
d. CraneVeyor Corp.
e. Hollaender Manufacturing Company.
f. Kee Industrial Products, Inc.
g. Moultrie Manufacturing Company.
h. Sterling Dula Architectural Products, Inc; Div. of Kane Manufacturing..
i. Superior Aluminum Products, Inc.
j. Thompson Fabricating, LLC.
k. Tri Tech, Inc.
l. Tubular Specialties Manufacturing, Inc.
m. Tuttle Railing Systems.
n. Wagner, R & B, Inc.

B. Source Limitations: Obtain each type of railing from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Structural Performance: Railings, including attachment to building construction, shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Handrails and Top Rails of Guards:

a. Uniform load of 50 lbf/ ft. (0.73 kN/m) applied in any direction.
b. Concentrated load of 200 lbf (0.89 kN) applied in any direction.
c. Uniform and concentrated loads need not be assumed to act concurrently.

B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C, material surfaces).

2.3 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.

B. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails unless otherwise indicated.

1. Provide type of bracket with predrilled hole for exposed bolt anchorage and that provides 1-1/2-inch (38-mm) clearance from inside face of handrail to finished wall surface.

2.4 ALUMINUM

A. Aluminum, General: Provide alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with not less than the strength and durability properties of alloy and temper designated below for each aluminum form required.

B. Extruded Structural Round Tubing: ASTM B 429/B 429M, Alloy 6063-T6.

1. Provide Standard Weight (Schedule 40) pipe unless otherwise indicated.

C. Die and Hand Forgings: ASTM B 247 (ASTM B 247M), Alloy 6061-T6.

D. Castings: ASTM B 26/B 26M, Alloy A356.0-T6.

2.5 FASTENERS

A. General: Provide the following:
1. Aluminum Railings: Type 304 stainless-steel fasteners.

2. Provide exposed fasteners with finish matching appearance, including color and texture, of railings.

B. Fasteners for Anchoring Railings to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction indicated and capable of withstanding design loads.

C. Fasteners for Interconnecting Railing Components (Railings to Brackets):
1. Provide tamper-resistant flat-head machine screws for exposed fasteners unless otherwise indicated.

D. Post-Installed Anchors: Torque-controlled expansion anchors capable of sustaining, without failure, a load equal to 6 times the load imposed when installed in unit masonry and 4 times the load imposed when installed in concrete, as determined by testing according to ASTM E 488/E 488M, conducted by a qualified independent testing agency.
1. Material for Exterior Locations: Alloy Group 1 (A1) stainless-steel bolts, ASTM F 593 (ASTM F 738M), and nuts, ASTM F 594 (ASTM F 836M).

2.6 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

1. For aluminum railings, provide type and alloy as recommended by producer of metal to be welded and as required for color match, strength, and compatibility in fabricated items.

B. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.

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

D. Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound.

1. Water-Resistant Product: At exterior locations provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating and that is recommended by manufacturer for exterior use.

2.7 FABRICATION

A. General: Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.

B. Shop assemble railings to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.

C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm) unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

D. Form work true to line and level with accurate angles and surfaces.

E. Fabricate connections that are exposed to weather in a manner that excludes water. Provide weep holes where water may accumulate.

F. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.

G. Connections: Fabricate each run of railing with welded connections unless otherwise indicated. Use mechanical fasteners to secure railings to brackets and to secure brackets to supporting construction.
   1. Welded Connections for Aluminum Pipe: Fabricate railings to interconnect members with concealed internal welds that eliminate surface grinding, using manufacturer's standard system of sleeve and socket fittings.

H. Form Changes in Direction as Follows:

   1. By inserting prefabricated elbow fittings.

I. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated. Close ends of returns unless clearance between end of rail and wall is 1/4 inch (6 mm) or less.

J. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to connect railings to other work unless otherwise indicated.

K. Provide inserts and other anchorage devices for connecting railings to concrete or masonry work. Fabricate anchorage devices capable of withstanding loads imposed by railings. Coordinate anchorage devices with supporting structure.

2.8 ALUMINUM FINISHES

A. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are unacceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

B. Mill Finish: AA-M12, nonspecular as fabricated.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Fit exposed connections together to form tight, hairline joints.

B. Perform cutting, drilling, and fitting required for installing railings. Set railings accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.

1. Do not weld, cut, or abrade surfaces of railing components that are intended for field connection without further cutting or fitting.
2. Set posts plumb within a tolerance of 1/16 inch in 3 feet (2 mm in 1 m).
3. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet (6 mm in 3.5 m).

C. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

1. Coat, with a heavy coat of bituminous paint, concealed surfaces of aluminum that are in contact with grout, concrete, masonry, wood, or dissimilar metals.

D. Adjust railings before anchoring to ensure matching alignment at abutting joints.

E. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

3.2 RAILING CONNECTIONS

A. Welded Connections: Use fully welded joints for permanently connecting railing sections within runs to provide a continuous railing. Comply with requirements for welded connections in "Fabrication" Article whether welding is performed in the shop or in the field.

B. Expansion Joints: Install expansion joints at locations indicated but not farther apart than required to accommodate thermal movement. Provide slip-joint internal sleeve extending 2 inches (50 mm) beyond joint on either side, fasten internal sleeve securely to one side, and locate joint within 6 inches (150 mm) of post.

3.3 ANCHORING POSTS

A. Form or core-drill holes not less than 5 inches (125 mm) deep and 3/4 inch (20 mm) larger than OD of post for installing posts in concrete. Clean holes of loose material, insert posts, and fill annular space between post and concrete with nonshrink, nonmetallic grout or anchoring cement, mixed and placed to comply with anchoring material manufacturer's written instructions.

B. Leave anchorage joint exposed with 1/8-inch (3-mm) buildup, sloped away from post.

3.4 ATTACHING RAILINGS

A. Attach railings to wall with wall brackets. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.

B. Use mechanical means for permanently connecting railings to brackets and brackets to other construction. Seal recessed holes of exposed locking screws using plastic cement filler colored to match finish of railings.

C. Secure wall brackets to building construction as follows:

1. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.

3.5 ADJUSTING AND CLEANING

A. Clean aluminum by washing thoroughly with clean water and soap and rinsing with clean water.

3.6 PROTECTION

A. Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Substantial Completion.

END OF SECTION 055213

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SECTION 061053 - MISCELLANEOUS ROUGH CARPENTRY

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. Rooftop equipment bases and support curbs.
2. Wood blocking and nailers.
3. Wood furring.
4. Plywood backing panels.

B. Related Requirements:

1. Section 061600 "Sheathing."

1.3 DEFINITIONS

A. Dimension Lumber: Lumber of 2 inches nominal (38 mm actual) or greater but less than 5 inches nominal (114 mm actual) in least dimension.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

1. Include data for wood-preservative treatment 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. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.
3. For fire-retardant treatments, include physical properties of treated lumber both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D 5664.
4. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
5. Include copies of warranties from chemical treatment manufacturers for each type of treatment.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Stack lumber flat with spacers beneath and between each bundle to provide air circulation. Protect lumber from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.

1. Factory mark each piece of lumber with grade stamp of grading agency.
2. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry lumber.

B. Maximum Moisture Content of Lumber: 19 percent unless otherwise indicated.

2.2 WOOD-PRESERVATIVE-TREATED MATERIALS

A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2.

1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.

B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or does not comply with requirements for untreated material.

C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.

D. Application: Treat items indicated on Drawings and the following:

1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.

2.3 FIRE-RETARDANT-TREATED MATERIALS

A. General: Where fire-retardant-treated materials are indicated, use materials complying with requirements in this article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.

B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame spread index of 25 or less when tested according to ASTM E 84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet (3.2 m) beyond the centerline of the burners at any time during the test.

1. Use treatment that does not promote corrosion of metal fasteners.
2. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated lumber and plywood by pressure process after being subjected to accelerated weathering according to ASTM D 2898. Use for exterior locations and where indicated.
3. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D 3201 at 92 percent relative humidity. Use where exterior type is not indicated.

C. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent.

D. Identify fire-retardant-treated wood with appropriate classification marking of testing and inspecting agency acceptable to authorities having jurisdiction.

E. Application: Treat all items indicated on Drawings, and the following:
1. Wood cants, nailers, curbs, equipment support bases, blocking, and similar members in connection with roofing.
2. Plywood backing panels.

2.4 MISCELLANEOUS LUMBER

A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:

1. Blocking.
2. Nailers.
3. Rooftop equipment bases and support curbs.
4. Cants.

B. For items of dimension lumber size, provide Standard, Stud, or No. 3 grade lumber of any species.

C. For blocking not used for attachment of other construction, Utility, Stud, or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.

D. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.

2.5 PLYWOOD BACKING PANELS

A. Equipment Backing Panels: fire-retardant treated, in thickness indicated or, if not indicated, not less than 3/4-inch (19-mm) nominal thickness.

2.6 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.

1. Where carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.

B. Nails, Brads, and Staples: ASTM F 1667.

C. Power-Driven Fasteners: NES NER-272.

D. Wood Screws: ASME B18.6.1.

E. Screws for Fastening to Metal Framing: ASTM C 1002 or ASTM C 954, length as recommended by screw manufacturer for material being fastened.

F. Lag Bolts: ASME B18.2.1 (ASME B18.2.3.8M).

G. Bolts: Steel bolts complying with ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with ASTM A 563 (ASTM A 563M) hex nuts and, where indicated, flat washers.

H. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry assemblies and equal to 4 times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing and inspecting agency.

1. Material: Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.
2. Material: Stainless steel with bolts and nuts complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2 (ASTM F 738M and ASTM F 836M, Grade A1 or A4).

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Set carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit carpentry to other construction; scribe and cope as needed for accurate fit. Locate nailers, blocking and similar supports to comply with requirements for attaching other construction.

B. Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels. Install fire-retardant treated plywood backing panels with classification marking of testing agency exposed to view.

C. Sort and select lumber so that natural characteristics will not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

D. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.

1. Use inorganic boron for items that are continuously protected from liquid water.
2. Use copper naphthenate for items not continuously protected from liquid water.

E. Securely attach carpentry work to substrate by anchoring and fastening as indicated, complying with the following:

1. NES NER-272 for power-driven fasteners.
2. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code.

F. Use steel common nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood. Drive nails snug but do not countersink nail heads unless otherwise indicated.

3.2 WOOD BLOCKING, AND NAILER INSTALLATION

A. Install where indicated and where required for screeding or attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.

B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.

3.3 PROTECTION

A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

B. Protect miscellaneous rough carpentry from weather. If, despite protection, miscellaneous rough carpentry becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION 061053

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SECTION 061600 - SHEATHING

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. Wall sheathing.
2. Roof sheathing.

B. Related Requirements:

1. Section 072500 "Weather Barriers" for water-resistive barrier applied over wall sheathing.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Stack panels flat with spacers beneath and between each bundle to provide air circulation. Protect sheathing from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WALL SHEATHING

A. Glass-Mat Gypsum Wall Sheathing: ASTM C 1177/1177M.

1. Products: Subject to compliance with requirements provide one of the following:

a. CertainTeed Corporation; GlasRoc.
b. G-P Gypsum Corporation; Dens-Glass Gold.
c. National Gypsum Company; Gold Bond e(2)XP.
d. Temple-Inland Inc.; GreenGlass
e. United States Gypsum Co.; Securock.

2. Type and Thickness: Type X, 5/8 inch (15.9 mm) thick.

B. Cellulose Fiber-Reinforced Gypsum Sheathing: ASTM C 1278/C 1278M, gypsum sheathing.

1. Product: Subject to compliance with requirements, provide "Fiberock Sheathing with Aqua-Tough" by United States Gypsum Co.
2. Type and Thickness: Type X, 5/8 inch (15.9 mm) thick.

2.2 ROOF SHEATHING

A. Plywood Roof Sheathing: Exterior.

1. Span Rating: Not less than 48/24.
2. Nominal Thickness: Not less than 1/2 inch (13 mm).

2.3 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.

1. For roof and wall sheathing, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M or of Type 304 stainless steel.

B. Screws for Fastening Gypsum Sheathing to Cold-Formed Metal Framing: Steel drill screws, in length recommended by sheathing manufacturer for thickness of sheathing to be attached, with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B 117.

1. For steel framing less than 0.0329 inch (0.835 mm) thick, use screws that comply with ASTM C 1002.
2. For steel framing from 0.033 to 0.112 inch (0.84 to 2.84 mm) thick, use screws that comply with ASTM C 954.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement. Arrange joints so that pieces do not span between fewer than three support members.

B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction unless otherwise indicated.

C. Securely attach to substrate by fastening as indicated, complying with the following:

1. Table 2304.9.1, "Fastening Schedule," in ICC's "International Building Code."

D. Use common wire nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections. Install fasteners without splitting wood.

E. Coordinate wall and roof sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.

F. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.

G. Coordinate sheathing installation with installation of materials installed over sheathing so sheathing is not exposed to precipitation or left exposed at end of the workday when rain is forecast.

3.2 GYPSUM SHEATHING INSTALLATION

A. Comply with GA-253 and with manufacturer's written instructions.

1. Fasten gypsum sheathing to wood framing with screws.
2. Fasten gypsum sheathing to cold-formed metal framing with screws.
3. Install boards with a 3/8-inch (9.5-mm) gap where non-load-bearing construction abuts structural elements.
4. Install boards with a 1/4-inch (6.4-mm) gap where they abut masonry or similar materials that might retain moisture, to prevent wicking.

B. Apply fasteners so heads bear tightly against face of sheathing, but do not cut into facing.

C. Vertical Installation: Install board vertical edges centered over studs. Abut ends and edges of each board with those of adjacent boards. Attach boards at perimeter and within field of board to each stud.

1. Space fasteners approximately 8 inches (200 mm) o.c. and set back a minimum of 3/8 inch (9.5 mm) from edges and ends of boards.

END OF SECTION 061600

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SECTION 064116 - PLASTIC-LAMINATE-FACED ARCHITECTURAL CABINETS

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. Plastic-laminate-faced architectural cabinets.
2. Wood furring, blocking, shims, and hanging strips for installing plastic-laminate-faced architectural cabinets unless concealed within other construction before cabinet installation.

B. Related Requirements:

1. Section 061053 "Miscellaneous Rough Carpentry" for wood furring, blocking, shims, and hanging strips required for installing cabinets and concealed within other construction before cabinet installation.
2. Section 101010 “Acoustic Wall Panels” for fabric wrapped panels installed at casework.
3. Section 123623.13 "Plastic-Laminate-Clad Countertops."
4. Section 123661 “Simulated Stone Countertops.”

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product, including panel products, high-pressure decorative laminate, adhesive for bonding plastic laminate and cabinet hardware and accessories.

B. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.

1. Show details full size.
2. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
3. Show locations and sizes of cutouts and holes for items installed in architectural plastic-laminate cabinets.
4. Apply AWI Quality Certification Program label to Shop Drawings.

C. Samples for Verification:

1. Plastic laminates, 8 by 10 inches (200 by 250 mm), for each type, color, pattern, and surface finish, with one sample applied to core material and specified edge material applied to one edge.
2. Thermoset decorative panels, 8 by 10 inches (200 by 250 mm), for each color, pattern, and surface finish, with edge banding on one edge.

3. Exposed cabinet hardware and accessories, one unit for each type and finish.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and fabricator.

B. Woodwork Quality Standard Compliance Certificates: AWI Quality Certification Program certificates.

1.6 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance. Shop is a certified participant in AWI's Quality Certification Program.

B. Installer Qualifications: Fabricator of products or other certified participant in AWI's Quality Certification Program.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver cabinets until painting and similar operations that could damage woodwork have been completed in installation areas. If cabinets must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

1.8 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install cabinets until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

B. Field Measurements: Where cabinets are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1. Locate concealed framing, blocking, and reinforcements that support cabinets by field measurements before being enclosed, and indicate measurements on Shop Drawings.

C. Established Dimensions: Where cabinets are indicated to fit to other construction, establish dimensions for areas where cabinets are to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.9 COORDINATION

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

PART 2 - PRODUCTS

2.1 PLASTIC-LAMINATE-FACED ARCHITECTURAL CABINETS

A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades of architectural plastic-laminate cabinets indicated for construction, finishes, installation, and other requirements.

1. Provide labels and/or certificates from AWI certification program indicating that woodwork, including installation, complies with requirements of grades specified.
2. The Contract Documents contain selections chosen from options in the quality standard and additional requirements beyond those of the quality standard. Comply with those selections and requirements in addition to the quality standard.

B. Grade: Premium.

C. Type of Construction: As indicated on drawings.

D. Cabinet, Door, and Drawer Front Interface Style: Flush overlay.

E. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or if not indicated, as required by woodwork quality standard.
1. Manufacturer: Subject to compliance with requirements, provide high-pressure decorative laminates as indicated in the Room Finish Legend located on the Drawings.

F. Laminate Cladding for Exposed Surfaces:

1. Horizontal Surfaces: Grade HGS.
2. Vertical Surfaces: Grade HGS.
3. Edges: PVC T-mold matching laminate in color, pattern, and finish.
4. Pattern Direction: As indicated on drawings.

G. Materials for Semiexposed Surfaces:

1. Surfaces Other Than Drawer Bodies: Thermoset decorative panels.

a. Edges of Plastic-Laminate Shelves: PVC T-mold matching laminate in color, pattern, and finish.
b. For semiexposed backs of panels with exposed plastic-laminate surfaces, provide surface of high-pressure decorative laminate, NEMA LD 3, Grade VGS.

2. Drawer Sides and Backs: Thermoset decorative panels with PVC or polyester edge banding.
3. Drawer Bottoms: Thermoset decorative panels.

H. Concealed Backs of Panels with Exposed Plastic-Laminate Surfaces: High-pressure decorative laminate, NEMA LD 3, Grade BKL.

I. Drawer Construction: Fabricate with exposed fronts fastened to subfront with mounting screws from interior of body.

1. Join subfronts, backs, and sides with glued rabbeted joints supplemented by mechanical fasteners or glued dovetail joints.

J. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:

1. As indicated by laminate manufacturer's designations.

2.2 WOOD MATERIALS

A. Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of woodwork and quality grade specified unless otherwise indicated.

1. Wood Moisture Content: 5 to 10 percent.

B. Composite Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of woodwork and quality grade specified unless otherwise indicated.
1. Particleboard: ANSI A208.1, Grade M-2, made with binder containing no urea formaldehyde.

2. Softwood Plywood: DOC PS 1.
3. Thermoset Decorative Panels: Particleboard or medium-density fiberboard finished with thermally fused, melamine-impregnated decorative paper and complying with requirements of NEMA LD 3, Grade VGL, for test methods 3.3, 3.4, 3.6, 3.8, and 3.10.

2.3 CABINET HARDWARE AND ACCESSORIES

A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets except for items specified in Section 087100 "Door Hardware."

B. Hardware Standard: Comply with ANSI/BHMA A156.9 "American National Standard for Cabinet Hardware".

1. Quality Level: Institutional grade, unless otherwise indicated.

C. Butt Hinges: 2-3/4-inch (70-mm), five-knuckle steel hinges made from 0.095-inch- (2.4-mm-) thick metal, and as follows:
1. Locations. Provide butt hinges at cabinet doors over 48-inches in height.
2. Semiconcealed Hinges for Overlay Doors: BHMA A156.9, B01521.

D. Frameless Concealed Hinges (European Type): BHMA A156.9, B01602, 135 degrees of opening, self-closing.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Hafaele Duomatic Premium Series.
      b. Grass System Snap On 3000 Series.
      c. Mepla CS 65.
      d. Hettich America Intermat 9000 Series.

E. Back-Mounted Pulls: BHMA A156.9, B02011.

F. Wire Pulls: Back mounted, solid metal, 4 inches (100 mm) long, 5/16 inch (8 mm) in diameter and 1-5/16 inch projection.
   1. Basis-of-Design Product: Ives #38 Wire Pull or comparable product by another manufacturer.

G. Catches: Magnetic catches, BHMA A156.9, B03141.

H. Cabinet Interior Shelf Rests: BHMA A156.9, B04013; metal, two-pin type with shelf hold-down clip.

I. Drawer Slides: BHMA A156.9.

   1. Heavy Duty (Grade 1HD-100 and Grade 1HD-200): Side mounted; full-extension type; zinc-plated steel ball-bearing slides.
   2. Box Drawer Slides: Grade 1HD-100; for drawers not more than 6 inches (150 mm) high and 24 inches (600 mm) wide.
   3. File Drawer Slides: Grade 1HD-200; for drawers more than 6 inches (150 mm) high or 24 inches (600 mm) wide.
   4. Pencil Drawer Slides: Grade 2; for drawers not more than 3 inches (75 mm) high and 24 inches (600 mm) wide.

J. Locks, General: Where indicated, provide standard pin-type or disc-type (5 or 7 pins or discs) tumbler locks, keyed alike, except as otherwise indicated.

K. Door Locks: BHMA A156.11, E07121.
   1. Where locks are indicated to be installed in cabinets, Contractor is to leave the keys in the locks at time of Substantial Completion. Keys will be removed and distributed by Owner.

L. Drawer Locks: BHMA A156.11, E07041.
   1. Where locks are indicated to be installed in cabinets, Contractor is to leave the keys in the locks at time of Substantial Completion. Keys will be removed and distributed by Owner.

M. Door and Drawer Silencers: BHMA A156.16, L03011.

N. Edge Angles: Metal angles of material and finish indicated on Drawings for protection of casework edges.

O. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated.
   1. Satin Chromium Plated: BHMA 626 for brass or bronze base; BHMA 652 for steel base.

P. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in BHMA A156.9.

2.4 MISCELLANEOUS MATERIALS

A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln dried to less than 15 percent moisture content.

B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide metal expansion sleeves or expansion bolts for post-installed anchors. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors.
   1. Screws: Select material, type, size and finish required for each use. Comply with FS FF-S-111 for applicable requirements.
      a. For metal framing supports, provide screws as recommended by metal framing manufacturer.
   2. Nails: Select material, type, size and finish required for each use. Comply with FS FF-N-105 for applicable requirements.

C. Adhesives: Do not use adhesives that contain urea formaldehyde.

D. Adhesive for Bonding Plastic Laminate: Contact cement.

   1. Adhesive for Bonding Edges: Hot-melt adhesive or adhesive specified above for faces.

2.5 FABRICATION

A. Fabricate cabinets to dimensions, profiles, and details indicated.

B. Complete fabrication, including assembly and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
   1. 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 before disassembling for shipment.

C. Shop-cut openings to maximum extent possible to receive hardware, appliances, 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.

PART 3 - EXECUTION

3.1 PREPARATION

A. Before installation, condition cabinets to average prevailing humidity conditions in installation areas.

B. Before installing cabinets, examine shop-fabricated work for completion and complete work as required.

3.2 INSTALLATION

A. Grade: Install cabinets to comply with same grade as item to be installed.

B. Assemble cabinets and complete fabrication at Project site to the extent that it was not completed in the shop.

C. Install cabinets level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches (3 mm in 2400 mm).

D. Scribe and cut cabinets to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.

E. Anchor cabinets to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with woodwork.

1. Use filler matching finish of items being installed.

F. Cabinets: Install without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.

1. Install cabinets with no more than 1/8 inch in 96-inch (3 mm in 2400-mm) sag, bow, or other variation from a straight line.
2. Fasten wall cabinets through back, near top and bottom, and at ends not more than 16 inches (400 mm) o.c. with No. 10 wafer-head screws sized for not less than 1-1/2-inch (38-mm) penetration into wood framing, blocking, or hanging strips or No. 10 wafer-head sheet metal screws through metal backing or metal framing behind wall finish.
3. Where locks are indicated to be installed in cabinets, Contractor is to leave the keys in the locks at time of Substantial Completion. Keys will be removed and distributed by Owner.

3.3 ADJUSTING AND CLEANING

A. Repair damaged and defective cabinets, where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.

B. Clean, lubricate, and adjust hardware.

C. Clean cabinets on exposed and semiexposed surfaces.

END OF SECTION 064116

SECTION 072100 - THERMAL INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Foam-plastic board insulation.
2. Glass-fiber blanket insulation.
3. Mineral-wool blanket insulation.
4. Loose-fill insulation.
5. Vapor retarders.

B. Related Sections:
1. Section 072413 "Polymer-Based Exterior Insulation and Finish System (EIFS)" for insulation specified as part of these systems.
2. Section 075323 "Ethylene-Propylene-Diene-Monomer (EPDM) Roofing" for insulation specified as part of roofing construction.
3. Section 078446 "Fire-Resistive Joint Systems" for insulation installed as part of a perimeter fire-resistive joint system.

1.3 ACTION SUBMITTALS

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

1.4 INFORMATIONAL SUBMITTALS

A. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each product.

B. Research/Evaluation Reports: For foam-plastic insulation, from ICC-ES.

1.5 QUALITY ASSURANCE

A. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1.6 DELIVERY, STORAGE, AND HANDLING

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

B. Protect foam-plastic board insulation as follows:

1. Do not expose to sunlight except to necessary extent for period of installation and concealment.
2. Protect against ignition at all times. Do not deliver foam-plastic board materials to Project site before installation time.
3. Quickly complete installation and concealment of foam-plastic board insulation in each area of construction.

PART 2 - PRODUCTS

2.1 FOAM-PLASTIC BOARD INSULATION

A. Extruded-Polystyrene Board Insulation: ASTM C 578, of type and minimum compressive strength indicated below, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E 84.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. DiversiFoam Products.
b. Dow Chemical Company (The).
c. Owens Corning.
d. Pactiv Building Products.

2. Type IV, 25 psi (173 kPa).

2.2 GLASS-FIBER BLANKET INSULATION

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. CertainTeed Corporation.
2. Guardian Building Products, Inc.
3. Johns Manville.
4. Knauf Insulation.
5. Owens Corning.

B. Reinforced-Foil-Faced, Glass-Fiber Blanket Insulation: ASTM C 665, Type III (reflective faced), Class A (faced surface with a flame-spread index of 25 or less); Category 1 (membrane is a vapor barrier), faced with foil scrim, foil-scrim kraft, or foil-scrim polyethylene.

2.3 MINERAL-WOOL BLANKET INSULATION

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Fibrex Insulations Inc.
2. Owens Corning.
3. Roxul Inc.
4. Thermafiber.

B. Unfaced, Mineral-Wool Blanket Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.

C. Reinforced-Foil-Faced, Mineral-Wool Blanket Insulation: ASTM C 665, Type III (reflective faced), Class A (faced surface with a flame-spread index of 25 or less per ASTM E 84); Category 1 (membrane is a vapor barrier), faced with foil scrim, foil-scrim kraft, or foil-scrim polyethylene.

2.4 LOOSE-FILL INSULATION

A. Glass-Fiber Loose-Fill Insulation: ASTM C 764, Type I for pneumatic application or Type II for poured application; with maximum flame-spread and smoke-developed indexes of 5, per ASTM E 84.

2.5 VAPOR RETARDERS

A. Foil-Polyester-Film Vapor Retarders: Two layers of 0.5-mil- (0.013-mm-) thick polyester film laminated to an inner layer of 1-mil- (0.025-mm-) thick aluminum foil, with maximum water-vapor transmission rate in flat condition of 0.0 g/h x sq. m and with maximum flame-spread and smoke-developed indexes of 5, per ASTM E 84.

1. Products: Subject to compliance with requirements, provide the following:

a. Alumiseal Corporation; Zero Perm Vapor Barrier.
b. Lamtec Corporation; R3035

B. Vapor-Retarder Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.

C. Adhesive for Vapor Retarders: Product recommended by vapor-retarder manufacturer and has demonstrated capability to bond vapor retarders securely to substrates indicated.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean substrates of substances that are harmful to insulation or vapor retarders, including removing projections capable of puncturing vapor retarders or that interfere with insulation attachment.

3.2 INSTALLATION, GENERAL

A. Comply with insulation manufacturer's written instructions applicable to products and applications indicated.

B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.

C. Extend insulation to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

D. Provide sizes to fit applications indicated and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units to produce thickness indicated unless multiple layers are otherwise shown or required to make up total thickness.

3.3 INSTALLATION OF BELOW-GRADE INSULATION

A. On vertical surfaces, set insulation units loosely laid according to manufacturer's written instructions.

1. If not otherwise indicated, extend insulation a minimum of 24 inches (610 mm) below exterior grade line.

B. On horizontal surfaces, loosely lay insulation units according to manufacturer's written instructions. Stagger end joints and tightly abut insulation units.

1. If not otherwise indicated, extend insulation a minimum of 24 inches (610 mm) in from exterior walls.

3.4 INSTALLATION OF INSULATION FOR FRAMED CONSTRUCTION

A. Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.

B. Glass-Fiber or Mineral-Wool Blanket Insulation: Install in cavities formed by framing members according to the following requirements:

1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, 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. Maintain 3-inch (76-mm) clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
4. For metal-framed wall cavities where cavity heights exceed 96 inches (2438 mm), support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.

C. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:

1. Loose-Fill Insulation: Compact to approximately 40 percent of normal maximum volume equaling a density of approximately 2.5 lb/cu. ft. (40 kg/cu. m).

3.5 INSTALLATION OF VAPOR RETARDERS

A. Place vapor retarders on side of construction indicated on Drawings. Extend vapor retarders to extremities of areas to protect from vapor transmission. Secure vapor retarders in place with adhesives or other anchorage system as indicated. Extend vapor retarders to cover miscellaneous voids in insulated substrates, including those filled with loose-fiber insulation.

B. Seal vertical joints in vapor retarders over framing by lapping no fewer than two studs.
1. Before installing vapor retarders, apply urethane sealant to flanges of metal framing including runner tracks, metal studs, and framing around door and window openings. Seal overlapping joints in vapor retarders with vapor-retarder tape according to vapor-retarder manufacturer's written instructions. Seal butt joints with vapor-retarder tape. Locate all joints over framing members or other solid substrates.
2. Firmly attach vapor retarders to metal framing and solid substrates with vapor-retarder fasteners as recommended by vapor-retarder manufacturer.

C. Seal joints caused by pipes, conduits, electrical boxes, and similar items penetrating vapor retarders with vapor-retarder tape to create an airtight seal between penetrating objects and vapor retarders.

D. Repair tears or punctures in vapor retarders immediately before concealment by other work. Cover with vapor-retarder tape or another layer of vapor retarders.

3.6 PROTECTION

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

3.7 INSULATION SCHEDULE

A. Insulation Installed at Foundation Wall and Under Slab-On-Grade:
1. Type IV extruded-polystyrene board insulation.

B. Insulation at Walls and Ceilings, Exposed to Plenums:
   1. Foil-faced, glass-fiber blanket insulation or foil-faced, mineral-wool blanket insulation.

C. Insulation at Walls and Ceilings, Where Insulation is Permanently Covered by Gypsum Board or Other Construction and Not Exposed to Plenums:
   1. Unfaced, glass-fiber or mineral-wool blanket insulation with separate vapor retarder.

D. Insulation for Miscellaneous Voids:
   1. Glass-fiber loose fill insulation.

END OF SECTION 072100

SECTION 072413 - POLYMER-BASED EXTERIOR INSULATION AND FINISH SYSTEM (EIFS)

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. EIFS-clad barrier-wall assemblies that are field applied over substrate consisting of gypsum sheathing and weather-resistant sheathing paper.

B. Related Requirements:

1. Section 061600 “Sheathing.”
2. Section 072500 “Weather Barriers” for weather-resistant sheathing paper.

1.3 DEFINITIONS

A. Definitions in ASTM E 2110 apply to Work of this Section.

B. EIFS: Exterior insulation and finish system(s).

C. IBC: International Building Code.

D. Polymer-Based Exterior Insulation and Finish System: Class PB EIFS, as defined in ASTM E 2568 and as described below:
1. Class PB EIFS: A non-load-bearing, exterior wall cladding system that consists of an insulation board attached adhesively, mechanically, or both to the substrate; an integrally reinforced base coat; and a textured protective finish coat.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.5 ACTION SUBMITTALS

A. Product Data: For each EIFS component, trim, and accessory.

B. Shop Drawings: For EIFS. Include plans, elevations, sections, details of components, details of penetration and termination, flashing details, joint locations and configurations, fastening and anchorage details including mechanical fasteners, and connections and attachments to other work.

C. Samples for Initial Selection: For each type of finish-coat color and texture indicated.

1. Include similar Samples of exposed accessories involving color selection.

D. Samples for Verification: 24-inch- (600-mm-) square panels for each type of finish-coat color and texture indicated, prepared using same tools and techniques intended for actual work.

1. Include exposed trim and accessory Samples to verify color selected.
2. Include a typical control joint filled with sealant of color selected, as specified in Section 079200 "Joint Sealants."

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Manufacturer Certificates: Signed by EIFS manufacturer certifying the following:

1. EIFS substrate is acceptable to EIFS manufacturer.
2. Accessory products installed with EIFS, including joint sealants, flashing, water-resistant barriers, and trim, whether or not furnished by EIFS manufacturer and whether or not specified in this Section, are acceptable to EIFS manufacturer.

C. Product Certificates: For insulation.

D. Product Test Reports: For each EIFS assembly and component, for tests performed by a qualified testing agency.

E. Field quality-control reports.

F. Sample Warranty: For manufacturer's special warranty.

1.7 CLOSEOUT SUBMITTALS

A. Maintenance Data: For EIFS to include in maintenance manuals.

1.8 QUALITY ASSURANCE

A. Installer Qualifications: An installer certified in writing by EIFS manufacturer as qualified to install manufacturer's system using trained workers.

B. Fire-Test-Response Characteristics: Provide EIFS and system components with the following fire-test-response characteristics as determined by testing identical EIFS and system components per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify products with appropriate markings of applicable testing agency.

1. Fire-Resistance Characteristics: Provide materials and construction tested for fire resistance per ASTM E 119.
2. Surface-Burning Characteristics: Provide insulation board, adhesives, base coats, and finish coats with flame-spread index of 25 or less and smoke-developed index of 450 or less, per ASTM E 84.

C. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, to set quality standards for materials and execution, and to set quality standards for fabrication and installation.

1. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original, unopened packages with manufacturers' labels intact and clearly identifying products.

B. Store materials inside and under cover; keep them dry and protected from weather, direct sunlight, surface contamination, aging, corrosion, damaging temperatures, construction traffic, and other causes.

1. Stack insulation board flat and off the ground.
2. Protect plastic insulation against ignition at all times. Do not deliver plastic insulating materials to Project site before installation time.
3. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

1.10 FIELD CONDITIONS

A. Weather Limitations: Maintain ambient temperatures above 40 deg F (4.4 deg C) for a minimum of 24 hours before, during, and after adhesives or coatings are applied. Do not apply EIFS adhesives or coatings during rainfall. Proceed with installation only when existing and forecasted weather conditions and ambient outdoor air, humidity, and substrate temperatures permit EIFS to be applied, dried, and cured according to manufacturers' written instructions and warranty requirements.

1.11 WARRANTY

A. Manufacturer's Special Warranty: Manufacturer agrees to repair or replace EIFS that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Bond integrity and weathertightness.
b. Deterioration of EIFS finishes and other EIFS materials beyond normal weathering.

2. Warranty coverage includes the following EIFS components:

a. EIFS finish, including base and finish coats and reinforcing mesh.
b. Insulation installed as part of EIFS.
c. Insulation adhesive and mechanical fasteners.
d. EIFS accessories, including trim components and flashing.

3. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Dryvit Systems, Inc.
2. Finestone; Degussa Wall Systems, Inc.
3. Senergy; Degussa Wall Systems, Inc.
4. Sto Corp.
5. Stuc-O-Flex International, Inc.
6. TEC; an H. B. Fuller company.

B. Source Limitations: Obtain EIFS from single source from single EIFS manufacturer and from sources approved by EIFS manufacturer as tested and compatible with EIFS components.

2.2 PERFORMANCE REQUIREMENTS

A. EIFS Performance: Comply with ASTM E 2568 and ICC-ES AC219 and with the following:
1. Weathertightness: Resistant to water penetration from exterior into EIFS and assemblies behind it or through them into interior of building that results in deterioration of thermal-insulating effectiveness or other degradation of EIFS and assemblies behind it, including substrates, supporting wall construction, and interior finish.
2. Structural Performance: EIFS assembly and components shall comply with ICC-ES AC219 when tested according to ASTM E 2568.
a. Wind Loads: Uniform pressure as directed by project Structural Engineer of Record.

3. Impact Performance: ASTM E 2568, Standard impact resistance unless otherwise indicated.
4. Bond Integrity: Free from bond failure within EIFS components or between EIFS and substrates, resulting from exposure to fire, wind loads, weather, or other in-service conditions.
5. Abrasion Resistance of Finish Coat: Sample consisting of 1-inch- (25.4-mm-) thick EIFS mounted on 1/2-inch- (12.7-mm-) thick gypsum board; cured for a minimum of 28 days and shows no cracking, checking, or loss of film integrity after exposure to 528 quarts (500 L) of sand when tested according to ASTM D 968, Method A.
6. Mildew Resistance of Finish Coat: Sample applied to 2-by-2-inch (50.8-by-50.8-mm) clean glass substrate; cured for 28 days and shows no growth when tested according to ASTM D 3273 and evaluated according to ASTM D 3274.
7. Absorption-Freeze Resistance: No visible deleterious effects and negligible weight loss after 60 cycles per EIMA 101.01.

8. Accelerated Weathering: Five samples per ICC-ES AC219 showing no cracking, checking, crazing, erosion, rusting, blistering, peeling, delamination, or other characteristics that might affect performance as a wall cladding after testing for 2000 hours when viewed under 5 times magnification per ASTM G 153 or ASTM G 155.
9. Freeze-Thaw: No surface changes, cracking, checking, crazing, erosion, rusting, blistering, peeling, or delamination, or indications of delamination between components when viewed under 5 times magnification after 10 cycles per ICC-ES AC219.
10. Salt-Spray Resistance: No deleterious affects when tested according to ICC-ES AC219.
11. Tensile Adhesion: No failure in the EIFS, adhesive, base coat, or finish coat when tested per ICC-ES AC219]
12. Water Penetration: Sample consisting of 1-inch- (25.4-mm-) thick EIFS mounted on 1/2-inch- (12.7-mm-)thick gypsum board, cured for 28 days, and showing no water penetration into the plane of the base coat to expanded-polystyrene board interface of the test specimen after 15 minutes at 6.24 lbf/sq. ft. (299 Pa) of air pressure difference or 20 percent of positive design wind pressure, whichever is greater, across the specimen during a test period when tested per EIMA 101.02.
13. Water Resistance: Three samples, each consisting of 1-inch- (25.4-mm-) thick EIFS mounted on 1/2-inch- (12.7-mm-) thick gypsum board; cured for 28 days; and showing no cracking, checking, crazing, erosion, rusting, blistering, peeling, or delamination after testing for 14 days per ASTM D 2247.
14. Wind-Driven-Rain Resistance: Resist wind-driven rain according to ICC-ES AC219.

2.3 EIFS MATERIALS

A. Compatibility: Provide adhesive, fasteners, board insulation, reinforcing meshes, base- and finish-coat systems, sealants, and accessories that are compatible with one another and with substrates and approved for use by EIFS manufacturer for Project.

B. Primer: EIFS manufacturer's standard factory-mixed, elastomeric-polymer primer for preparing base-coat surface for application of finish coat.

C. Flexible-Membrane Flashing: Cold-applied, self-adhering, self-healing, rubberized-asphalt and polyethylene-film composite sheet or tape and primer; EIFS manufacturer's standard or product recommended in writing by EIFS manufacturer.

D. Insulation Adhesive: EIFS manufacturer's standard formulation designed for indicated use; compatible with substrate.

E. Molded, (Expanded) Rigid Cellular Polystyrene Board Insulation (EPS): Comply with ASTM C 578, Type I; and with EIFS manufacturer's requirements for most stringent requirements for material performance and qualities of insulation, including dimensions and permissible variations, and the following:

1. Aging: Before cutting and shipping, age insulation in block form by air drying for not less than six weeks.
2. Flame-Spread and Smoke-Developed Indexes: 25 and 450 or less, respectively, according to ASTM E 84.
3. Dimensions: Provide insulation boards of not more than 24 by 48 inches (610 by 1219 mm) thick or in other thickness indicated, but not more than 4 inches (102 mm) thick or less than the thickness allowed by ASTM C 1397.
4. Foam Build-Outs: Provide with profiles and dimensions indicated on Drawings.

F. Reinforcing Mesh: Balanced, alkali-resistant, open-weave, glass-fiber mesh treated for compatibility with other EIFS materials, made from continuous multiend strands with retained mesh tensile strength of not less than 120 lbf/in. (21 dN/cm) according to ASTM E 2098 and the following:

1. Reinforcing Mesh for EIFS, General: Not less than weight required to meet impact-performance level specified in "Performance Requirements" Article.
2. Strip Reinforcing Mesh: Not less than 3.75 oz./sq. yd. (127 g/sq. m).
3. Detail Reinforcing Mesh: Not less than 4.0 oz./sq. yd. (136 g/sq. m).
4. Corner Reinforcing Mesh: Not less than 7.2 oz./sq. yd. (244 g/sq. m).

G. Base-Coat Materials: EIFS manufacturer's standard mixture.

H. Waterproof Adhesive/Base-Coat Materials: EIFS manufacturer's standard waterproof formulation.

I. Mechanical Fasteners: EIFS manufacturer's standard corrosion-resistant fasteners consisting of thermal cap, standard washer and shaft attachments, and fastener indicated below; designed to resist Project's design loads; capable of pulling fastener head below surface of insulation board; and complying with the following:

1. For attachment to steel studs from 0.033 to 0.112 inch (0.84 to 2.84 mm) in thickness, provide steel drill screws complying with ASTM C 954.
2. For attachment to light-gage steel framing members not less than 0.0179 inch (0.45 mm) in thickness, provide steel drill screws complying with ASTM C 1002.

J. Primer: EIFS manufacturer's standard factory-mixed, elastomeric-polymer primer for preparing base-coat surface for application of finish coat.

K. Finish-Coat Materials: EIFS manufacturer's standard acrylic-based coating with enhanced mildew resistance complying with the following:

1. Factory-mixed formulation of polymer-emulsion binder, colorfast mineral pigments, sound stone particles, and fillers.

2. Colors: As selected by Architect from manufacturer's full range.
3. Textures: As selected by Architect from manufacturer's full range.

L. Water: Potable.

M. Trim Accessories: Type as designated or required to suit conditions indicated and to comply with EIFS manufacturer's written instructions; manufactured from UV-stabilized PVC; and complying with ASTM D 1784 and ASTM C 1063.

1. Casing Bead: Prefabricated, one-piece type for attachment behind insulation, of depth required to suit thickness of coating and insulation, with face leg perforated for bonding to coating and back leg.
2. Drip Screed/Track: Prefabricated, one-piece type for attachment behind insulation with face leg extended to form a drip, of depth required to suit thickness of coating and insulation, with face leg perforated for bonding to coating and back leg.
3. Expansion Joint: Prefabricated, one-piece V profile; designed to relieve stress of movement.

2.4 MIXING

A. Comply with EIFS manufacturer's requirements for combining and mixing materials. Do not introduce admixtures, water, or other materials except as recommended by EIFS manufacturer. Mix materials in clean containers. Use materials within time period specified by EIFS manufacturer or discard.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roof edges, wall framing, flashings, openings, substrates, and junctures at other construction for suitable conditions where EIFS will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

1. Begin coating application only after surfaces are dry.
2. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Protect contiguous work from moisture deterioration and soiling caused by application of EIFS. Provide temporary covering and other protection needed to prevent spattering of exterior finish coats on other work.

B. Protect EIFS, substrates, and wall construction behind them from inclement weather during installation. Prevent penetration of moisture behind EIFS and deterioration of substrates.

C. Prepare and clean substrates to comply with EIFS manufacturer's written instructions to obtain optimum bond between substrate and adhesive for insulation.

3.3 EIFS INSTALLATION, GENERAL

A. Comply with ASTM C 1397, ASTM E 2511, and EIFS manufacturer's written instructions for installation of EIFS as applicable to each type of substrate.

3.4 TRIM INSTALLATION

A. Trim: Apply trim accessories at perimeter of EIFS, at expansion joints, and elsewhere as indicated. Coordinate with installation of insulation.

1. Drip Screed/Track: Use at bottom edges of EIFS unless otherwise indicated.
2. Expansion Joint: Use where indicated on Drawings.
3. Casing Bead: Use at other locations.

3.5 INSULATION INSTALLATION

A. Board Insulation: Mechanically attach insulation to substrate in compliance with ASTM C 1397 and the following:
   1. Mechanically attach insulation to substrate by method complying with EIFS manufacturer's written instructions. Install top surface of fastener heads flush with plane of insulation. Install fasteners into or through substrates with the following minimum penetration:
      a. Steel Framing: 5/16 inch (8 mm).
   2. Apply insulation over dry substrates in courses with long edges of boards oriented horizontally.
   3. Begin first course of insulation from a level base line and work upward.
   4. Begin first course of insulation from screed/track and work upward. Work from perimeter casing beads toward interior of panels if possible.
   5. Stagger vertical joints of insulation boards in successive courses to produce running bond pattern. Locate joints so no piece of insulation is less than 12 inches (300 mm) wide or 6 inches (150 mm) high. Offset joints not less than 6 inches (150 mm) from corners of window and door openings and not less than 4 inches (100 mm) from aesthetic reveals.
      a. Mechanical Attachment: Offset joints of insulation from horizontal joints in sheathing.
   6. Interlock ends at internal and external corners.
   7. Abut insulation tightly at joints within and between each course to produce flush, continuously even surfaces without gaps or raised edges between boards. If gaps greater than 1/16 inch (1.6 mm) occur, fill with insulation cut to fit gaps exactly; insert insulation without using adhesive or other material.
   8. Cut insulation to fit openings, corners, and projections precisely and to produce edges and shapes complying with details indicated.
   9. Rasp or sand flush entire surface of insulation to remove irregularities projecting more than 1/32 inch (0.8 mm) from surface of insulation and to remove yellowed areas due to sun exposure; do not create depressions deeper than 1/16 inch (1.6 mm). Prevent airborne dispersal and immediately collect insulation raspings or sandings.
   10. Cut aesthetic reveals in outside face of insulation with high-speed router and bit configured to produce grooves, rabbets, and other features that comply with profiles and locations indicated. Do not reduce insulation thickness at aesthetic reveals to less than 3/4 inch (19 mm).
   11. Install foam build-outs and attach to sheathing.
   12. Interrupt insulation for expansion joints where indicated.
   13. Form joints for sealant application by leaving gaps between adjoining insulation edges and between insulation edges and dissimilar adjoining surfaces. Make gaps wide enough to produce joint widths indicated after encapsulating joint substrates with base coat and reinforcing mesh.
   14. Form joints for sealant application with back-to-back casing beads for joints within EIFS and with perimeter casing beads at dissimilar adjoining surfaces. Make gaps between casing beads and between perimeter casing beads and adjoining surfaces of width indicated.
   15. After installing insulation and before applying reinforcing mesh, fully wrap board edges with strip reinforcing mesh. Cover edges of board and extend encapsulating mesh not less than 2-1/2 inches (64 mm) over front and back face unless otherwise indicated on Drawings.
   16. Treat exposed edges of insulation as follows:

a. Except for edges forming substrates of sealant joints, encapsulate with base coat, reinforcing mesh, and finish coat.
b. Encapsulate edges forming substrates of sealant joints within EIFS or between EIFS and other work with base coat and reinforcing mesh.
c. At edges trimmed by accessories, extend base coat, reinforcing mesh, and finish coat over face leg of accessories.

17. Coordinate installation of flashing and insulation to produce wall assembly that does not allow water to penetrate behind flashing and EIFS protective-coating lamina.

B. Expansion Joints: Install at locations indicated, where required by EIFS manufacturer, and as follows:

1. At expansion joints in substrates behind EIFS.
2. Where EIFS adjoin dissimilar substrates, materials, and construction, including other EIFS.
3. Where wall height or building shape changes.
4. Where EIFS manufacturer requires joints in long continuous elevations.

3.6 BASE-COAT INSTALLATION

A. Base Coat: Apply to exposed surfaces of insulation and foam build-outs in minimum thickness recommended in writing by EIFS manufacturer, but not less than 1/16-inch (1.6-mm) dry-coat thickness.

B. Reinforcing Mesh: Embed reinforcing mesh in wet base coat to produce wrinkle-free installation with mesh continuous at corners, overlapped not less than 2-1/2 inches (64 mm) or otherwise treated at joints to comply with ASTM C 1397 and EIFS manufacturer's written instructions. Do not lap reinforcing mesh within 8 inches (200 mm) of corners. Completely embed mesh, applying additional base-coat material if necessary, so reinforcing-mesh color and pattern are invisible.
1. Standard-impact reinforcing mesh unless otherwise indicated.

C. Additional Reinforcing Mesh: Apply strip reinforcing mesh around openings, extending 4 inches (100 mm) beyond perimeter. Apply additional 9-by-12-inch (230-by-300-mm) strip reinforcing mesh diagonally at corners of openings (re-entrant corners). Apply 8-inch- (200-mm-) wide, strip reinforcing mesh at both inside and outside corners unless base layer of mesh is lapped not less than 4 inches (100 mm) on each side of corners.

1. At aesthetic reveals, apply strip reinforcing mesh not less than 8 inches (200 mm) wide.
2. Embed strip reinforcing mesh in base coat before applying first layer of reinforcing mesh.

D. Foam Build-Outs: Fully embed reinforcing mesh in base coat.

3.7 FINISH-COAT INSTALLATION

A. Finish Coat: Apply over dry base coat, maintaining a wet edge at all times for uniform appearance, in thickness required by EIFS manufacturer to produce a uniform finish of color and texture matching approved sample and free of cold joints, shadow lines, and texture variations.

3.8 CLEANING AND PROTECTION

A. Remove temporary covering and protection of other work. Promptly remove coating materials from window and door frames and other surfaces outside areas indicated to receive EIFS coatings.

END OF SECTION 072413

SECTION 072500 - WEATHER BARRIERS

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. Building wrap.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

   1. For building wrap, include data on air and water-vapor permeance based on testing according to referenced standards.

PART 2 - PRODUCTS

2.1 WATER-RESISTIVE BARRIER

A. Building Wrap: ASTM E 1677, Type I air barrier; with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, when tested according to ASTM E 84; UV stabilized; and acceptable to authorities having jurisdiction.

   1. Products: Subject to compliance with requirements, provide one of the following:

      a. Dow Chemical Company (The); Styrofoam Weathermate Plus Brand Housewrap.
      b. DuPont (E. I. du Pont de Nemours and Company); Tyvek CommercialWrap.
      c. Raven Industries Inc.; Fortress Pro Weather Protective Barrier.
      d. Reemay, Inc.; Typar HouseWrap.

   2. Water-Vapor Permeance: Not less 50 g through 1 sq. m of surface in 24 hours per ASTM E 96/E 96M, Desiccant Method (Procedure A).
   3. Allowable UV Exposure Time: Not less than three months.

B. Building-Wrap Tape: Pressure-sensitive plastic tape recommended by building-wrap manufacturer for sealing joints and penetrations in building wrap.

2.2 MISCELLANEOUS MATERIALS

A. Nails and Staples: ASTM F 1667.

PART 3 - EXECUTION

3.1 WATER-RESISTIVE BARRIER INSTALLATION

A. Cover exposed exterior surface of sheathing with water-resistive barrier securely fastened to framing immediately after sheathing is installed.

B. Cover sheathing with water-resistive barrier as follows:

1. Cut back barrier 1/2 inch (13 mm) on each side of the break in supporting members at expansion- or control-joint locations.
2. Apply barrier to cover vertical flashing with a minimum 4-inch (100-mm) overlap unless otherwise indicated.

C. Building Wrap: Comply with manufacturer's written instructions.

1. Seal seams, edges, fasteners, and penetrations with tape.
2. Extend into jambs of openings and seal corners with tape.

END OF SECTION 072500

SECTION 074243 - COMPOSITE WALL PANELS

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 metal-faced composite wall panels.

1.3 DEFINITION

A. Metal-Faced Composite Wall Panel Assembly: Metal-faced composite wall panels, attachment system components, miscellaneous metal framing, and accessories necessary for a complete weathertight wall system.

1.4 PERFORMANCE REQUIREMENTS

A. General Performance: Metal-faced composite wall panel assemblies shall comply with performance requirements without failure due to defective manufacture, fabrication, installation, or other defects in construction.

B. Delegated Design: Design metal-faced composite wall panel assembly, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

C. Air Infiltration: Air leakage through assembly of not more than 0.06 cfm/sq. ft. (0.3 L/s per sq. m) of wall area when tested according to ASTM E 283 at the following test-pressure difference:

1. Test-Pressure Difference: 1.57 lbf/sq. ft. (75 Pa).

D. Water Penetration Under Static Pressure: No water penetration when tested according to ASTM E 331 at the following test-pressure difference:

1. Test-Pressure Difference: 6.24 lbf/sq. ft. (300 Pa).

E. Structural Performance: Provide metal-faced composite wall panel assemblies capable of withstanding the effects of the following loads and stresses within limits and under conditions indicated, based on testing according to ASTM E 330:

1. Wind Loads: Determine loads based on the following minimum design wind pressures:

a. Uniform pressure of 30 lbf/sq. ft. (1436 Pa) acting inward or outward.

2. Deflection Limits: Metal-faced composite wall panel assemblies shall withstand wind loads with horizontal deflections no greater than 1/175 of the span at the perimeter and 1/60 of the span anywhere in the panel.

F. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F (67 deg C,), ambient; 180 deg F (100 deg C) material surfaces.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of metal-faced composite wall panel and accessory.

B. Shop Drawings: Show fabrication and installation layouts of metal-faced composite wall panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details. Distinguish among factory-, shop-, and field-assembled work.

1. Accessories: Include details of the following items, at a scale of not less than 1-1/2 inches per 12 inches (1:10):

a. Flashing and trim.
b. Anchorage systems.

C. Samples for Initial Selection: For each type of metal-faced composite wall panel indicated with factory-applied color finishes.

1. Include similar Samples of trim and accessories involving color selection.
2. Include manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each sealant exposed to view.

D. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below:

1. Metal-Faced Composite Wall Panels: Minimum 12 x 12 inches (300 x 300 mm). Include fasteners, closures, and other metal-faced composite wall panel accessories.

a. Composite Panels: Include four-way joint.

2. Trim and Closures: 12 inches (300 mm) long. Include fasteners and other exposed accessories.
3. Accessories: 12-inch- (300-mm-) long Samples for each type of accessory.
4. Exposed Gaskets: 12 inches (300 mm) long.
5. Exposed Sealants: For each type and color of joint sealant required. Install joint sealants in 1/2-inch- (13-mm-) wide joints formed between two 6-inch- (150-mm-) long strips of material matching the appearance of metal-faced composite wall panels adjacent to joint sealants.

E. Delegated-Design Submittal: For metal-faced composite wall panel assembly indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.6 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Exterior elevations, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Attachments.
2. Wall-mounted items including doors, windows, louvers, and lighting fixtures.
3. Penetrations of wall by pipes and utilities.

B. Compatibility and Adhesion Test Reports: From sealant manufacturer, indicating the following:

1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.
2. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.

C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each product.

D. Field quality-control reports.

E. Warranties: Samples of special warranties.

1.7 CLOSEOUT SUBMITTALS

A. Maintenance Data: For metal wall panels to include in maintenance manuals.

1.8 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.

B. Source Limitations: Obtain each type of metal-faced composite wall panel from single source from single manufacturer.

C. Preinstallation Conference: Conduct conference at Project site.

1. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, metal-faced composite wall panel Installer, metal-faced composite wall panel manufacturer's representative, structural-support Installer, and installers whose work interfaces with or affects metal-faced composite wall panels including installers of doors and windows.
2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
3. Review methods and procedures related to metal-faced composite wall panel installation, including manufacturer's written instructions.
4. Examine support conditions for compliance with requirements, including alignment between and attachment to structural members.

5. Review flashings, special siding details, wall penetrations, openings, and condition of other construction that will affect metal-faced composite wall panels.
6. Review governing regulations and requirements for insurance, certificates, and tests and inspections if applicable.
7. Review temporary protection requirements for metal-faced composite wall panel assembly during and after installation.
8. Review wall panel observation and repair procedures after metal-faced composite wall panel installation.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver components, sheets, metal-faced composite wall panels, and other manufactured items so as not to be damaged or deformed. Package metal-faced composite wall panels for protection during transportation and handling.

B. Unload, store, and erect metal-faced composite wall panels in a manner to prevent bending, warping, twisting, and surface damage.

C. Store metal-faced composite wall panels vertically, covered with suitable weathertight and ventilated covering. Store metal-faced composite wall panels to ensure dryness, with positive slope for drainage of water. Do not store metal-faced composite wall panels in contact with other materials that might cause staining, denting, or other surface damage. Do not allow storage space to exceed 120 deg F (49 deg C).

D. Retain strippable protective covering on metal-faced composite wall panel for period of panel installation.

1.10 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal-faced composite wall panels to be performed according to manufacturer's written instructions and warranty requirements.

B. Field Measurements: Verify locations of structural members and wall opening dimensions by field measurements before metal-faced composite wall panel fabrication and indicate measurements on Shop Drawings.

1.11 COORDINATION

A. Coordinate metal-faced composite wall panel assemblies with rain drainage work, flashing, trim, and construction of studs, soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.12 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal-faced composite wall panel assemblies that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures, including rupturing, cracking, or puncturing.
b. Deterioration of metals and other materials beyond normal weathering.

2. Warranty Period: Two years from date of Substantial Completion.

B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal-faced composite wall panels that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PANEL MATERIALS

A. Aluminum Sheet: Coil-coated sheet, ASTM B 209 (ASTM B 209M), alloy as standard with manufacturer, with temper as required to suit forming operations and structural performance required.

1. Surface: Smooth, flat finish.
2. Exposed Coil-Coated Finishes:
a. Metallic Fluoropolymer: AAMA 620. 3-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.

3. Concealed Finish: Apply pretreatment and 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 (0.013 mm).

B. Panel Sealants:

1. Joint Sealant: ASTM C 920; elastomeric polyurethane, polysulfide, or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal-faced composite wall panels and remain weathertight; and as recommended in writing by panel manufacturer.

2.2 MISCELLANEOUS METAL FRAMING

A. Miscellaneous Metal Framing, General: ASTM C 645, cold-formed metallic-coated steel sheet, ASTM A 653/A 653M, G60 (Z180) hot-dip galvanized or coating with equivalent corrosion resistance unless otherwise indicated.

B. Fasteners for Miscellaneous Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten miscellaneous metal framing members to substrates.

2.3 MISCELLANEOUS MATERIALS

A. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), alloy and temper recommended by manufacturer for type of use and finish indicated.

B. Fasteners: Self-tapping screws, bolts, nuts, self-locking rivets and bolts, end-welded studs, and other suitable fasteners designed to withstand design loads. Provide exposed fasteners with heads matching color of metal-faced composite wall panels by means of plastic caps or factory-applied coating. Provide EPDM, PVC, or neoprene sealing washers.

2.4 METAL-FACED COMPOSITE WALL PANELS

A. General: Provide factory-formed and -assembled, metal-faced composite wall panels fabricated from two metal facings bonded, using no glues or adhesives, to solid, extruded thermoplastic core; formed into profile for installation method indicated. Include attachment system components and accessories required for weathertight system.

1. Products: Subject to compliance with requirements, provide one of the following:

    a. Alcan Composites USA Inc.; Alucobond.
    b. Alcoa Inc.; Reynobond PE.
    c. ALPOLIC, Division of Mitsubishi Chemical America, Inc.; ALPOLIC.

B. Aluminum-Faced Composite Wall Panels: Formed with 0.020-inch- (0.50-mm-) thick, coil-coated aluminum sheet facings.

1. Panel Thickness: 0.157 inch (4 mm).
2. Core: Standard.
3. Exterior Finish: Metallic fluoropolymer.

    a. Color: As selected by Architect from manufacturer's full range.

C. Attachment System Components: Formed from extruded aluminum.

1. Include manufacturer's standard perimeter extrusions with integral weather stripping, panel stiffeners, panel clips and anchor channels.

2.5 ACCESSORIES

A. Wall Panel Accessories: Provide components required for a complete metal-faced composite wall panel assembly including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal-faced composite wall panels unless otherwise indicated.

2.6 FABRICATION

A. General: Fabricate and finish metal-faced composite wall panels and accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.

B. Fabricate metal-faced composite wall panels in a manner that eliminates condensation on interior side of panel and with joints between panels designed to form weathertight seals.

C. Metal-Faced Composite Wall Panels: Factory form panels in a continuous process with no glues or adhesives or in a batch process by laminating each sheet using glues or adhesives between dissimilar materials. Trim and square edges of sheets with no displacement of face sheets or protrusion of core material.

1. Form panel lines, breaks, and angles to be sharp and true, with surfaces free from warp and buckle.
2. Fabricate panels with sharply cut edges, with no displacement of face sheets or protrusion of core material.
3. Fabricate panels with panel stiffeners, as required to comply with deflection limits, attached to back of panels with structural silicone sealant or bond tape.
4. Dimensional Tolerances:

a. Panel Bow: 0.8 percent maximum of panel length or width.
b. Squareness: 0.25 inch (5 mm) maximum.

2.7 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical and painted 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. Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal-faced composite wall panel supports, and other conditions affecting performance of the Work.

1. Examine wall framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by metal-faced composite wall panel manufacturer.
2. Examine wall sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal-faced composite wall panel manufacturer.
3. Verify that weather-resistant sheathing paper has been installed over sheathing or backing substrate to prevent air infiltration or water penetration.

B. Examine roughing-in for components and systems penetrating metal-faced composite wall panels to verify actual locations of penetrations relative to seam locations of panels before panel installation.

C. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Miscellaneous Framing: Install subgirts, base angles, sills, furring, and other miscellaneous wall panel support members and anchorage according to ASTM C 754 and metal-faced composite wall panel manufacturer's written instructions.

3.3 METAL-FACED COMPOSITE WALL PANEL INSTALLATION

A. General: Install metal-faced composite wall panels according to manufacturer's written instructions in orientation, sizes, and locations indicated on Drawings. Install panels perpendicular to girts and subgirts unless otherwise indicated. Anchor panels and other components of the Work securely in place, with provisions for thermal and structural movement.
1. Shim or otherwise plumb substrates receiving metal-faced composite wall panels.
2. Flash and seal metal-faced composite wall panels at perimeter of all openings. Do not begin installation until weather barrier and flashings that will be concealed by panels are installed.
3. Install flashing and trim as metal-faced composite wall panel work proceeds.
4. Apply elastomeric sealant continuously between metal base channel (sill angle) and concrete, and elsewhere as indicated or, if not indicated, as necessary for waterproofing.
5. Provide weathertight escutcheons for pipe and conduit penetrating exterior walls.

B. Fasteners:

1. Aluminum Wall Panels: Use aluminum or stainless-steel fasteners for surfaces exposed to the exterior and aluminum or galvanized-steel fasteners for surfaces exposed to the interior.

C. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action as recommended by metal-faced composite wall panel manufacturer.

D. Joint Sealers: Install gaskets, joint fillers, and sealants where indicated and where required for weathertight performance of metal-faced composite wall panel assemblies. Provide types of

gaskets, fillers, and sealants indicated or, if not indicated, types recommended by panel manufacturer.

1. Prepare joints and apply sealants to comply with requirements in Section 079200 "Joint Sealants."

E. Attachment System Installation, General: Install attachment system required to support metal-faced composite wall panels and to provide a complete weathertight wall system, including subgirts, perimeter extrusions, tracks, drainage channels, panel clips, and anchor channels.

1. Include attachment to supports, panel-to-panel joinery, panel-to-dissimilar-material joinery, and panel-system joint seals.
2. Do not begin installation until weather barrier and flashings that will be concealed by composite panels are installed.

F. Clip Installation: Attach panel clips to supports at each metal-faced composite wall panel joint at locations, spacings, and with fasteners recommended by manufacturer. Attach routed-and-returned flanges of wall panels to panel clips with manufacturer's standard fasteners.

1. Seal horizontal and vertical joints between adjacent panels with sealant backing and sealant. Install sealant backing and sealant according to requirements specified in Section 079200 "Joint Sealants."

3.4 ACCESSORY INSTALLATION

A. General: Install accessories with positive anchorage to building and weathertight mounting and provide for thermal expansion. Coordinate installation with flashings and other components.

1. Install components required for a complete metal-faced composite wall panel assembly including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.

B. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and 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. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet (3 m) with no joints allowed within 24 inches (610 mm) 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 inch (25 mm) deep, filled with mastic sealant (concealed within joints).

3.5 ERECTION TOLERANCES

A. Installation Tolerances: Shim and align metal-faced composite wall panel units within installed tolerance of 1/4 inch in 20 feet (6 mm in 6 m), nonaccumulative, on level, plumb, and location

lines as indicated and within 1/8-inch (3-mm) offset of adjoining faces and of alignment of matching profiles.

3.6 CLEANING

A. Remove temporary protective coverings and strippable films, if any, as metal-faced composite wall panels are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of metal-faced composite wall panel installation, clean finished surfaces as recommended by panel manufacturer. Maintain in a clean condition during construction.

B. After metal-faced composite wall panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.

C. Replace metal-faced composite wall panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 074243

SECTION 075323 - ETHYLENE-PROPYLENE-DIENE-MONOMER (EPDM) ROOFING

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. Adhered EPDM membrane roofing system.
2. Roof insulation.

B. Related Sections:

1. Section 053100 "Steel Decking."
2. Section 061053 "Miscellaneous Rough Carpentry" for wood nailers, curbs, and blocking.
3. Section 077100 “Roof Specialties” for manufactured roof-edge, coping and downspouts.
4. Section 077129 "Manufactured Roof Expansion Joints" for proprietary manufactured roof expansion-joint assemblies.
5. Section 079200 "Joint Sealants" for joint sealants, joint fillers, and joint preparation.

1.3 COORDINATION

A. Coordinate new roofing work with installer of existing roofing:
1. John Losher; Garland Roofing; Work Phone: (270) 443-3346.
2. Remove, replace, patch, and repair materials and surfaces cut or damaged during re-roofing, by methods and with materials so as not to void existing roofing system warranty. Notify warrantor before proceeding.

1.4 DEFINITIONS

A. Roofing Terminology: See ASTM D 1079 and glossary of NRCA's "The NRCA Roofing and Waterproofing Manual" for definitions of terms related to roofing work in this Section.

1.5 PERFORMANCE REQUIREMENTS

A. General Performance: Installed membrane roofing and base flashings shall withstand specified 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: Provide 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: Provide membrane roofing system that is identical to systems that have been successfully tested by a qualified testing and inspecting agency to resist uplift pressure calculated according to ASCE/SEI 7.

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: SH.

1.6 ACTION SUBMITTALS

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

B. Shop Drawings: For roofing system. Include plans, elevations, sections, details, and attachments to other work.

1. Base flashings and membrane terminations.
2. Tapered insulation, including slopes.
3. Roof plan showing orientation of steel roof deck and orientation of membrane roofing and fastening spacings and patterns for mechanically fastened membrane roofing components.
4. Insulation fastening patterns for corner, perimeter, and field-of-roof locations.

1.7 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer and manufacturer.

B. Manufacturer Certificate: Signed by roofing manufacturer certifying that membrane roofing system complies with requirements specified in "Performance Requirements" Article.

1. Submit evidence of complying with performance requirements.

C. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for components of membrane roofing system.

D. Research/Evaluation Reports: For components of membrane roofing system, from the ICC-ES.

E. Field quality-control reports.

F. Warranties: Sample of special warranties.

1.8 CLOSEOUT SUBMITTALS

A. Maintenance Data: For membrane roofing system to include in maintenance manuals.

1.9 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer that is FM Approvals approved for membrane roofing system identical to that used for this Project.

B. Installer Qualifications: A qualified firm that is approved, authorized, or licensed by membrane roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's special warranty.

C. Source Limitations: Obtain components including roof insulation for membrane roofing system from same manufacturer as membrane roofing or approved by membrane roofing manufacturer.

D. Exterior Fire-Test Exposure: ASTM E 108, Class A; for application and roof slopes indicated, as determined by testing identical membrane roofing materials by a qualified testing agency. Materials shall be identified with appropriate markings of applicable testing agency.

E. Preliminary Roofing Conference: Before starting roof deck construction, conduct conference at Project site.

1. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, roofing Installer, roofing system manufacturer's representative, deck Installer, and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
3. Review temporary protection requirements for existing roofing system components that are to remain.
4. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
5. Review requirements for deck substrate conditions and finishes, including flatness and fastening.
6. Review structural loading limitations of roof deck during and after roofing.
7. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect roofing system.
8. Review governing regulations and requirements for insurance and certificates if applicable.
9. Review temporary protection requirements for roofing system during and after installation.
10. Review roof observation and repair procedures after roofing installation.

F. Preinstallation Roofing Conference: Conduct conference at Project site.

1. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, roofing Installer, roofing system manufacturer's representative, deck Installer, and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
3. Review temporary protection requirements for existing roofing system components that are to remain.
4. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
5. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.

6. Review structural loading limitations of roof deck during and after roofing.
7. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect roofing system.
8. Review governing regulations and requirements for insurance and certificates if applicable.
9. Review temporary protection requirements for roofing system during and after installation.
10. Review roof observation and repair procedures after roofing installation.

1.10 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.

1. 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.

1.11 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.

1.12 WARRANTY

A. Special Warranty: Manufacturer's standard or customized form, without monetary limitation, covering wind speed protection up to 72 miles per hour as measured 10 meters above the ground and signed by the roof system manufacturer, in which manufacturer agrees to repair or replace components of membrane roofing system that fail in materials or workmanship within specified warranty period. Failure includes roof leaks.
1. Special warranty includes membrane roofing, base flashings, roof insulation, fasteners, roofing accessories, and other components of membrane roofing system.
2. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 EPDM MEMBRANE ROOFING

A. EPDM: ASTM D 4637, Type I, non-reinforced, uniform, flexible EPDM sheet.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Carlisle SynTec Incorporated.
   b. Firestone Building Products.
   c. GAF Materials Corporation.
   d. GenFlex Roofing Systems.
   e. Johns Manville.
   f. Versico Incorporated.

2. Thickness: 60 mils (1.5 mm), nominal.
3. Exposed Face Color: Black.

2.2 AUXILIARY MEMBRANE ROOFING MATERIALS

A. General: Auxiliary membrane roofing materials recommended by roofing system manufacturer for intended use and compatible with membrane roofing.

1. Liquid-type auxiliary materials shall comply with VOC limits of authorities having jurisdiction.

B. Sheet Flashing: 60-mil- (1.5-mm-) thick EPDM, partially cured or cured, according to application.

C. Bonding Adhesive: Manufacturer's standard.

D. Seaming Material: Manufacturer's standard, synthetic-rubber polymer primer and 3-inch- (75-mm-) wide minimum, butyl splice tape with release film.

E. Lap Sealant: Manufacturer's standard, single-component sealant.

F. Water Cutoff Mastic: Manufacturer's standard butyl mastic sealant.

G. Metal Termination Bars: Manufacturer's standard, predrilled stainless-steel or aluminum bars, approximately 1 by 1/8 inch (25 by 3 mm) thick; with anchors.

H. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening membrane to substrate, and acceptable to roofing system manufacturer.

I. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, reinforced EPDM securement strips, T-joint covers, in-seam sealants, termination reglets, cover strips, and other accessories.

2.3 ROOF INSULATION

A. General: Preformed roof insulation boards manufactured or approved by EPDM membrane roofing manufacturer, selected from manufacturer's standard sizes suitable for application, of thicknesses indicated and that produce FM Approvals-approved roof insulation.

B. Polyisocyanurate Board Insulation: ASTM C 1289, Type II, Class 1, Grade 2, felt or glass-fiber mat facer on both major surfaces.

C. Tapered Insulation: Provide factory-tapered insulation boards fabricated to slope of 1/4 inch per 12 inches (1:48) unless otherwise indicated.

D. Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated.

2.4 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 and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening roof insulation to substrate, and acceptable to roofing system manufacturer.

C. Bead-Applied Insulation Adhesive: Insulation manufacturer's recommended bead-applied, low-rise, one- or multicomponent urethane adhesive formulated to attach roof insulation to substrate or to another insulation layer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with the following requirements and other conditions affecting performance of roofing system:

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 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 in Section 053100 "Steel Decking."
4. Verify that minimum concrete drying period recommended by roofing system manufacturer has passed.
5. Verify that concrete substrate is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D 4263.
6. Verify that concrete curing compounds that will impair adhesion of roofing components to roof deck have been removed.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

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.

C. Do not permit water to enter into or under existing roofing system components that are to remain.

D. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at the end of the workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.

3.3 INSULATION INSTALLATION

A. Coordinate installing membrane roofing system components so insulation is not exposed to precipitation or left exposed at the end of the workday.

B. Comply with membrane roofing system and insulation manufacturer's written instructions for installing roof insulation.

C. Install tapered insulation under area of roofing to conform to slopes indicated.

D. Install insulation under area of roofing to achieve required thickness. Where overall insulation thickness is 2.7 inches (68 mm) or greater, install two or more layers with joints of each succeeding layer staggered from joints of previous layer a minimum of 6 inches (150 mm) in each direction.

E. Trim surface of insulation where necessary at roof drains so completed surface is flush and does not restrict flow of water.

F. Install insulation with long joints of insulation in a continuous straight line with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding 1/4 inch (6 mm) with insulation.

1. Cut and fit insulation within 1/4 inch (6 mm) of nailers, projections, and penetrations.

G. Mechanically Fastened and Adhered Insulation: Install first layer of insulation to deck using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to deck type.

1. Fasten first layer of insulation according to requirements in FM Approvals' "RoofNav" for specified Windstorm Resistance Classification.
2. Fasten first layer of insulation to resist uplift pressure at corners, perimeter, and field of roof.
3. Set each subsequent layer of insulation in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining insulation in place.

3.4 ADHERED MEMBRANE ROOFING INSTALLATION

A. Adhere membrane roofing over area to receive roofing according to membrane roofing system manufacturer's written instructions. Unroll membrane roofing and allow to relax before installing.

B. Start installation of membrane roofing in presence of membrane roofing system manufacturer's technical personnel.

C. Accurately align membrane roofing and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.

D. Bonding Adhesive: Apply to substrate and underside of membrane roofing at rate required by manufacturer and allow to partially dry before installing membrane roofing. Do not apply to splice area of membrane roofing.

E. In addition to adhering, mechanically fasten membrane roofing securely at terminations, penetrations, and perimeters.

F. Apply membrane roofing with side laps shingled with slope of roof deck where possible.

G. Adhesive Seam Installation: Clean both faces of splice areas, apply splicing cement, and firmly roll side and end laps of overlapping membrane roofing according to manufacturer's written instructions to ensure a watertight seam installation. Apply lap sealant and seal exposed edges of membrane roofing terminations.

1. Apply a continuous bead of in-seam sealant before closing splice if required by membrane roofing system manufacturer.

H. Tape Seam Installation: Clean and prime both faces of splice areas, apply splice tape, and firmly roll side and end laps of overlapping membrane roofing according to manufacturer's written instructions to ensure a watertight seam installation. Apply lap sealant and seal exposed edges of membrane roofing terminations.

I. Repair tears, voids, and lapped seams in roofing that does not comply with requirements.

J. Spread sealant or mastic bed over deck drain flange at roof drains and securely seal membrane roofing in place with clamping ring.

K. Install membrane roofing and auxiliary materials to tie in to existing membrane roofing to maintain weather-tightness of transition and to not void warranty for existing membrane roofing system.

3.5 BASE FLASHING INSTALLATION

A. Install sheet flashings and preformed flashing accessories and adhere to substrates according to membrane roofing system manufacturer's written instructions.

B. Apply bonding adhesive to substrate and underside of sheet flashing at required rate and allow to partially dry. Do not apply to seam area of flashing.

C. Flash penetrations and field-formed inside and outside corners with cured or uncured sheet flashing.

D. Clean splice areas, apply splicing cement, and firmly roll side and end laps of overlapping sheets to ensure a watertight seam installation. Apply lap sealant and seal exposed edges of sheet flashing terminations.

E. Terminate and seal top of sheet flashings and mechanically anchor to substrate through termination bars.

3.6 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified independent testing agency to perform inspections.

B. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion.

C. Repair or remove and replace components of membrane roofing system where inspections indicate that they do not comply with specified requirements.

D. Additional inspections, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.7 PROTECTING AND CLEANING

A. Protect membrane 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 membrane roofing system that does not comply with requirements, repair substrates and repair or reinstall membrane 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 075323

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SECTION 077100 - ROOF SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Copings.
2. Roof-edge flashings.
3. Roof drainage systems.

B. Related Sections:

1. Section 061053 "Miscellaneous Rough Carpentry" for wood nailers, curbs, and blocking.
2. Section 077129 "Manufactured Roof Expansion Joints" for manufactured roof expansion-joint cover assemblies.
3. Section 079200 "Joint Sealants" for field-applied sealants between roof specialties and adjacent materials.
4. Section 079500 "Expansion Control" for manufactured sheet metal expansion-joint covers.

1.3 PERFORMANCE REQUIREMENTS

A. General Performance: Roof specialties shall withstand exposure to weather and resist thermally induced movement without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.

B. FM Approvals' Listing: Manufacture and install copings and roof-edge flashings that are listed in FM Approvals' "RoofNav" and approved for windstorm classification, Class 1-90. Identify materials with FM Approvals' markings.

C. SPRI Wind Design Standard: Manufacture and install copings and roof-edge flashings tested according to SPRI ES-1 and capable of resisting the following design pressures:

1. Design Pressure: As indicated on Drawings or as directed by Project Structural Engineer of Record.

D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Provide clips that resist rotation and avoid shear stress as a result of thermal movements. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: For roof specialties. Include plans, elevations, expansion-joint locations, keyed details, and attachments to other work. Distinguish between plant- and field-assembled work. Include the following:

1. Details for expansion and contraction; locations of expansion joints, including direction of expansion and contraction.
2. Pattern of seams and layout of fasteners, cleats, clips, and other attachments.
3. Details of termination points and assemblies, including fixed points.
4. Details of special conditions.

C. Samples for Initial Selection: For each type of roof specialty indicated with factory-applied color finishes.

1.5 INFORMATIONAL SUBMITTALS

A. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for copings and roof-edge flashings.

B. Warranty: Sample of special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For roofing specialties to include in maintenance manuals.

1.7 QUALITY ASSURANCE

A. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.

1. Build mockup of typical roof edge, approximately 10 feet (3.0 m) long, including supporting construction, seams, attachments, underlayment, and accessories.
2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
3. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

B. Preinstallation Conference: Conduct conference at Project site.

1. Meet with Owner, Architect, Owner's insurer if applicable, Installer, and installers whose work interfaces with or affects roof specialties including installers of roofing materials and accessories.

2. Examine substrate conditions for compliance with requirements, including flatness and attachment to structural members.
3. Review special roof details, roof drainage, and condition of other construction that will affect roof specialties.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Do not store roof specialties in contact with other materials that might cause staining, denting, or other surface damage. Store roof specialties away from uncured concrete and masonry.

B. Protect strippable protective covering on roof specialties from exposure to sunlight and high humidity, except to extent necessary for the period of roof specialties installation.

1.9 WARRANTY

A. Special Warranty on Painted Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace roof specialties that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Fluoropolymer Finish: Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 EXPOSED METALS

A. Aluminum Sheet: ASTM B 209 (ASTM B 209M), alloy as standard with manufacturer for finish required, with temper to suit forming operations and performance required.

1. Surface: Smooth, flat finish.
2. Exposed Coil-Coated Finishes: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

a. Two-Coat Fluoropolymer: AAMA 620. System consisting of primer and fluoropolymer color topcoat containing not less than 70 percent PVDF resin by weight.
b. Concealed Surface: 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 (0.013 mm).

2.2 CONCEALED METALS

A. Aluminum Sheet: ASTM B 209 (ASTM B 209M), alloy and temper recommended by manufacturer for type of use and structural performance indicated, mill finished.

B. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), alloy and temper recommended by manufacturer for type of use and structural performance indicated, mill finished.

C. Stainless-Steel Sheet: ASTM A 240/A 240M or ASTM A 666, Type 304.

D. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 (Z275) coating designation.

2.3 UNDERLAYMENT MATERIALS

A. Felt: ASTM D 226, Type II (No. 30), asphalt-saturated organic felt, nonperforated.

B. Slip Sheet: Building paper, 3-lb/100 sq. ft. (0.16-kg/sq. m) minimum, rosin sized.

2.4 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items required by manufacturer for a complete installation.

B. Fasteners: Manufacturer's recommended fasteners, suitable for application and designed to meet performance requirements. Furnish the following unless otherwise indicated:

1. Exposed Penetrating Fasteners: Gasketed screws with hex washer heads matching color of sheet metal.
2. Fasteners for Aluminum: Aluminum or Series 300 stainless steel.

C. Elastomeric Sealant: ASTM C 920, elastomeric polymer sealant of type, grade, class, and use classifications required by roofing-specialty manufacturer for each application.

D. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.

E. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187.

F. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

2.5 COPINGS

A. Copings: Manufactured coping system consisting of formed-metal coping cap in section lengths not exceeding 12 feet (3.6 m), concealed anchorage; corner units, end cap units, and concealed splice plates with same finish as coping caps.

1. Manufacturers: Subject to compliance with requirements, provide products by same manufacturer as roof-edge flashing.

2. Coping-Cap Material: Formed aluminum, thickness as required to meet performance requirements.

a. Finish: Two-coat fluoropolymer.
b. Color: As selected by Architect from manufacturer's full range.

3. Corners: Factory mitered and continuously welded.

4. Coping-Cap Attachment Method: Face leg hooked to continuous cleat with back leg fastener exposed, fabricated from coping-cap material.
5. Snap-on-Coping Anchor Plates: Concealed, galvanized-steel sheet, 12 inches (300 mm) wide, with integral cleats.
6. Face Leg Cleats: Concealed, continuous stainless steel.

2.6 ROOF-EDGE FLASHINGS

A. Roof-Edge Fascia: Manufactured, two-piece, roof-edge fascia consisting of snap-on metal fascia cover in section lengths not exceeding 12 feet (3.6 m) and a continuous formed- or extruded-aluminum anchor bar with integral drip-edge cleat to engage fascia cover. Provide matching corner units.
   1. Basis-of-Design Product: Subject to compliance with requirements, provide **Hickman Company, W. P.; Econosnap 3** or comparable product by one of the following:
      a. Hickman Company, W. P.
      b. Johns Manville.
      c. Metal-Era, Inc.
      d. Metal-Fab Manufacturing, LLC.
      e. National Sheet Metal Systems, Inc.
      f. Perimeter Systems; a division of Southern Aluminum Finishing Company, Inc.
   2. Fascia Cover: Fabricated from the following exposed metal:
      a. Formed Aluminum: Thickness as required to meet performance requirements.
   3. Corners: Factory mitered and continuously welded.
   4. Splice Plates: Concealed, of same material, finish, and shape as fascia cover.
   5. Fascia Accessories: Fascia extenders with continuous hold-down cleats.

2.7 ROOF DRAINAGE SYSTEMS

A. Manufacturers: Subject to compliance with requirements, provide products by same manufacturer as roof-edge flashings.

B. Downspouts: Plain round complete with mitered or smooth-curve elbows, manufactured from one of the following exposed metal. Furnish with metal hangers, from same material as downspouts, and anchors.
   1. Formed Aluminum: 0.063 inch (1.60 mm) thick.
   2. Extruded Aluminum: 0.125 inch (3.18 mm) thick.

C. Splash Pans: Fabricate from the following exposed metal:
   1. Formed Aluminum: 0.040 inch (1.02 mm) thick.

D. Aluminum Finish: Two-coat fluoropolymer.
   1. Color: As selected by Architect from manufacturer's full range.

2.8 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical and painted 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. 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.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of the Work.

B. Examine walls, roof edges, and parapets for suitable conditions for roof specialties.

C. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 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 inches (50 mm).

3.3 INSTALLATION, GENERAL

A. General: Install roof specialties according to manufacturer's written instructions. Anchor roof specialties securely in place, with provisions for thermal and structural movement. Use fasteners, solder, protective coatings, separators, sealants, and other miscellaneous items as required to complete roof-specialty systems.

1. Install roof specialties level, plumb, true to line and elevation; with limited oil-canning and without warping, jogs in alignment, buckling, or tool marks.
2. Provide uniform, neat seams with minimum exposure of solder and sealant.
3. Install roof specialties to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before manufacture.
4. Torch cutting of roof specialties is not permitted.
5. Do not use graphite pencils to mark metal surfaces.

B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.

1. Coat concealed side of uncoated aluminum roof specialties with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.
2. Underlayment: Where installing metal flashing directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet.
3. Bed flanges in thick coat of asphalt roofing cement where required by manufacturers of roof specialties for waterproof performance.

C. Expansion Provisions: Allow for thermal expansion of exposed roof specialties.

1. Space movement joints at a maximum of 12 feet (3.6 m) with no joints within 18 inches (450 mm) of corners or intersections unless otherwise shown on Drawings.
2. When ambient temperature at time of installation is between 40 and 70 deg F (4 and 21 deg C), set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures.

D. Fastener Sizes: Use fasteners of sizes that will penetrate wood blocking or sheathing not less than 1-1/4 inches (32 mm) for nails and not less than 3/4 inch (19 mm) for wood screws.

E. Seal joints with sealant as required by roofing-specialty manufacturer.

F. Seal joints as required for watertight construction. Place sealant to be completely concealed in joint. Do not install sealants at temperatures below 40 deg F (4 deg C).

3.4 ROOF-EDGE FLASHING AND COPING INSTALLATION

A. Install cleats, cants, and other anchoring and attachment accessories and devices with concealed fasteners.

B. Anchor with manufacturer's required devices, fasteners, and fastener spacing to meet performance requirements.

C. Anchor to meet performance requirements.

3.5 ROOF DRAINAGE-SYSTEM INSTALLATION

A. General: Install components to produce a complete roof drainage system indicated and according to manufacturer's written instructions.

B. Downspouts: Join sections with manufacturer's standard telescoping joints. Provide hangers with fasteners designed to hold downspouts securely to in place, to walls and 1 inch (25 mm) away from walls; locate fasteners at top and bottom and at approximately 60 inches (1500 mm) o.c.

1. Provide elbows at base of downspout to direct water.

C. Splash Pans: Install where downspouts discharge on low-slope roofs. Set in elastomeric sealant.

3.6 CLEANING AND PROTECTION

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B. Clean and neutralize flux materials. Clean off excess solder and sealants.

C. Remove temporary protective coverings and strippable films as roof specialties are installed. On completion of installation, clean finished surfaces including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain roof specialties in a clean condition during construction.

D. Replace roof specialties that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION 077100

SECTION 077129 – MANUFACTURED ROOF EXPANSION ASSEMBLIES

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. This Section includes the following:

1. Metal-flanged, bellows-type roof expansion assemblies.

B. Related Sections include the following:

1. Section 061053 "Miscellaneous Rough Carpentry" for wooden curbs for mounting roof expansion assemblies.
2. Section 075323 “Ethylene-Propylene-Diene-Monomer (EPDM) Roofing."
3. Section 077100 "Roof Specialties" for other manufactured roof items.

1.3 PERFORMANCE REQUIREMENTS

A. General: Provide roof expansion assemblies that, when installed, remain watertight within movement limitations specified by manufacturer.

1.4 SUBMITTALS

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

B. Shop Drawings: Include plans, elevations, sections, details, joints, splices, locations of joints and splices, intersections, transitions, fittings, and attachments to other work. Where joint assemblies change planes, provide isometric drawings depicting how components interconnect to achieve continuity.

C. Research/Evaluation Reports: For roof expansion assemblies.

D. Warranties: Special warranties specified in this Section.

E. Qualification Data: For Installer.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Installer of roof membrane.

B. Source Limitations: Obtain metal-flanged, bellows-type roof expansion assemblies approved by roofing membrane manufacturer and that are part of roofing membrane warranty.

C. Product Options: Drawings indicate size, profiles, and dimensional requirements of roof expansion assemblies and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements."

1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.

D. Fire-Test-Response Characteristics: Provide fire-barrier assemblies with fire-test-response characteristics not less than that of adjacent construction, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Assemblies shall be capable of anticipated movement while maintaining fire rating. Identify assemblies with appropriate markings of applicable testing and inspecting agency.
1. Fire-Resistance Ratings: ASTM E 119.

1.6 SCHEDULING

A. Coordinate delivery and installation of roof expansion assemblies to prevent damage and provide timely integration of units with roofing membranes and flashing.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer and Installer agree to repair or replace roof expansion assemblies that leak, deteriorate in excess of rates specified in manufacturer's published product literature, or otherwise fail to perform within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

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. Products: Subject to compliance with requirements, provide one of the products specified.

2.2 METALS

A. Galvanized Steel Sheet: ASTM A 653/A 653M, hot-dip zinc-coating designation G90 (Z275), stretcher-leveled standard of flatness and either commercial or forming steel, minimum 0.019 inch (0.5 mm) thick.

2.3 MISCELLANEOUS MATERIALS

A. Roof Cement: ASTM D 4586, Type II.

B. Elastomeric Sealant: ASTM C 920, elastomeric polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and to remain watertight.

C. Flexible Cellular Sponge or Expanded Rubber: ASTM D 1056.

D. Fasteners: Manufacturer's recommended fasteners, suitable for application and designed to withstand design loads.

1. Exposed Penetrating Fasteners: Gasketed screws with hex washer heads matching color of sheet metal.

2.4 BELLOWS-TYPE ROOF EXPANSION ASSEMBLIES

A. Metal-Flanged, Bellows-Type Roof Expansion Assemblies: Provide manufacturer's standard assemblies of sizes and types indicated, with prefabricated units for corner and joint intersections and horizontal and vertical transitions including those to other building expansion joints, splicing units, adhesives, coatings, and other components as recommended by roof expansion assembly manufacturer for complete installation. Fabricate assemblies specifically for roof-to-roof applications and other project specific locations required.

B. Provide assemblies consisting of exposed polymeric sheet over foam bellows, securely anchored at both edges to 3- to 4-inch- (76- to 100-mm-) wide sheet metal nailing flanges, either flat or angle formed to fit cant or curbs as required. Insulate bellows with closed-cell, flexible rubber or plastic foam not less than 5/16 inch (8 mm) thick; adhere bellows to underside of polymeric sheet.

1. Basis-Of-Design Product: Provide C/S Group; Model **BRJ or a comparable product by one of the following manufacturers:**

a. Architectural Art Mfg., Inc.
b. Balco Metalines, a division of Balco, Inc.
c. Johns Manville.
d. JointMaster, a division of InPro Corporation.
e. MM Systems Corporation.
f. Watson Bowman Acme Corp.

2. Polymeric Sheet: EPDM, 60 mils (1.5 mm) thick, white.
3. Metal Flanges: Zinc-coated (galvanized) steel, minimum 0.019 inch (0.5 mm) thick.
4. Moisture Barrier: Manufacturer's standard, flexible, continuous, polymeric moisture barrier looped under roof expansion assemblies at locations indicated.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with manufacturer's written instructions for handling and installing roof expansion assemblies and materials unless more stringent requirements are indicated.

B. Coordinate installation of roof expansion assembly materials and associated work so complete assemblies comply with assembly performance requirements.

C. Extend roof expansion assemblies over elements in the construction profile, with factory-fabricated intersections and transitions to provide continuous, uninterrupted, waterproof roof expansion assemblies.

1. Install factory-fabricated transitions between roof expansion assemblies and building architectural joint systems, specified in Division 5 Section "Architectural Joint Systems," to provide continuous, uninterrupted, watertight construction.

D. Splice roof expansion assemblies with materials provided by roof expansion assembly manufacturer for this purpose, according to manufacturer's written instructions, to provide continuous, uninterrupted, waterproof roof expansion assemblies.

E. Provide uniform profile of roof expansion assembly throughout length of each installation; do not stretch polymeric sheets.

F. Bed anchorage flanges in cement or sealant recommended by manufacturer and securely nail to curbs and cant strips as recommended by manufacturer but not less than 6 inches (150 mm) o.c.

G. Anchor roof expansion assemblies complying with manufacturer's written instructions.

H. On single-ply roofing, install roof expansion assemblies complying with manufacturer's written instructions. Anchor to cants or curbs and seal to membrane with sealant compatible with roofing membrane and roof expansion assembly. Cover flanges with stripping or flashing and install according to requirements in Section 075323 “Ethylene-Propylene-Diene-Monomer (EPDM) Roofing."

3.2 PROTECTION

A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensures that roof expansion assemblies are without damage or deterioration at time of Substantial Completion.

END OF SECTION 077129

SECTION 078100 - APPLIED FIREPROOFING

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 sprayed fire-resistive materials (SFRM).

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review products, design ratings, restrained and unrestrained conditions, densities, thicknesses, bond strengths, and other performance requirements.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Framing plans, schedules, or both, indicating the following:

1. Extent of fireproofing for each construction and fire-resistance rating.
2. Applicable fire-resistance design designations of a qualified testing and inspecting agency acceptable to authorities having jurisdiction.
3. Minimum fireproofing thicknesses needed to achieve required fire-resistance rating of each structural component and assembly.
4. Treatment of fireproofing after application.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and testing agency.

B. Product Certificates: For each type of fireproofing.

C. Evaluation Reports: For fireproofing, from ICC-ES.

D. Field quality-control reports.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: A firm or individual certified, licensed, or otherwise qualified by fireproofing manufacturer as experienced and with sufficient trained staff to install manufacturer's products according to specified requirements.

1.7 FIELD CONDITIONS

A. Environmental Limitations: Do not apply fireproofing when ambient or substrate temperature is 44 deg F (7 deg C) or lower unless temporary protection and heat are provided to maintain temperature at or above this level for 24 hours before, during, and for 24 hours after product application.

B. Ventilation: Ventilate building spaces during and after application of fireproofing, providing complete air exchanges according to manufacturer's written instructions. Use natural means or, if they are inadequate, forced-air circulation until fireproofing dries thoroughly.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Assemblies: Provide fireproofing, including auxiliary materials, according to requirements of each fire-resistance design and manufacturer's written instructions.

B. Source Limitations: Obtain fireproofing from single source.

C. Fire-Resistance Design: Indicated on Drawings, tested according to ASTM E 119 or UL 263 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Steel members are to be considered unrestrained unless specifically noted otherwise.

D. VOC Content: Products shall comply with VOC content limits of authorities having jurisdiction and the following VOC limits when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

1. Flat Paints and Coatings: 50 g/L.
2. Nonflat Paints and Coatings: 150 g/L.
3. Primers, Sealers, and Undercoaters: 200 g/L.
4. Anticorrosive and Antirust Paints Applied to Ferrous Metals: 250 g/L.

E. Asbestos: Provide products containing no detectable asbestos.

2.2 SPRAYED FIRE-RESISTIVE MATERIALS

A. SFRM: Manufacturer's standard, factory-mixed, lightweight, dry formulation, complying with indicated fire-resistance design, and mixed with water at Project site to form a slurry or mortar be-

fore conveyance and application or conveyed in a dry state and mixed with atomized water at place of application.

1. Bond Strength: Minimum 150-lbf/sq. ft. (7.18-kPa) cohesive and adhesive strength based on field testing according to ASTM E 736.
2. Density: Not less than 15 lb/cu. ft. (240 kg/cu. m) and as specified in the approved fire-resistance design, according to ASTM E 605.
3. Thickness: As required for fire-resistance design indicated, measured according to requirements of fire-resistance design or ASTM E 605, whichever is thicker, but not less than 0.375 inch (9 mm).
4. Combustion Characteristics: ASTM E 136.
5. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

    a. Flame-Spread Index: 10 or less.
    b. Smoke-Developed Index: 10 or less.
6. Corrosion Resistance: No evidence of corrosion according to ASTM E 937.
7. Deflection: No cracking, spalling, or delamination according to ASTM E 759.
8. Effect of Impact on Bonding: No cracking, spalling, or delamination according to ASTM E 760.
9. Air Erosion: Maximum weight loss of 0.025 g/sq. ft. (0.270 g/sq. m) in 24 hours according to ASTM E 859.
10. Fungal Resistance: Treat products with manufacturer's standard antimicrobial formulation to result in no growth on specimens per ASTM G 21.

2.3 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that are compatible with fireproofing and substrates and are approved by UL or another testing and inspecting agency acceptable to authorities having jurisdiction for use in fire-resistance designs indicated.

B. Substrate Primers: Primers approved by fireproofing manufacturer and complying with one or both of the following requirements:

1. Primer and substrate are identical to those tested in required fire-resistance design by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.
2. Primer's bond strength in required fire-resistance design complies with specified bond strength for fireproofing and with requirements in UL's "Fire Resistance Directory" or in the listings of another qualified testing agency acceptable to authorities having jurisdiction, based on a series of bond tests according to ASTM E 736.

C. Bonding Agent: Product approved by fireproofing manufacturer and complying with requirements in UL's "Fire Resistance Directory" or in the listings of another qualified testing agency acceptable to authorities having jurisdiction.

D. Metal Lath: Expanded metal lath fabricated from material of weight, configuration, and finish required, according to fire-resistance designs indicated and fireproofing manufacturer's written recommendations. Include clips, lathing accessories, corner beads, and other anchorage devices required to attach lath to substrates and to receive fireproofing.

E. Reinforcing Fabric: Glass- or carbon-fiber fabric of type, weight, and form required to comply with fire-resistance designs indicated; approved and provided by fireproofing manufacturer.

F. Reinforcing Mesh: Metallic mesh reinforcement of type, weight, and form required to comply with fire-resistance design indicated; approved and provided by fireproofing manufacturer. Include pins and attachment.

G. Sealer: Transparent-drying, water-dispersible, tinted protective coating recommended in writing by fireproofing manufacturer for each fire-resistance design.

H. Topcoat: Suitable for application over applied fireproofing; of type recommended in writing by fireproofing manufacturer for each fire-resistance design.

1. Cement-Based Topcoat: Factory-mixed, cementitious hard-coat formulation for trowel or spray application over SFRM.

2. Water-Based Permeable Topcoat: Factory-mixed formulation for brush, roller, or spray application over applied SFRM. Provide application at a rate of 30 sq. ft./gal. (0.75 sq. m/L).

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for substrates and other conditions affecting performance of the Work and according to each fire-resistance design. Verify compliance with the following:

1. Substrates are free of dirt, oil, grease, release agents, rolling compounds, mill scale, loose scale, incompatible primers, paints, and encapsulants, or other foreign substances capable of impairing bond of fireproofing with substrates under conditions of normal use or fire exposure.
2. Objects penetrating fireproofing, including clips, hangers, support sleeves, and similar items, are securely attached to substrates.
3. Substrates receiving fireproofing are not obstructed by ducts, piping, equipment, or other suspended construction that will interfere with fireproofing application.

B. Verify that concrete work on steel deck has been completed before beginning fireproofing work.

C. Verify that roof construction, installation of roof-top HVAC equipment, and other related work is complete before beginning fireproofing work.

D. Conduct tests according to fireproofing manufacturer's written recommendations to verify that substrates are free of substances capable of interfering with bond.

E. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

F. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Cover other work subject to damage from fallout or overspray of fireproofing materials during application.

B. Clean substrates of substances that could impair bond of fireproofing.

C. Prime substrates where included in fire-resistance design and where recommended in writing by fireproofing manufacturer unless compatible shop primer has been applied and is in satisfactory condition to receive fireproofing.

3.3 APPLICATION

A. Construct fireproofing assemblies that are identical to fire-resistance design indicated and products as specified, tested, and substantiated by test reports; for thickness, primers, sealers, topcoats, finishing, and other materials and procedures affecting fireproofing work.

B. Comply with fireproofing manufacturer's written instructions for mixing materials, application procedures, and types of equipment used to mix, convey, and apply fireproofing; as applicable to particular conditions of installation and as required to achieve fire-resistance ratings indicated.

C. Coordinate application of fireproofing with other construction to minimize need to cut or remove fireproofing.

1. Do not begin applying fireproofing until clips, hangers, supports, sleeves, and other items penetrating fireproofing are in place.
2. Defer installing ducts, piping, and other items that would interfere with applying fireproofing until application of fireproofing is completed.

D. Metal Decks:

1. Do not apply fireproofing to underside of metal deck substrates until concrete topping, if any, has been completed.
2. Do not apply fireproofing to underside of metal roof deck until roofing has been completed; prohibit roof traffic during application and drying of fireproofing.

E. Install auxiliary materials as required, as detailed, and according to fire-resistance design and fireproofing manufacturer's written recommendations for conditions of exposure and intended use. For auxiliary materials, use attachment and anchorage devices of type recommended in writing by fireproofing manufacturer.

F. Spray apply fireproofing to maximum extent possible. Following the spraying operation in each area, complete the coverage by trowel application or other placement method recommended in writing by fireproofing manufacturer.

G. Extend fireproofing in full thickness over entire area of each substrate to be protected.

H. Install body of fireproofing in a single course unless otherwise recommended in writing by fireproofing manufacturer.

I. Where sealers are used, apply products that are tinted to differentiate them from fireproofing over which they are applied.

J. Provide a uniform finish complying with description indicated for each type of fireproofing material and matching finish approved for required mockups.

K. Cure fireproofing according to fireproofing manufacturer's written recommendations.

L. Do not install enclosing or concealing construction until after fireproofing has been applied, inspected, and tested and corrections have been made to deficient applications.

M. Finishes: Where indicated, apply fireproofing to produce the following finishes:
1. Spray-Textured Finish: Finish left as spray applied with no further treatment.

3.4 FIELD QUALITY CONTROL

A. Special Inspections: Engage a qualified special inspector to perform the following special inspections:

1. Test and inspect as required by the IBC, 1704.10.

B. Perform the tests and inspections of completed Work in successive stages. Do not proceed with application of fireproofing for the next area until test results for previously completed applications of fireproofing show compliance with requirements. Tested values must equal or exceed values as specified and as indicated and required for approved fire-resistance design.

C. Fireproofing will be considered defective if it does not pass tests and inspections.

1. Remove and replace fireproofing that does not pass tests and inspections, and retest.
2. Apply additional fireproofing, per manufacturer's written instructions, where test results indicate insufficient thickness, and retest.

D. Prepare test and inspection reports.

3.5 CLEANING, PROTECTING, AND REPAIRING

A. Cleaning: Immediately after completing spraying operations in each containable area of Project, remove material overspray and fallout from surfaces of other construction and clean exposed surfaces to remove evidence of soiling.

B. Protect fireproofing, according to advice of manufacturer and Installer, from damage resulting from construction operations or other causes, so fireproofing will be without damage or deterioration at time of Substantial Completion.

C. As installation of other construction proceeds, inspect fireproofing and repair damaged areas and fireproofing removed due to work of other trades.

D. Repair fireproofing damaged by other work before concealing it with other construction.

E. Repair fireproofing by reapplying it using same method as original installation or using manufacturer's recommended trowel-applied product.

END OF SECTION 078100

SECTION 078413 - PENETRATION FIRESTOPPING

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. Penetrations in fire-resistance-rated walls.
2. Penetrations in smoke barriers.

B. Related Sections:

1. Section 078446 "Fire-Resistive Joint Systems" for joints in or between fire-resistance-rated construction, at exterior curtain-wall/floor intersections, and in smoke barriers.

1.3 ACTION SUBMITTALS

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

B. Product Schedule: For each penetration firestopping system. Include location and design designation of qualified testing and inspecting agency.

1. Where Project conditions require modification to a qualified testing and inspecting agency's illustration for a particular penetration firestopping condition, submit illustration, with modifications marked, approved by penetration firestopping manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Installer Certificates: From Installer indicating penetration firestopping has been installed in compliance with requirements and manufacturer's written recommendations.

C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for penetration firestopping.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A firm experienced in installing penetration firestopping similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful performance. Qualifications include having the necessary experience, staff, and training to install manufacturer's products per specified requirements. Manufacturer's willingness to sell its penetration firestopping products to Contractor or to Installer engaged by Contractor does not in itself confer qualification on buyer.

B. Fire-Test-Response Characteristics: Penetration firestopping shall comply with the following requirements:

1. Penetration firestopping tests are performed by a qualified testing agency acceptable to authorities having jurisdiction.

a. Penetration firestopping products bear classification marking of qualified testing and inspecting agency.
b. Classification markings on penetration firestopping correspond to designations listed by the following:

1) UL in its "Fire Resistance Directory."

C. Preinstallation Conference: Conduct conference at Project site.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Do not install penetration firestopping when ambient or substrate temperatures are outside limits permitted by penetration firestopping manufacturers or when substrates are wet because of rain, frost, condensation, or other causes.

B. Install and cure penetration firestopping per manufacturer's written instructions using natural means of ventilations or, where this is inadequate, forced-air circulation.

1.7 COORDINATION

A. Coordinate construction of openings and penetrating items to ensure that penetration firestopping is installed according to specified requirements.

B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate penetration firestopping.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by the following:
1. Specified Technologies Inc.

2.2 PENETRATION FIRESTOPPING

A. Provide penetration firestopping that is produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated. Penetration firestopping systems shall be compatible with one another, with the substrates forming openings, and with penetrating items if any.

B. Penetrations in Fire-Resistance-Rated Walls: Provide penetration firestopping with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg (2.49 Pa).

1. Fire-resistance-rated walls include fire-barrier walls, smoke-barrier walls and fire partitions.
2. F-Rating: Not less than the fire-resistance rating of constructions penetrated.

C. Penetrations in Smoke Barriers: Provide penetration firestopping with ratings determined per UL 1479.

1. L-Rating: Not exceeding 5.0 cfm/sq. ft. (0.025 cu. m/s per sq. m) of penetration opening at 0.30-inch wg (74.7 Pa) at both ambient and elevated temperatures.

D. Exposed Penetration Firestopping: Provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.

E. VOC Content: Penetration firestopping sealants and sealant primers shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

1. Sealants: 250 g/L.
2. Sealant Primers for Nonporous Substrates: 250 g/L.
3. Sealant Primers for Porous Substrates: 775 g/L.

F. Accessories: Provide components for each penetration firestopping system that are needed to install fill materials and to maintain ratings required. Use only those components specified by penetration firestopping manufacturer and approved by qualified testing and inspecting agency for firestopping indicated.

1. Permanent forming/damming/backing materials, including the following:

a. Slag-wool-fiber or rock-wool-fiber insulation.
b. Sealants used in combination with other forming/damming/backing materials to prevent leakage of fill materials in liquid state.
c. Fire-rated form board.
d. Fillers for sealants.

2. Temporary forming materials.
3. Substrate primers.
4. Collars.
5. Steel sleeves.

2.3 FILL MATERIALS

A. Cast-in-Place Firestop Devices: Factory-assembled devices for use in cast-in-place concrete floors and consisting of an outer metallic sleeve lined with an intumescent strip, a radial extended flange attached to one end of the sleeve for fastening to concrete formwork, and a neoprene gasket.

B. Latex Sealants: Single-component latex formulations that do not re-emulsify after cure during exposure to moisture.

C. Firestop Devices: Factory-assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrant.

D. Intumescent Composite Sheets: Rigid panels consisting of aluminum-foil-faced elastomeric sheet bonded to galvanized-steel sheet.

E. Intumescent Putties: Nonhardening dielectric, water-resistant putties containing no solvents, inorganic fibers, or silicone compounds.

F. Intumescent Wrap Strips: Single-component intumescent elastomeric sheets with aluminum foil on one side.

G. Mortars: Prepackaged dry mixes consisting of a blend of inorganic binders, hydraulic cement, fillers, and lightweight aggregate formulated for mixing with water at Project site to form a nonshrinking, homogeneous mortar.

H. Pillows/Bags: Reusable heat-expanding pillows/bags consisting of glass-fiber cloth cases filled with a combination of mineral-fiber, water-insoluble expansion agents, and fire-retardant additives. Where exposed, cover openings with steel-reinforcing wire mesh to protect pillows/bags from being easily removed.

I. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

J. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below:

1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces, and nonsag formulation for openings in vertical and sloped surfaces, unless indicated firestopping limits use of nonsag grade for both opening conditions.

2.4 MIXING

A. For those products requiring mixing before application, comply with penetration firestopping manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning: Clean out openings immediately before installing penetration firestopping to comply with manufacturer's written instructions and with the following requirements:

1. Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of penetration firestopping.
2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with penetration firestopping. Remove loose particles remaining from cleaning operation.
3. Remove laitance and form-release agents from concrete.

B. Priming: Prime substrates where recommended in writing by manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

C. Masking Tape: Use masking tape to prevent penetration firestopping from contacting adjoining surfaces that will remain exposed on completion of the Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove stains. Remove tape as soon as possible without disturbing firestopping's seal with substrates.

3.3 INSTALLATION

A. General: Install penetration firestopping to comply with manufacturer's written installation instructions and published drawings for products and applications indicated.

B. Install forming materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.

1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of firestopping.

C. Install fill materials for firestopping by proven techniques to produce the following results:

1. Fill voids and cavities formed by openings, forming materials, accessories, and penetrating items as required to achieve fire-resistance ratings indicated.
2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.

3. For fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 IDENTIFICATION

A. Identify penetration firestopping with preprinted metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches (150 mm) of firestopping edge so labels will be visible to anyone seeking to remove penetrating items or firestopping. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:

1. The words "Warning - Penetration Firestopping - Do Not Disturb. Notify Building Management of Any Damage."
2. Contractor's name, address, and phone number.
3. Designation of applicable testing and inspecting agency.
4. Date of installation.
5. Manufacturer's name.
6. Installer's name.

3.5 FIELD QUALITY CONTROL

A. Engage a qualified testing agency to perform tests and inspections.

B. Where deficiencies are found or penetration firestopping is damaged or removed because of testing, repair or replace penetration firestopping to comply with requirements.

C. Proceed with enclosing penetration firestopping with other construction only after inspection reports are issued and installations comply with requirements.

3.6 CLEANING AND PROTECTION

A. Clean off excess fill materials adjacent to openings as the Work progresses by methods and with cleaning materials that are approved in writing by penetration firestopping manufacturers and that do not damage materials in which openings occur.

B. Provide final protection and maintain conditions during and after installation that ensure that penetration firestopping is without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, immediately cut out and remove damaged or deteriorated penetration firestopping and install new materials to produce systems complying with specified requirements.

END OF SECTION 078413

SECTION 078446 - FIRE-RESISTIVE JOINT SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Joints in or between fire-resistance-rated constructions.
2. Joints in smoke barriers.

B. Related Sections:

1. Section 078413 "Penetration Firestopping" for penetrations in fire-resistance-rated walls, horizontal assemblies, and smoke barriers.

1.3 ACTION SUBMITTALS

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

B. Product Schedule: For each fire-resistive joint system. Include location and design designation of qualified testing agency.

1. Where Project conditions require modification to a qualified testing agency's illustration for a particular fire-resistive joint system condition, submit illustration, with modifications marked, approved by fire-resistive joint system manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Installer Certificates: From Installer indicating fire-resistive joint systems have been installed in compliance with requirements and manufacturer's written recommendations.

C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for fire-resistive joint systems.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A firm experienced in installing fire-resistive joint systems similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful performance. Qualifications include having the necessary experience, staff, and training to install manufacturer's products per specified requirements. Manufacturer's willingness to sell its fire-resistive joint system products to Contractor or to Installer engaged by Contractor does not in itself confer qualification on buyer.

B. Fire-Test-Response Characteristics: Fire-resistive joint systems shall comply with the following requirements:

1. Fire-resistive joint system tests are performed by a qualified testing agency acceptable to authorities having jurisdiction.
2. Fire-resistive joint systems are identical to those tested per testing standard referenced in "Fire-Resistive Joint Systems" Article. Provide rated systems complying with the following requirements:

a. Fire-resistive joint system products bear classification marking of qualified testing agency.
b. Fire-resistive joint systems correspond to those indicated by reference to designations listed by the following:

1) UL in its "Fire Resistance Directory."
2) Intertek ETL SEMKO in its "Directory of Listed Building Products."

C. Preinstallation Conference: Conduct conference at Project site.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Do not install fire-resistive joint systems when ambient or substrate temperatures are outside limits permitted by fire-resistive joint system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.

B. Install and cure fire-resistive joint systems per manufacturer's written instructions using natural means of ventilation or, where this is inadequate, forced-air circulation.

1.7 COORDINATION

A. Coordinate construction of joints to ensure that fire-resistive joint systems are installed according to specified requirements.

B. Coordinate sizing of joints to accommodate fire-resistive joint systems.

C. Notify Owner's testing agency at least seven days in advance of fire-resistive joint system installations; confirm dates and times on day preceding each series of installations.

D. Individual subcontractors are responsible for sealing all penetrations made by their respective trades, in walls, ceilings, floors, shafts, and other parts of the building construction, whether made in new or existing construction. Sealing is required to maintain fire, smoke or other re-

quired ratings or qualities of the penetrated construction. As with all other general construction requirements, the General Contractor is responsible for directing this work of the subcontractors.

E. The General Contractor and individual subcontractors are responsible for reporting any existing penetrations in walls, ceilings, floors, shafts and other parts of the building construction discovered while uncovering in-place work. Subcontractors are required to report to the General Contractor. The General Contractor is required to report to the Architect for direction.

PART 2 - PRODUCTS

2.1 FIRE-RESISTIVE JOINT SYSTEMS

A. Where required, provide fire-resistive joint systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of assemblies in or between which fire-resistive joint systems are installed. Fire-resistive joint systems shall accommodate building movements without impairing their ability to resist the passage of fire and hot gases.

B. Manufacturers: Subject to compliance with requirements, provide products by the following:
   1. Specified Technologies Inc.

C. Joints in or between Fire-Resistance-Rated Construction: Provide fire-resistive joint systems with ratings determined per ASTM E 1966 or UL 2079:
   1. Joints include those installed in or between fire-resistance-rated walls and roofs or roof/ceiling assemblies.
   2. Fire-Resistance Rating: Equal to or exceeding the fire-resistance rating of construction they will join.

D. Joints in Smoke Barriers: Provide fire-resistive joint systems with ratings determined per UL 2079.
   1. L-Rating: Not exceeding 5.0 cfm/ft (0.00775 cu. m/s x m) of joint at 0.30 inch wg (74.7 Pa) at both ambient and elevated temperatures.

E. VOC Content: Fire-resistive joint system sealants shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

   1. Architectural Sealants: 250 g/L.
   2. Sealant Primers for Nonporous Substrates: 250 g/L.
   3. Sealant Primers for Porous Substrates: 775 g/L.

F. Accessories: Provide components of fire-resistive joint systems, including primers and forming materials, that are needed to install fill materials and to maintain ratings required. Use only components specified by fire-resistive joint system manufacturer and approved by the qualified testing agency for systems indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for joint configurations, substrates, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning: Clean joints immediately before installing fire-resistive joint systems to comply with fire-resistive joint system manufacturer's written instructions and the following requirements:

1. Remove from surfaces of joint substrates foreign materials that could interfere with adhesion of fill materials.
2. Clean joint substrates to produce clean, sound surfaces capable of developing optimum bond with fill materials. Remove loose particles remaining from cleaning operation.
3. Remove laitance and form-release agents from concrete.

B. Priming: Prime substrates where recommended in writing by fire-resistive joint system manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

C. Masking Tape: Use masking tape to prevent fill materials of fire-resistive joint system from contacting adjoining surfaces that will remain exposed on completion of the Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove stains. Remove tape as soon as possible without disturbing fire-resistive joint system's seal with substrates.

3.3 INSTALLATION

A. General: Install fire-resistive joint systems to comply with manufacturer's written installation instructions and published drawings for products and applications indicated.

B. Install forming materials and other accessories of types required to support fill materials during their application and in position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.

1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of fire-resistive joint system.

C. Install fill materials for fire-resistive joint systems by proven techniques to produce the following results:

1. Fill voids and cavities formed by joints and forming materials as required to achieve fire-resistance ratings indicated.

2. Apply fill materials so they contact and adhere to substrates formed by joints.
3. For fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 IDENTIFICATION

A. Identify fire-resistive joint systems with preprinted metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches (150 mm) of joint edge so labels will be visible to anyone seeking to remove or penetrate joint system. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:

1. The words "Warning - Fire-Resistive Joint System - Do Not Disturb. Notify Building Management of Any Damage."
2. Contractor's name, address, and phone number.
3. Designation of applicable testing agency.
4. Date of installation.
5. Manufacturer's name.
6. Installer's name.

3.5 FIELD QUALITY CONTROL

A. Inspecting Agency: Engage a qualified testing agency to perform tests and inspections.

B. Where deficiencies are found or fire-resistive joint systems are damaged or removed due to testing, repair or replace fire-resistive joint systems so they comply with requirements.

C. Proceed with enclosing fire-resistive joint systems with other construction only after inspection reports are issued and installations comply with requirements.

3.6 CLEANING AND PROTECTING

A. Clean off excess fill materials adjacent to joints as the Work progresses by methods and with cleaning materials that are approved in writing by fire-resistive joint system manufacturers and that do not damage materials in which joints occur.

B. Provide final protection and maintain conditions during and after installation that ensure fire-resistive joint systems are without damage or deterioration at time of Substantial Completion. If damage or deterioration occurs despite such protection, cut out and remove damaged or deteriorated fire-resistive joint systems immediately and install new materials to produce fire-resistive joint systems complying with specified requirements.

END OF SECTION 078446

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SECTION 079200 - JOINT SEALANTS

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. Silicone joint sealants.
2. Urethane joint sealants.
3. Latex joint sealants.

B. RelatedSections:

1. Section 078446 "Fire-Resistive Joint Systems" for sealing joints in fire-resistance-rated construction.

1.3 ACTION SUBMITTALS

A. Product Data: For each joint-sealant product indicated.

B. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.

C. Joint-Sealant Schedule: Include the following information:
1. Joint-sealant application, joint location, and designation.
2. Joint-sealant manufacturer and product name.
3. Joint-sealant formulation.
4. Joint-sealant color.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Product Certificates: For each kind of joint sealant and accessory, from manufacturer.

C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating that sealants comply with requirements.

D. Warranties: Sample of special warranties.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

B. Source Limitations: Obtain each kind of joint sealant from single source from single manufacturer.

C. Product Testing: Test joint sealants using a qualified testing agency.

1. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated.

D. Preinstallation Conference: Conduct conference at Project site.

1.6 PROJECT CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:

1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F (5 deg C).
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.

1.7 WARRANTY

A. Special Installer's Warranty: Manufacturer's standard form in which Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

B. Special Manufacturer's Warranty: Manufacturer's standard form in which joint-sealant manufacturer agrees to furnish joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period:
   a. Silicone Sealants: 20 years from date of Substantial Completion.
   b. Other Sealants: 5 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.

B. VOC Content of Interior Sealants: Sealants and sealant primers used inside the weatherproofing system shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

1. Architectural Sealants: 250 g/L.
2. Sealant Primers for Nonporous Substrates: 250 g/L.
3. Sealant Primers for Porous Substrates: 775 g/L.

C. Liquid-Applied Joint Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied joint sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.

D. Stain-Test-Response Characteristics: Where sealants are specified to be nonstaining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.

E. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.2 SILICONE JOINT SEALANTS

A. Mildew-Resistant, Single-Component, Acid-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 25, for Use NT.

1. Products: Subject to compliance with requirements, provide one of the following:

a. BASF Building Systems; Omniplus.
b. Dow Corning Corporation; 786 Mildew Resistant.
c. GE Advanced Materials - Silicones; Sanitary SCS1700.
d. May National Associates, Inc.; Bondaflex Sil 100 WF.
e. Tremco Incorporated; Tremsil 200 Sanitary.

2.3 URETHANE JOINT SEALANTS

A. Multicomponent, Nonsag, Urethane Joint Sealant: ASTM C 920, Type M, Grade NS, Class 50, for Use NT.
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. Pecora Corporation; Dynatrol II.
b. Polymeric Systems, Inc.; PSI-270.
c. Tremco Incorporated; Dymeric 240.

2.4 LATEX JOINT SEALANTS

A. Latex Joint Sealant: Acrylic latex or siliconized acrylic latex, ASTM C 834, Type OP, Grade NF.

1. Products: Subject to compliance with requirements, provide one of the following:

a. BASF Building Systems; Sonolac.
b. Bostik, Inc.; Chem-Calk 600.
c. May National Associates, Inc.; Bondaflex 600 or Bondaflex Sil-A 700.
d. Pecora Corporation; AC-20+.
e. Schnee-Morehead, Inc.; SM 8200.
f. Tremco Incorporated; Tremflex 834.

2.5 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:
1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
2. Clean porous joint substrate surfaces by brushing, grinding, 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. Porous joint substrates include the following:
a. Concrete.
b. Masonry.
c. Unglazed surfaces of ceramic tile.
d. Exterior insulation and finish systems.

3. Remove laitance and form-release agents from concrete.
4. Clean nonporous 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. Nonporous joint substrates include the following:
a. Metal.
b. Glass.
c. Porcelain enamel.
d. Glazed surfaces of ceramic tile.

B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant 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. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Install sealant backings 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 stretch, twist, puncture, or tear sealant backings.
3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.

D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:

1. Place sealants so they directly contact and fully wet joint substrates.
2. Completely fill recesses in each joint configuration.
3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified 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.

1. Remove excess sealant from surfaces adjacent to joints.
2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
3. Provide concave joint profile per Figure 8A in ASTM C 1193, unless otherwise indicated.

a. Use masking tape where required to protect surfaces adjacent to tooled joints.

3.4 FINAL FINISHING

A. Where sealants are installed against one or more painted surfaces, paint over installed sealant to match adjacent painted surface. Such locations include joints between hollow metal frames and surrounding walls and countertops or window stools and surrounding walls.

3.5 CLEANING

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

3.6 PROTECTION

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

3.7 JOINT-SEALANT SCHEDULE

A. Exterior Joint-Sealant Application: Exterior joints in vertical surfaces and horizontal nontraffic surfaces.
1. Joint Locations:
   a. Control and expansion joints in unit masonry.
   b. Joints in exterior insulation and finish systems.
   c. Joints between metal panels.
   d. Joints between different materials listed above.
   e. Perimeter joints between materials listed above and frames of doors and windows.
   f. Control and expansion joints in ceilings and soffits.
   g. Other joints as indicated.
2. Urethane Joint Sealant: Multicomponent, nonsag,, Class 50.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

B. Plumbing Fixtures Joint-Sealant Application: Mildew-resistant interior joints in vertical surfaces and horizontal nontraffic surfaces.
   1. Joint Sealant Location:
      a. Joints between plumbing fixtures and adjoining walls, floors, and counters.
      b. Other joints as indicated.
   2. Joint Sealant: Single component, nonsag, mildew resistant, acid curing.
   3. Joint-Sealant Color: White.

C. Interior Joint Sealant Application: Interior joints in vertical and horizontal non-traffic surfaces.

   1. Joint Locations:

      a. Joints between interior wall surfaces and frames.
      b. Other joints as indicated.

   2. Joint Sealant: Latex joint sealant.
   3. Joint Sealant Color: Paintable.

END OF SECTION 079200

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SECTION 079500 - EXPANSION CONTROL

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. Interior expansion control systems.
2. Exterior wall expansion control systems.

B. Related Requirements:

1. Section 077129 "Manufactured Roof Expansion Assemblies" for factory-fabricated roof expansion control.
2. Section 078446 "Fire-Resistive Joint Systems" for liquid-applied joint sealants in fire-resistive building joints.
3. Section 079200 "Joint Sealants" for liquid-applied joint sealants and for elastomeric sealants without metal frames.

1.3 ACTION SUBMITTALS

A. Shop Drawings: For each expansion control system specified. Include plans, elevations, sections, details, splices, attachments to other work, and line diagrams showing entire route of each expansion control system. Where expansion control systems change planes, provide isometric or clearly detailed drawing depicting how components interconnect.

B. Samples: For each exposed expansion control system and for each color and texture specified, full width by 6 inches (150 mm) long in size.

C. Product Schedule: Prepared by or under the supervision of the supplier. Include the following information in tabular form:

1. Manufacturer and model number for each expansion control system.
2. Expansion control system location cross-referenced to Drawings.
3. Nominal joint width.
4. Movement capability.
5. Classification as thermal or seismic.
6. Materials, colors, and finishes.
7. Product options.

1.4 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each fire barrier provided as part of an expansion control system, for tests performed by a qualified testing agency.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

A. General: Provide expansion control systems of design, basic profile, materials, and operation indicated. Provide units with capability to accommodate variations in adjacent surfaces.

1. Furnish units in longest practicable lengths to minimize field splicing. Install with hairline mitered corners where expansion control systems change direction or abut other materials.
2. Include factory-fabricated closure materials and transition pieces, T-joints, corners, curbs, cross-connections, and other accessories as required to provide continuous expansion control systems.

B. Coordination: Coordinate installation of exterior wall expansion control systems with roof expansion control systems to ensure that wall transitions are watertight. Roof expansion joint assemblies are specified elsewhere.

2.2 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Expansion control systems shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. The term "withstand" means "the system will remain in place without separation of any parts when subjected to the seismic forces specified and the system will be fully operational after the seismic event."
2. Component Importance Factor is 1.5.

2.3 INTERIOR EXPANSION CONTROL SYSTEMS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated or a comparable product by one of the following:

1. Architectural Art Mfg., Inc.; Division of Pittcon Industries.
2. Balco, Inc.
3. Construction Specialties, Inc.
4. JointMaster/InPro Corporation.
5. Michael Rizza Company, LLC.
6. MM Systems Corporation.
7. Nystrom, Inc.
8. Watson Bowman Acme Corp.; a BASF Construction Chemicals business.

B. Source Limitations: Obtain expansion control systems from single source from single manufacturer.

C. Wall-to-Wall and Wall-Corner:
1. Basis-of-Design Product: **FWF and FWFC-200 by Construction Specialties, Inc.**
2. Design Criteria:

a. Nominal Joint Width: 2 inches.
b. Movement Capability: As indicated by basis-of-design product indicated.
c. Type of Movement: Seismic.

3. Type: Elastomeric seal.

a. Metal: Aluminum.

1) Finish: Mill.

b. Seal Material: Manufacturer's standard.

1) Color: As selected by Architect from manufacturer's full range.

D. Ceiling-to-Ceiling:
1. Basis-of-Design Product: **FCF-200 by Construction Specialties, Inc.**
2. Design Criteria:

a. Nominal Joint Width: 2 inches.
b. Movement Capability: As indicated by basis-of-design product indicated.
c. Type of Movement: Seismic.

3. Type: Accordion.

a. Metal: Aluminum.

1) Finish: Manufacturer's standard.

b. Seal Material: Manufacturer's standard.

1) Color: As selected by Architect from manufacturer's full range.

2.4 EXTERIOR WALL EXPANSION CONTROL SYSTEMS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated or a comparable product by one of the following:

1. Architectural Art Mfg., Inc.; Division of Pittcon Industries.
2. Balco, Inc.
3. Chase Construction Products; Division of Chase Corporation.
4. Construction Specialties, Inc.
5. D. S. Brown Company (The).
6. EMSEAL Corporation.
7. Erie Metal Specialties, Inc.
8. JointMaster/InPro Corporation.
9. LymTal International, Inc.
10. Michael Rizza Company, LLC.
11. MM Systems Corporation.

12. Nystrom, Inc.
13. RJ Watson, Inc.
14. Schul International Company, Inc.
15. Tremco Incorporated.
16. Watson Bowman Acme Corp.; a BASF Construction Chemicals business.
17. Williams Products, Inc.

B. Source Limitations: Obtain expansion control systems from single source from single manufacturer.

C. Wall-to-Wall:
1. Basis-of-Design Product: **VF-200** by **Construction Specialties, Inc**.
2. Design Criteria:

a. Nominal Joint Width: 2 inches.
b. Minimum Joint Width: 1 inch.
c. Maximum Joint Width: 3 inches.
d. Type of Movement: Thermal and Seismic.

3. Type: Preformed cellular foam.

a. Foam Material: Manufacturer's standard.

1) Color: As selected by Architect from manufacturer's full range.

2.5 MATERIALS

A. Aluminum: ASTM B 221 (ASTM B 221M), Alloy 6063-T5 for extrusions; ASTM B 209 (ASTM B 209M), Alloy 6061-T6 for sheet and plate.

1. Apply manufacturer's standard protective coating on aluminum surfaces to be placed in contact with cementitious materials.

B. Elastomeric Seals: ASTM E 1783; preformed elastomeric membranes or extrusions to be installed in metal frames.

C. Cellular Foam Seals: Extruded, compressible foam designed to function under compression.

D. Accessories: Manufacturer's standard anchors, clips, fasteners, set screws, spacers, and other accessories compatible with material in contact, as indicated or required for complete installations.

2.6 GENERAL FINISH REQUIREMENTS

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. 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.

2.7 ALUMINUM FINISHES

A. Mill finish.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces where expansion control 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.

3.2 PREPARATION

A. Prepare substrates according to expansion control system manufacturer's written instructions.

B. Coordinate and furnish anchorages, setting drawings, and instructions for installing expansion control systems. Provide fasteners of metal, type, and size to suit type of construction indicated and to provide for secure attachment of expansion control systems.

C. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary to secure joint systems to in-place construction, including threaded fasteners with drilled-in expansion shields for masonry and concrete where anchoring members are not embedded in concrete. 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 storing, handling, and installing expansion control systems and materials unless more stringent requirements are indicated.

B. Seals in Metal Frames: Install elastomeric seals and membranes in frames to comply with manufacturer's written instructions. Install with minimum number of end joints.

1. Provide in continuous lengths for straight sections.
2. Seal transitions according to manufacturer's written instructions. Vulcanize or heat-weld field-spliced joints as recommended by manufacturer.
3. Installation: Mechanically lock seals into frames or adhere to frames with adhesive or pressure-sensitive tape as recommended by manufacturer.

C. Foam Seals: Install with adhesive recommended by manufacturer.

D. Terminate exposed ends of expansion control systems with field- or factory-fabricated termination devices.

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.

B. Protect the installation from damage by work of other Sections. Where necessary due to heavy construction traffic, remove and properly store cover plates or seals and install temporary protection over expansion control systems. Reinstall cover plates or seals prior to Substantial Completion of the Work.

END OF SECTION 079500

SECTION 081113 - HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Standard hollow frames. Welded frames, knock-down frames are not acceptable.

B. Related Sections:

1. Section 087100 "Door Hardware" for door hardware for hollow metal frames.
2. Section 099123 "Interior Painting" for field painting hollow metal frames.
3. Division 26 Sections for electrical connections including conduit and wiring for door controls and operators that affect door frames.

1.3 DEFINITIONS

A. Minimum Thickness: Minimum thickness of base metal without coatings.

B. Standard Hollow Metal Work: Hollow metal work fabricated according to ANSI/SDI A250.8.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, core descriptions, fire-resistance rating, temperature-rise ratings, and finishes.

B. Shop Drawings: Include the following:

1. Elevations of each door frame design.
2. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
3. Locations of reinforcement and preparations for hardware.
4. Details of each different wall opening condition.
5. Details of anchorages, joints, field splices, and connections.
6. Details of accessories.
7. Details of conduit and preparations for power, signal, and control systems.

C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each type of hollow metal frame.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain hollow metal work from single source from single manufacturer.

B. Fire-Rated Door Frame Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing according to NFPA 252.

C. Fire-Rated, Borrowed-Light Frame Assemblies: Assemblies complying with NFPA 80 that are listed and labeled, by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 257 or UL 9. Label each individual glazed lite.

D. Smoke-Control Door Frame Assemblies: Comply with NFPA 105 or UL 1784.

E. Preinstallation Conference: Conduct conference at Project site.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver hollow metal work palletized, wrapped, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.

1. Provide additional protection to prevent damage to finish of factory-finished units.

B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

C. Store hollow metal work under cover at Project site. Place in stacks of five units maximum in a vertical position with heads up, spaced by blocking, on minimum 4-inch- (102-mm-) high wood blocking. Do not store in a manner that traps excess humidity.

1. Provide minimum 1/4-inch (6-mm) space between each stacked door frames to permit air circulation.

1.7 PROJECT CONDITIONS

A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

1.8 COORDINATION

A. Coordinate installation of anchorages for hollow metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Amweld Building Products, LLC.
2. Benchmark; a division of Therma-Tru Corporation.
3. Ceco Door Products; an Assa Abloy Group company.
4. Curries Company; an Assa Abloy Group company.
5. Deansteel Manufacturing Company, Inc.
6. Firedoor Corporation.
7. Fleming Door Products Ltd.; an Assa Abloy Group company.
8. Habersham Metal Products Company.
9. Karpen Steel Custom Doors & Frames.
10. Kewanee Corporation (The).
11. Mesker Door Inc.
12. Pioneer Industries, Inc.
13. Security Metal Products Corp.
14. Steelcraft; an Ingersoll-Rand company.
15. Windsor Republic Doors.

2.2 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

B. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.

C. Frame Anchors: ASTM A 591/A 591M, Commercial Steel (CS), 40Z (12G) coating designation; mill phosphatized.

D. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.

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 a maximum slump of 4 inches (102 mm), as measured according to ASTM C 143/C 143M.

G. Glazing: Comply with requirements in Division 08 Section "Glazing."

H. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil (0.4-mm) dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.3 STANDARD HOLLOW METAL FRAMES

A. General: Comply with ANSI/SDI A250.8 and with details indicated for type and profile. Knock down frames are not acceptable.

B. Interior Frames: Fabricated from cold-rolled steel sheet unless metallic-coated sheet is indicated.

1. Fabricate frames with mitered or coped corners.
2. Fabricate frames as full profile welded.
3. Frames for Wood Doors: 0.053-inch- (1.3-mm-) thick steel sheet.
4. Frames for Borrowed Lights: 0.053-inch- (1.3-mm-) thick steel sheet or same as adjacent door frame.

C. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 with reinforcement plates from same material as frames.

2.4 FRAME ANCHORS

A. Jamb Anchors:

1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, not less than 0.042 inch (1.0 mm) thick, with corrugated or perforated straps not less than 2 inches (50 mm) wide by 10 inches (250 mm) long; or wire anchors not less than 0.177 inch (4.5 mm) thick.
2. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 inch (1.0 mm) thick.
3. Compression Type for Drywall Slip-on Frames: Adjustable compression anchors.
4. Postinstalled Expansion Type for In-Place Concrete or Masonry: Minimum 3/8-inch- (9.5-mm-) diameter bolts with expansion shields or inserts. Provide pipe spacer from frame to wall, with throat reinforcement plate, welded to frame at each anchor location.

B. Floor Anchors: Formed from same material as frames, not less than 0.042 inch (1.0 mm) thick, and as follows:

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-inch (50-mm) height adjustment. Terminate bottom of frames at finish floor surface.

2.5 ACCESSORIES

A. Grout Guards: Formed from same material as frames, not less than 0.016 inch (0.4 mm) thick.

2.6 FABRICATION

A. 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. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.

B. Tolerances: Fabricate hollow metal work to tolerances indicated in ANSI/NAAMM-HMMA 861.

C. Hollow Metal Frames: 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.

1. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.
2. Sidelight Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.
3. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
4. Grout Guards: Weld guards to frame at back of hardware mortises in frames to be grouted.
5. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
6. Jamb Anchors: Provide number and spacing of anchors as follows:

    a. Masonry Type: Locate anchors not more than 18 inches (457 mm) from top and bottom of frame. Space anchors not more than 32 inches (813 mm) o.c. and as follows:

        1) Two anchors per jamb up to 60 inches (1524 mm) high.
        2) Three anchors per jamb from 60 to 90 inches (1524 to 2286 mm) high.
        3) Four anchors per jamb from 90 to 120 inches (2286 to 3048 mm) high.
        4) Four anchors per jamb plus 1 additional anchor per jamb for each 24 inches (610 mm) or fraction thereof above 120 inches (3048 mm) high.

    b. Stud-Wall Type: Locate anchors not more than 18 inches (457 mm) from top and bottom of frame. Space anchors not more than 32 inches (813 mm) o.c. and as follows:

        1) Three anchors per jamb up to 60 inches (1524 mm) high.
        2) Four anchors per jamb from 60 to 90 inches (1524 to 2286 mm) high.
        3) Five anchors per jamb from 90 to 96 inches (2286 to 2438 mm) high.
        4) Five anchors per jamb plus 1 additional anchor per jamb for each 24 inches (610 mm) or fraction thereof above 96 inches (2438 mm) high.
        5) Two anchors per head for frames above 42 inches (1066 mm) wide and mounted in metal-stud partitions.

    c. Compression Type: Not less than two anchors in each jamb.
    d. Postinstalled Expansion Type: Locate anchors not more than 6 inches (152 mm) from top and bottom of frame. Space anchors not more than 26 inches (660 mm) o.c.

7. Door Silencers: Except on weather-stripped doors, drill stops to receive door silencers as follows. Keep holes clear during construction.

    a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
    b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.

D. Fabricate concealed stiffeners, edge channels, and hardware reinforcement from either cold- or hot-rolled steel sheet.

E. Hardware Preparation: Factory prepare hollow metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to the Door Hardware Schedule and templates furnished as specified in Division 08 Section "Door Hardware."

1. Locate hardware as indicated, or if not indicated, according to ANSI/SDI A250.8.
2. Reinforce frames to receive nontemplated, mortised and surface-mounted door hardware.
3. Comply with applicable requirements in ANSI/SDI A250.6 and 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.

2.7 STEEL FINISHES

A. Prime Finish: Apply manufacturer's standard primer immediately after cleaning and pretreating.

1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI/SDI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for embedded and built-in anchors to verify actual locations before frame installation.

C. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.

B. Prior to installation, adjust and securely brace welded hollow metal frames for squareness, alignment, twist, and plumbness to the following tolerances:

1. Squareness: Plus or minus 1/16 inch (1.6 mm), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
2. Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.

3. Twist: Plus or minus 1/16 inch (1.6 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
4. Plumbness: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a perpendicular line from head to floor.

C. Drill and tap frames to receive nontemplated, mortised, and surface-mounted door hardware.

3.3 INSTALLATION

A. General: Install hollow metal work plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.

B. Hollow Metal Frames: Install hollow metal frames of size and profile indicated. Comply with ANSI/SDI A250.11.

1. 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. At fire-protection-rated openings, install frames according to NFPA 80.
    b. 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.
    c. Install frames with removable glazing stops located on secure side of opening.
    d. Install door silencers in frames before grouting.
    e. Remove temporary braces necessary for installation only after frames have been properly set and secured.
    f. Check plumbness, squareness, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
    g. Field apply bituminous coating to backs of frames that are filled with grout containing antifreezing agents.

2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with postinstalled expansion anchors.

    a. Floor anchors may be set with powder-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.

3. Metal-Stud Partitions: Solidly pack mineral-fiber insulation behind frames.
4. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout.
5. In-Place Concrete or Masonry Construction: Secure frames in place with postinstalled expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
6. In-Place Gypsum Board Partitions: Secure frames in place with postinstalled expansion anchors through floor anchors at each jamb. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
7. Ceiling Struts: Extend struts vertically from top of frame at each jamb to overhead structural supports or substrates above frame unless frame is anchored to masonry or to other structural support at each jamb. Bend top of struts to provide flush contact for securing to supporting construction. Provide adjustable wedged or bolted anchorage to frame jamb members.

8. Installation Tolerances: Adjust hollow metal door frames for squareness, alignment, twist, and plumb to the following tolerances:

   a. Squareness: Plus or minus 1/16 inch (1.6 mm), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
   b. Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.
   c. Twist: Plus or minus 1/16 inch (1.6 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
   d. Plumbness: Plus or minus 1/16 inch (1.6 mm), measured at jambs at floor.

3.4 ADJUSTING AND CLEANING

A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow metal work that is warped, bowed, or otherwise unacceptable.

B. Remove grout and other bonding material from hollow metal work immediately after installation.

C. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.

END OF SECTION 081113

SECTION 081416 - FLUSH WOOD DOORS

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. Solid-core doors with wood-veneer faces.
2. Factory finishing flush wood doors.
3. Factory fitting flush wood doors to frames and factory machining for hardware.

B. Related Requirements:
1. Section 088000 "Glazing" for glass view panels in flush wood doors.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of door. Include details of core and edge construction and trim for openings. Include factory-finishing specifications.

B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; and the following:

1. Dimensions and locations of blocking.
2. Dimensions and locations of mortises and holes for hardware.
3. Dimensions and locations of cutouts.
4. Requirements for veneer matching.
5. Doors to be factory finished and finish requirements.
6. Fire-protection ratings for fire-rated doors.

C. Samples for Verification:

1. Factory finishes applied to actual door face materials, approximately 8 by 10 inches (200 by 250 mm), for each material and finish. For each wood species and transparent finish, provide set of three Samples showing typical range of color and grain to be expected in finished Work.

1.5 INFORMATIONAL SUBMITTALS

A. Sample Warranty: For special warranty.

B. Quality Standard Compliance Certificates: AWI Quality Certification Program certificates.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer that is a certified participant in AWI's Quality Certification Program.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Comply with requirements of referenced standard and manufacturer's written instructions.

B. Package doors individually in cardboard cartons and wrap bundles of doors in plastic sheeting.

C. Mark each door on bottom rail with opening number used on Shop Drawings.

1.8 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install doors until 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.

1.9 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Warping (bow, cup, or twist) more than 1/4 inch (6.4 mm) in a 42-by-84-inch (1067-by-2134-mm) section.
b. Telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch (0.25 mm in a 76.2-mm) span.

2. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.
3. Warranty Period for Solid-Core Interior Doors: Life of installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Algoma Hardwoods, Inc.
2. Eggers Industries.
3. Graham Wood Doors; an Assa Abloy Group company.
4. Marshfield Door Systems, Inc.
5. Mohawk Doors; a Masonite company.
6. VT Industries, Inc.

B. Source Limitations: Obtain flush wood doors from single manufacturer.

2.2 FLUSH WOOD DOORS, GENERAL

A. Quality Standard: In addition to requirements specified, comply with AWI's "Architectural Woodwork Standards and WDMA I.S.1-A, "Architectural Wood Flush Doors."
1. Provide AWI Quality Certification Labels or an AWI letter of licensing for Project indicating that doors comply with requirements of grades specified.
2. Contract Documents contain selections chosen from options in quality standard and additional requirements beyond those of quality standard. Comply with those selections and requirements in addition to quality standard.

B. Low-Emitting Materials: Fabricate doors with adhesives and composite wood products that do not contain urea formaldehyde.

C. WDMA I.S.1-A Performance Grade:

1. Heavy Duty unless otherwise indicated.
2. Extra Heavy Duty: Public toilets, janitor's closets, exits and patient rooms.

D. Fire-Rated Wood Doors: Doors complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252.
1. Cores: Provide core specified or mineral core as needed to provide fire-protection rating indicated.
2. Edge Construction: Provide edge construction with intumescent seals concealed by outer stile. Comply with specified requirements for exposed edges.
3. Pairs: Provide formed-steel edges and astragals with intumescent seals.

E. Smoke- and Draft-Control Door Assemblies: Listed and labeled for smoke and draft control, based on testing according to UL 1784.

F. Particleboard-Core Doors:

1. Particleboard: ANSI A208.1, Grade LD-1 or Grade LD-2, made with binder containing no urea-formaldehyde.
2. Blocking: Provide wood blocking in particleboard-core doors as needed to eliminate through-bolting hardware.

G. Mineral-Core Doors:

1. Core: Noncombustible mineral product complying with requirements of referenced quality standard and testing and inspecting agency for fire-protection rating indicated.
2. Blocking: Provide composite blocking with improved screw-holding capability approved for use in doors of fire-protection ratings indicated as needed to eliminate through-bolting hardware.

3. Edge Construction: At hinge stiles, provide laminated-edge construction with improved screw-holding capability and split resistance. Comply with specified requirements for exposed edges.

   a. Screw-Holding Capability: 550 lbf (2440 N) per WDMA T.M.-10.

2.3 VENEER-FACED DOORS FOR TRANSPARENT FINISH

A. Interior Solid-Core Doors:

1. Grade: Premium, with Grade AA faces.
2. Species: Red oak.
3. Cut: Plain sliced (flat sliced).
4. Match between Veneer Leaves: Book match.
5. Assembly of Veneer Leaves on Door Faces: Balance match.
6. Pair and Set Match: Provide for doors hung in same opening.
7. Room Match: Match door faces within each separate room or area of building. Corridor-door faces do not need to match where they are separated by 20 feet (6 m) or more.
8. Exposed Vertical Edges: Same species as faces or a compatible species.
9. Core: Particleboard.
10. Construction: Five or seven plies. Stiles and rails are bonded to core, then entire unit is abrasive planed before veneering. Faces are bonded to core using a hot press.

2.4 LIGHT FRAMES

A. Wood Beads for Light Openings in Wood Doors: Provide manufacturer's standard wood beads unless otherwise indicated.

1. Wood Species: Same species as door faces.
2. Profile: Match hospital standard.
3. At wood-core doors with 20-minute fire-protection ratings, provide wood beads and metal glazing clips approved for such use.

B. Wood-Veneered Beads for Light Openings in Fire-Rated Doors: Manufacturer's standard wood-veneered noncombustible beads matching veneer species of door faces and approved for use in doors of fire-protection rating indicated. Include concealed metal glazing clips where required for opening size and fire-protection rating indicated.

2.5 FABRICATION

A. Factory fit doors to suit frame-opening sizes indicated. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.

1. Comply with NFPA 80 requirements for fire-rated doors.

B. Factory machine doors for hardware that is not surface applied. Locate hardware to comply with DHI-WDHS-3. Comply with final hardware schedules, door frame Shop Drawings, BHMA-156.115-W, and hardware templates.

1. Coordinate with hardware mortises in metal frames to verify dimensions and alignment before factory machining.

C. Openings: Factory cut and trim openings through doors.

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 088000 "Glazing."

2.6 FACTORY FINISHING

A. General: Comply with referenced quality standard for factory finishing. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.

1. Finish faces, all four edges, edges of cutouts, and mortises. Stains and fillers may be omitted on top and bottom edges, edges of cutouts, and mortises.

B. Factory finish doors.

C. Transparent Finish:

1. Grade: Premium.
2. Finish: AWI's System 5, conversion varnish.
3. Staining: As selected by Architect from manufacturer's full range.
4. Effect: Open-grain finish.
5. Sheen: Satin.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and installed door frames, with Installer present, before hanging doors.

1. Verify that installed 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.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Hardware: For installation, see Section 087100 "Door Hardware."

B. Installation Instructions: Install doors to comply with manufacturer's written instructions and referenced quality standard, and as indicated.

1. Install fire-rated doors according to NFPA 80.
2. Install smoke- and draft-control doors according to NFPA 105.

C. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.

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 081416

SECTION 083113 - ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Access doors and frames for walls and ceilings.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, fire ratings, materials, individual components and profiles, and finishes.

B. Shop Drawings:

1. Include plans, elevations, sections, details, and attachments to other work.
2. Detail fabrication and installation of access doors and frames for each type of substrate.

C. Product Schedule: Provide complete access door and frame schedule, including types, locations, sizes, latching or locking provisions, and other data pertinent to installation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Rated Access Doors and Frames: Units complying with NFPA 80 that are identical to access door and frame assemblies tested for fire-test-response characteristics according to the following test method and that are listed and labeled by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:

1. NFPA 252 or UL 10B for fire-rated access door assemblies installed vertically.
2. NFPA 288 for fire-rated access door assemblies installed horizontally.

2.2 ACCESS DOORS AND FRAMES FOR WALLS AND CEILINGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Access Panel Solutions.
2. Acudor Products, Inc.
3. Alfab, Inc.
4. Babcock-Davis.
5. Cendrex Inc.
6. Elmdor/Stoneman Manufacturing Co.; Div. of Acorn Engineering Co.
7. Jensen Industries; Div. of Broan-Nutone, LLC.
8. J. L. Industries, Inc.; Div. of Activar Construction Products Group.
9. Karp Associates, Inc.
10. Larsen's Manufacturing Company.
11. Maxam Metal Products Limited.
12. Metropolitan Door Industries Corp.
13. MIFAB, Inc.
14. Milcor Inc.
15. Nystrom, Inc.
16. Williams Bros. Corporation of America (The).

B. Source Limitations: Obtain each type of access door and frame from single source from single manufacturer.

C. Flush Access Doors with Concealed Flanges:
1. Assembly Description: Fabricate door to fit flush to frame. Provide frame with gypsum board beads for concealed flange installation.
2. Locations: Wall and ceiling.
3. Uncoated Steel Sheet for Door: Nominal 0.060 inch (1.52 mm), 16 gage.
    a. Finish: Factory prime.
    b. Where galvanized finish is indicated, provide metallic-coated steel sheet for door: Nominal 0.064 inch (1.63 mm), 16 gage.
        1) Finish: Factory prime.
4. Frame Material: Same material and thickness as door.
5. Hinges: Manufacturer's standard.
6. Hardware: Latch.

D. Fire-Rated, Flush Access Doors with Concealed Flanges:
1. Assembly Description: Fabricate door to fit flush to frame, uninsulated. Provide self-latching door with automatic closer and interior latch release. Provide frame with gypsum board beads for concealed flange installation.
2. Locations: Wall and ceiling.
3. Fire-Resistance Rating: Not less than that of adjacent construction.
4. Uncoated Steel Sheet for Door: Nominal 0.036 inch (0.91 mm), 20 gage.
    a. Finish: Factory prime.
    b. Where galvanized finish is indicated, provide metallic-coated steel sheet for door: Nominal 0.040 inch (1.02 mm), 20 gage.

1) Finish: Factory prime.

5. Frame Material: Same material, thickness, and finish as door.
6. Hinges: Manufacturer's standard.
7. Hardware: Latch.

E. Hardware:

1. Latch: Cam latch operated by screwdriver with interior release.

2.3 MATERIALS

A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

B. Steel Sheet: Uncoated or electrolytic zinc coated, ASTM A 879/A 879M, with cold-rolled steel sheet substrate complying with ASTM A 1008/A 1008M, Commercial Steel (CS), exposed.

C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.

D. Frame Anchors: Same type as door face.

E. Inserts, Bolts, and Anchor Fasteners: Hot-dip galvanized steel according to ASTM A 153/A 153M or ASTM F 2329.

2.4 FABRICATION

A. General: Provide access door and frame 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 doors to types of supports indicated.

1. For concealed flanges with drywall bead, provide edge trim for gypsum board securely attached to perimeter of frames.
2. Provide mounting holes in frames for attachment of units to metal or wood framing.

D. Latching Mechanisms: Furnish number required to hold doors in flush, smooth plane when closed.

2.5 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. 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.

D. Steel and Metallic-Coated-Steel Finishes:

1. Factory Prime: Apply manufacturer's standard, fast-curing, lead- and chromate-free, universal primer immediately after surface preparation and pretreatment.

PART 3 - EXECUTION

3.1 PREPARATION

A. Review locations required for access doors with installers of equipment, controls, and other miscellaneous devices requiring access after completion of construction activities. Document access panel locations and sizes in schedule indicated under “Submittals” article.

B. Advise installers of other work about specific requirements relating to access door and floor door installation, including sizes of openings to receive access door and frame, as well as locations of supports, inserts, and anchoring devices.

3.2 EXAMINATION

A. Examine substrates 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.

3.3 INSTALLATION

A. Comply with manufacturer's written instructions for installing access doors and frames.

B. 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 and frames that are warped, bowed, or otherwise damaged.

END OF SECTION 083113

SECTION 084113 - ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
1. Storefront framing for punched openings.
2. Exterior manual-swing entrance doors and door-frame units.

B. Related Sections:
1. Section 084229.23 "Sliding Automatic Entrances" for sliding automatic entrances.
2. Section 084243 "Intensive Care Unit/Critical Care Unit (ICU/CCU) Entrances" for manual-sliding entrances.

1.3 DEFINITIONS

A. ADA/ABA Accessibility Guidelines: U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disability Act (ADA) and Architectural Barriers Act (ABA) Accessibility Guidelines for Buildings and Facilities."

1.4 PERFORMANCE REQUIREMENTS

A. General Performance: Aluminum-framed systems shall withstand the effects of the following performance requirements without exceeding performance criteria or failure due to defective manufacture, fabrication, installation, or other defects in construction:

1. Movements of supporting structure indicated on Drawings including, but not limited to, story drift and deflection from uniformly distributed and concentrated live loads.
2. Dimensional tolerances of building frame and other adjacent construction.
3. Failure includes the following:

a. Deflection exceeding specified limits.
b. Thermal stresses transferring to building structure.
c. Framing members transferring stresses, including those caused by thermal and structural movements to glazing.
d. Noise or vibration created by wind and by thermal and structural movements.
e. Loosening or weakening of fasteners, attachments, and other components.
f. Sealant failure.
g. Failure of operating units.

B. Structural Loads:

1. Wind Loads: As indicated on Drawings.

2. Seismic Loads: As indicated on Drawings.

C. Deflection of Framing Members:

1. Deflection Normal to Wall Plane: Limited to 1/175 of clear span for spans up to 13 feet 6 inches (4.1 m) and to 1/240 of clear span plus 1/4 inch (6.35 mm) for spans greater than 13 feet 6 inches (4.1 m)] or an amount that restricts edge deflection of individual glazing lites to 3/4 inch (19 mm), whichever is less.
2. Deflection Parallel to Glazing Plane: Limited to L/360 of clear span or 1/8 inch (3.2 mm), whichever is smaller and limited to an 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 directly below them to less than 1/8 inch (3.2 mm) and clearance between members and operable units directly below them to less than 1/16 inch (1.5 mm).

D. Structural-Test Performance: Provide aluminum-framed systems tested according to ASTM E 330 as follows:

1. When tested at positive and negative wind-load design pressures, systems do not evidence deflection exceeding specified limits.
2. When tested at 150 percent of positive and negative wind-load design pressures, systems, including anchorage, do not evidence material failures, structural distress, and permanent deformation of main framing members exceeding 0.2 percent of span.
3. Test Durations: As required by design wind velocity, but not fewer than 10 seconds.

E. Air Infiltration: Provide aluminum-framed systems with maximum air leakage through fixed glazing and framing areas of 0.06 cfm/sq. ft. (0.03 L/s per sq. m) of fixed wall area when tested according to ASTM E 283 at a minimum static-air-pressure difference of 1.57 lbf/sq. ft. (75 Pa).

F. Water Penetration under Static Pressure: Provide aluminum-framed systems that do not evidence water penetration through fixed glazing and framing areas when tested according to ASTM E 331 at a minimum static-air-pressure difference of 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft. (300 Pa).

G. Thermal Movements: Provide aluminum-framed systems that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

2. Interior Ambient-Air Temperature: 75 deg F (24 deg C).

H. Condensation Resistance: Provide aluminum-framed systems with fixed glazing and framing areas having condensation-resistance factor (CRF) of not less than 45 when tested according to AAMA 1503.

I. Thermal Conductance: Provide aluminum-framed systems with fixed glazing and framing areas having an average U-factor of not more than 0.69 Btu/sq. ft. x h x deg F (3.92 W/sq. m x K) when tested according to AAMA 1503.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for aluminum-framed systems.

B. Shop Drawings: For aluminum-framed systems. Include plans, elevations, sections, details, and attachments to other work.

1. Include details of provisions for system expansion and contraction and for drainage of moisture in the system to the exterior.
2. For entrance doors, include hardware schedule and indicate operating hardware types, functions, quantities, and locations.

C. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.

D. Other Action Submittals:

1. Entrance Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of entrance door hardware, as well as procedures and diagrams. Coordinate final entrance door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of entrance door hardware.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer and testing agency.

B. Seismic Qualification Certificates: For aluminum-framed systems, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

C. Welding certificates.

D. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for aluminum-framed systems, indicating compliance with performance requirements.

E. Source quality-control reports.

F. Field quality-control reports.

G. Warranties: Sample of special warranties.

1.7 CLOSEOUT SUBMITTALS

A. Maintenance Data: For aluminum-framed systems to include in maintenance manuals.

1.8 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

B. Testing Agency Qualifications: Qualified according to ASTM E 699 for testing indicated.

C. Product Options: Information on Drawings and in Specifications establishes requirements for systems' aesthetic effects and performance characteristics. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods including preconstruction testing, field testing, and in-service performance.

1. Do not revise intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If revisions are proposed, submit comprehensive explanatory data to Architect for review.

D. Accessible Entrances: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.

E. Source Limitations for Aluminum-Framed Systems: Obtain from single source from single manufacturer.

F. Welding Qualifications: Qualify procedures and personnel according to AWS D1.2, "Structural Welding Code - Aluminum."

G. Preinstallation Conference: Conduct conference at Project site.

1.9 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of structural supports for aluminum-framed systems by field measurements before fabrication and indicate measurements on Shop Drawings.

1.10 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of aluminum-framed systems that do not comply with requirements or that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including, but not limited to, excessive deflection.
b. Noise or vibration caused by thermal movements.
c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
d. Water leakage through fixed glazing and framing areas.
e. Failure of operating components.

2. Warranty Period: Two years from date of Substantial Completion.

B. Special Finish Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components on which finishes do not comply with requirements or that fail in materials or workmanship within specified warranty period. Warranty does not include normal weathering.

1. Warranty Period: Five years from date of Substantial Completion.

1.11 MAINTENANCE SERVICE

A. Entrance Door Hardware:

1. 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 entrance door hardware.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide **Trifab VersaGlaze 451T Framing with Series 500 Wide Stile Entrances by Kawneer North America; an Alcoa company** or comparable product by one of the following:

1. Arcadia, Inc.
2. Arch Aluminum & Glass Co., Inc.
3. CMI ArchitecturalCommercial Architectural Products, Inc.
4. EFCO Corporation.
5. Leed Himmel Industries, Inc.
6. Pittco Architectural Metals, Inc.
7. TRACO.
8. Tubelite.
9. United States Aluminum.
10. Vistawall Architectural Products; The Vistawall Group; a Bluescope Steel company.
11. 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 (ASTM B 209M).
2. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221 (ASTM B 221M).
3. Extruded Structural Pipe and Tubes: ASTM B 429.
4. Structural Profiles: ASTM B 308/B 308M.
5. Welding Rods and Bare Electrodes: AWS A5.10/A5.10M.

B. Steel Reinforcement: Manufacturer's standard zinc-rich, corrosion-resistant primer, complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreat-

ment. Select surface preparation methods according to recommendations in SSPC-SP COM and prepare surfaces according to applicable SSPC standard.

1. Structural Shapes, Plates, and Bars: ASTM A 36/A 36M.
2. Cold-Rolled Sheet and Strip: ASTM A 1008/A 1008M.
3. Hot-Rolled Sheet and Strip: ASTM A 1011/A 1011M.

2.3 FRAMING SYSTEMS

A. Framing Members: Manufacturer's standard extruded-aluminum framing members of thickness required and reinforced as required to support imposed loads.

1. Construction: Thermally broken.
2. Glazing System: Retained mechanically with gaskets on four sides.
3. Glazing Plane: Center.

B. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

C. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.

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.

D. Concealed Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials.

E. Framing System Gaskets and Sealants: Manufacturer's standard, recommended by manufacturer for joint type.

2.4 GLAZING SYSTEMS

A. Glazing: As specified in Section 088000 "Glazing."

B. Glazing Gaskets: Manufacturer's standard compression types; replaceable, molded or extruded, of profile and hardness required to maintain watertight seal.

C. Spacers and Setting Blocks: Manufacturer's standard elastomeric type.

2.5 ENTRANCE DOOR SYSTEMS

A. Entrance Doors: Manufacturer's standard glazed entrance doors for manual-swing operation.

1. Door Construction: 1-3/4-inch (44.5-mm) overall thickness, with minimum 0.125-inch-(3.2-mm-) thick, extruded-aluminum tubular rail and stile members. Mechanically fasten

corners with reinforcing brackets that are deeply penetrated and fillet welded or that incorporate concealed tie rods.

2. Door Design: Wide stile; 5-inch (127-mm) nominal width.

   a. Accessible Doors: Smooth surfaced for width of door in area within 10 inches (255 mm) above floor or ground plane.

3. Glazing Stops and Gaskets: Square, snap-on, extruded-aluminum stops and preformed gaskets.

   a. Provide nonremovable glazing stops on outside of door.

2.6 ENTRANCE DOOR HARDWARE

A. General: Provide entrance door hardware and entrance door hardware sets indicated in door and frame schedule for each entrance door to comply with requirements in this Section.

1. Entrance Door Hardware Sets: Provide quantity, item, size, finish or color indicated, and products equivalent in function and comparable in quality to named products and products complying with BHMA standard referenced.
2. Sequence of Operation: Provide electrified door hardware function, sequence of operation, and interface with other building control systems indicated.
3. Opening-Force Requirements:

   a. Egress Doors: Not more than 15 lbf (67 N) to release the latch and not more than 30 lbf (133 N)to set the door in motion and not more than 15 lbf (67 N) to open the door to its minimum required width.

B. Designations: Requirements for design, grade, function, finish, size, and other distinctive qualities of each type of entrance door hardware are indicated herein and on drawings. Products are identified by using entrance door hardware designations as follows:

1. Named Manufacturers' Products: Manufacturer and product designation are listed for each door hardware type required for the purpose of establishing minimum requirements.
2. References to BHMA Standards: Provide products complying with these standards and requirements for description, quality, and function.

C. Opening-Force Requirements:

1. Delayed-Egress Locks: Lock releases within 15 seconds after applying a force of not more than 15 lbf (67 N) for not more than 3 seconds.
2. Latches and Exit Devices: Not more than 15 lbf (67 N) required to release latch.

D. Pivot Hinges: BHMA A156.4, Grade 1.

1. Offset-Pivot Hinges: Provide top, bottom, and intermediate offset pivots at each door leaf.

E. Mortise Auxiliary Locks: BHMA A156.5, Grade 1.

F. Panic Exit Devices: BHMA A156.3, Grade 1, listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for panic protection, based on testing according to UL 305.

G. Cylinders: As specified in Section 087100 "Door Hardware."

H. Strikes: Provide strike with black-plastic dust box for each latch or lock bolt; fabricated for aluminum framing.

I. Operating Trim: BHMA A156.6.

J. Closers: BHMA A156.4, Grade 1, with accessories required for a complete installation, sized as required by door size, exposure to weather, and anticipated frequency of use; adjustable to meet field conditions and requirements for opening force.

K. Weather Stripping: Manufacturer's standard replaceable components.

1. Compression Type: Made of ASTM D 2000, molded neoprene, or ASTM D 2287, molded PVC.

L. Weather Sweeps: Manufacturer's standard exterior-door bottom sweep with concealed fasteners on mounting strip.

M. Silencers: BHMA A156.16, Grade 1.

N. Thresholds: BHMA A156.21, raised thresholds beveled with a slope of not more than 1:2, with maximum height of 1/2 inch (13 mm).

O. Finger Guards: Manufacturer's standard collapsible neoprene or PVC gasket anchored to frame hinge-jamb at center-pivoted doors.

2.7 ACCESSORY MATERIALS

A. Joint Sealants: For installation at perimeter of aluminum-framed systems, as specified in Section 079200 "Joint Sealants."

B. Bituminous Paint: Cold-applied, asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos; formulated for 30-mil (0.762-mm) thickness per coat.

2.8 FABRICATION

A. Form or extrude aluminum shapes before finishing.

B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.

C. Framing Members, General: Fabricate components that, when assembled, have the following characteristics:

1. Profiles that are sharp, straight, and free of defects or deformations.

2. Accurately fitted joints with ends coped or mitered.
3. Means to drain water passing joints, condensation within framing members, and moisture migrating within the system to exterior.
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. Provisions for field replacement of glazing from interior.
7. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.

D. Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.

E. 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 weather stripping at fixed stops.

F. 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.

G. Entrance Door Hardware Installation: Factory install entrance door hardware to the greatest extent possible. Cut, drill, and tap for factory-installed entrance door hardware before applying finishes.

H. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.9 ALUMINUM FINISHES

A. Clear Anodic Finish at Entrance Doors: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.

B. Clear Anodic Finish at Storefront Framing: AAMA 611, AA-M12C22A31, Class II, 0.010 mm or thicker.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General:

1. Comply with manufacturer's written instructions.
2. Do not install damaged components.
3. Fit joints to produce hairline joints free of burrs and distortion.
4. Rigidly secure nonmovement joints.
5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration.
6. Seal joints watertight unless otherwise indicated.

B. Metal Protection:

1. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or applying sealant or tape, or by installing nonconductive spacers as recommended by manufacturer for this purpose.
2. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

C. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within the system to exterior.

D. Set continuous sill members and flashing in full sealant bed as specified in Section 079200 "Joint Sealants" to produce weathertight installation.

E. Install components plumb and true in alignment with established lines and grades, and without warp or rack.

F. Install glazing as specified in Section 088000 "Glazing."

G. 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.

H. Install perimeter joint sealants as specified in Section 079200 "Joint Sealants" to produce weathertight installation.

3.3 ERECTION TOLERANCES

A. Install aluminum-framed systems to comply with the following maximum erection tolerances:

1. Location and Plane: Limit variation from true location and plane to 1/8 inch in 12 feet (3 mm in 3.7 m); 1/4 inch (6 mm) over total length.
2. Alignment:

a. Where surfaces abut in line, limit offset from true alignment to 1/16 inch (1.5 mm).
b. Where surfaces meet at corners, limit offset from true alignment to 1/32 inch (0.8 mm).

B. Diagonal Measurements: Limit difference between diagonal measurements to 1/8 inch (3 mm).

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified independent testing and inspecting agency to perform field tests and inspections.

B. Testing Services: Testing and inspecting of representative areas to determine compliance of installed systems with specified requirements shall take place as follows and in successive phases as indicated on Drawings. Do not proceed with installation of the next area until test results for previously completed areas show compliance with requirements.
   1. Air Infiltration: Areas shall be tested for air leakage of 1.5 times the rate specified for laboratory testing under "Performance Requirements" Article, but not more than 0.09 cfm/sq. ft. (0.03 L/s per sq. m), of fixed wall area when tested according to ASTM E 783 at a minimum static-air-pressure difference of 1.57 lbf/sq. ft. (75 Pa).
   2. Water Penetration: Areas shall be tested according to ASTM E 1105 at a minimum static-air-pressure difference of 0.67 times the static-air-pressure difference specified for laboratory testing under "Performance Requirements" Article, but not less than 4.18 lbf/sq. ft. (200 Pa), and shall not evidence water penetration.
   3. Water Spray Test: Before installation of interior finishes has begun, a minimum of 3 punched openings designated by Architect shall be tested according to AAMA 501.2 and shall not evidence water penetration.

C. Repair or remove work if test results and inspections indicate that it does not comply with specified requirements.

D. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

E. Aluminum-framed assemblies will be considered defective if they do not pass tests and inspections.

F. Prepare test and inspection reports.

3.5 ADJUSTING

A. Adjust operating entrance door hardware to function smoothly as recommended by manufacturer.

   1. For entrance doors accessible to people with disabilities, adjust closers to provide a 3-second closer sweep period for doors to move from a 70-degree open position to 3 inches (75 mm) from the latch, measured to the leading door edge.

END OF SECTION 084113

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SECTION 084229.23 - SLIDING AUTOMATIC ENTRANCES

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 exterior, sliding, power-operated automatic entrances.

B. Related Requirements:
1. Section 084243 "Intensive Care Unit/Critical Care Unit (ICU/CCU) Entrances" for swinging-sliding, manual ICU/CCU entrance door assemblies.
2. Section 087113 "Automatic Door Operators" for automatic door operators furnished separately from doors and frames.

1.3 DEFINITIONS

A. AAADM: American Association of Automatic Door Manufacturers.

B. Activation Device: A control that, when actuated, sends an electrical signal to the door operator to open the door.

C. IBC: International Building Code.

D. Safety Device: A control that, to avoid injury, prevents a door from opening or closing.

E. For automatic door terminology, refer to BHMA A156.10 for definitions of terms.

1.4 COORDINATION

A. Templates: Distribute for doors, frames, and other work specified to be factory prepared for installing automatic entrances. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing automatic entrances to comply with indicated requirements.

B. Coordinate hardware with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish. Coordinate hardware for automatic entrances with hardware required for rest of Project.

C. Electrical System Roughing-in: Coordinate layout and installation of automatic entrances with connections to power supplies and access-control system.

1.5 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.6 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for automatic entrances.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: For automatic entrances.

1. Include plans, elevations, sections, hardware mounting heights, and attachment details.
2. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include diagrams for power, signal, and control wiring.
4. Indicate locations of activation and safety devices.
5. Include hardware schedule and indicate hardware types, functions, quantities, and locations.

C. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.

D. Delegated-Design Submittal: For automatic entrances.

1.7 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer, manufacturer and Certified Inspector.

B. Product Certificates: For each type of automatic entrance. Include emergency-exit features of automatic entrances serving as a required means of egress.

C. Product Test Reports: For each type of automatic entrance, for tests performed by a qualified testing agency.

D. Field quality-control reports.

E. Sample Warranties: For manufacturer's special warranties.

1.8 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For automatic entrances, safety devices, and control systems to include in operation and maintenance manuals.

1.9 QUALITY ASSURANCE

A. Manufacturer Qualifications: A manufacturer with company certificate issued by AAADM indicating that manufacturer has a Certified Inspector on staff.

B. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation and maintenance of units required for this Project and who employs a Certified Inspector.

1. Maintenance Proximity: Not more than two hours' normal travel time from Installer's place of business to Project site.

C. Certified Inspector Qualifications: Certified by AAADM.

1.10 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of automatic entrances that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including, but not limited to, excessive deflection.
b. Faulty operation of operators, controls, and hardware.
c. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.

2. Warranty Period: Two years from date of Substantial Completion.

B. Special Finish Warranty: Manufacturer agrees to repair or replace components on which finishes fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 AUTOMATIC ENTRANCE ASSEMBLIES

A. Source Limitations: Obtain sliding automatic entrances from single source from single manufacturer.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Power-Operated Door Standard: BHMA A156.10.

2.2 PERFORMANCE REQUIREMENTS

A. Structural Performance: Automatic entrances shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.

B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

C. Operating Temperature Range: Automatic entrances shall operate within minus 20 to plus 122 deg F (minus 29 to plus 50 deg C).

D. Air Infiltration: Maximum air leakage through fixed glazing and framing areas of 1.25 cfm/sq. ft. (6.4 L/s x sq. m) of fixed entrance-system area when tested according to ASTM E 283 at a minimum static-air-pressure difference of 1.57 lbf/sq. ft. (75 Pa).

E. Opening Force:

1. Power-Operated Doors: Not more than 50 lbf (222 N) required to manually set door in motion if power fails, and not more than 15 lbf (67 N) required to open door to minimum required width.
2. Breakaway Device for Power-Operated Doors: Not more than 50 lbf (222 N) required for a breakaway door or panel to open.

F. Entrapment-Prevention Force:

1. Power-Operated Sliding Doors: Not more than 30 lbf (133 N) required to prevent stopped door from closing.

2.3 SLIDING AUTOMATIC ENTRANCES

A. General: Provide manufacturer's standard automatic entrances including doors, sidelites, framing, headers, carrier assemblies, roller tracks, door operators, controls, and accessories required for a complete installation.

B. Telescoping Automatic Entrance:
1. Basis-of-Design Product: Subject to compliance with requirements, provide **Dura-Max Series 5400 Telescopic Slide Door System** by **Stanley Access Technologies, LLC; Division of Stanley Security Solutions** or comparable product by one of the following:

a. Biparting-Telescoping Sliding Units:

1) Besam Entrance Solutions; Subsidiary of ASSA ABLOY Entrance Systems.
2) Horton Automatics; a division of Overhead Door Corporation.

2. Configuration: Biparting-telescoping-sliding doors with four sliding leaves and sidelites.

a. Traffic Pattern: Two way.
b. Emergency Breakaway Capability: All leaves.
c. Mounting: Between jambs.

3. Operator Features:

a. Power opening and closing.
b. Drive System: Manufacturer's standard.
c. Adjustable opening and closing speeds.
d. Adjustable hold-open time between zero and 30 seconds.
e. Obstruction recycle.
f. On-off/hold-open switch to control electric power to operator, key operated.

4. Sliding-Door Carrier Assemblies and Overhead Roller Tracks: Carrier assembly that allows vertical adjustment; consisting of nylon- or delrin-covered, ball-bearing-center steel wheels operating on a continuous roller track, or ball-bearing-center steel wheels operating on a nylon- or delrin-covered, continuous roller track. Support doors from carrier assembly by cantilever and pivot assembly.

a. Rollers: Minimum of two ball-bearing roller wheels and two antirise rollers for each active leaf.

5. Sliding-Door Threshold: Threshold members and bottom-guide-track system with stainless-steel, ball-bearing-center roller wheels.
a. Configuration: No threshold across door opening and surface-mounted guide-track system at sidelites.

6. Controls: Activation and safety devices according to BHMA standards.

a. Provide Combination Activation Device and Safety Device.
1) Activation Device: Motion sensor mounted on each side of door header to detect pedestrians in activating zone and to open door.
2) Safety Device: Presence sensor mounted on each side of door header and two photoelectric beams mounted in sidelite jambs on one side of the door to detect pedestrians in presence zone and to prevent door from closing.
b. Opening-Width Control: Two-position switch that in the normal position allows sliding doors to travel to full opening width and in the alternate position reduces opening to a selected partial opening width.

7. Finish: Finish framing, door(s), and header with Class I, clear anodic finish.

2.4 ENTRANCE COMPONENTS

A. Framing Members: Extruded aluminum, minimum 0.125 inch (3.2 mm) thick and reinforced as required to support imposed loads.

1. Nominal Size: 1-3/4 by 6 inches (45 by 150 mm).
2. Extruded Glazing Stops and Applied Trim: Minimum 0.062-inch (1.6-mm) wall thickness.

B. Stile and Rail Doors: 1-3/4-inch- (45-mm-) thick, glazed doors with minimum 0.125-inch- (3.2-mm-) thick, extruded-aluminum tubular stile and rail members. Mechanically fasten corners

with reinforcing brackets that are welded, or incorporate concealed tie-rods that span full length of top and bottom rails.

1. Glazing Stops and Gaskets: Square, snap-on, extruded-aluminum stops and preformed gaskets.
2. Stile Design: Narrow, as standard with basis-of-design product indicated.
3. Rail Design: 10-inch (254-mm) nominal height.

C. Sidelites: 1-3/4-inch- (45-mm-) deep sidelites with minimum 0.125-inch- (3.2-mm-) thick, extruded-aluminum tubular stile and rail members matching door design.

1. Glazing Stops and Gaskets: Same materials and design as for stile and rail door.

D. Headers: Fabricated from minimum 0.125-inch- (3.2-mm-) thick extruded aluminum and extending full width of automatic entrance units to conceal door operators and controls. Provide hinged or removable access panels for service and adjustment of door operators and controls. Secure panels to prevent unauthorized access.

1. Mounting: Concealed, with one side of header flush with framing.
2. Capacity: Capable of supporting doors up to 175 lb (79 kg) per leaf over spans up to 14 feet (4.3 m) without intermediate supports.

E. Brackets and Reinforcements: High-strength aluminum with nonstaining, nonferrous shims for aligning system components.

F. Signage: As required by cited BHMA standard.

1. Application Process: Door manufacturer's standard process.
2. Provide sign materials with instructions for field application after glazing is installed.

2.5 MATERIALS

A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.

1. Extrusions: ASTM B 221 (ASTM B 221M).
2. Sheet: ASTM B 209 (ASTM B 209M).

B. Steel Reinforcement: Reinforcement with corrosion-resistant primer complying with SSPC-PS Guide No. 12.00 applied immediately after surface preparation and pretreatment. Use surface preparation methods according to recommendations in SSPC-SP COM and prepare surfaces according to applicable SSPC standard.

C. Glazing: As specified in Section 088000 "Glazing."

D. Sealants and Joint Fillers: As specified in Section 079200 "Joint Sealants."

E. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187.

F. Fasteners and Accessories: Corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.

2.6 DOOR OPERATORS AND CONTROLS

A. General: Provide operators and controls, which include activation and safety devices, according to BHMA standards, for condition of exposure, and for long-term, maintenance-free operation under normal traffic load for type of occupancy indicated.

B. Door Operators: Provide door operators of size recommended by manufacturer for door size, weight, and movement.

1. Door Operator Performance: Door operators shall open and close doors and maintain them in fully closed position when subjected to Project's design wind loads.
2. Electromechanical Operators: Concealed, self-contained, overhead unit powered by fractional-horsepower, permanent-magnet dc motor; with closing speed controlled mechanically by gear train and dynamically by braking action of electric motor; with solid-state microprocessor controller; UL 325; and with manual operation with power off.

C. Motion Sensors: Self-contained, K-band-frequency, microwave-scanner units; fully enclosed by its plastic housing; adjustable to provide detection-field sizes and functions required by BHMA A156.10.

1. Provide capability for switching between bidirectional and unidirectional detection.
2. For one-way traffic, sensor on egress side shall not be active when doors are fully closed.

D. Presence Sensors: Self-contained, active-infrared scanner units; adjustable to provide detection-field sizes and functions required by BHMA A156.10; with relay hold time of not less than 2 to 10 seconds. Sensors shall remain active at all times.

E. Photoelectric Beams: Pulsed infrared, sender-receiver assembly for recessed mounting. Beams shall not be active when doors are fully closed.

F. Electrical Interlocks: Unless units are equipped with self-protecting devices or circuits, provide electrical interlocks to prevent activation of operator when door is locked, latched, or bolted.

2.7 HARDWARE

A. General: Provide units in sizes and types recommended by automatic entrance and hardware manufacturers for entrances and uses indicated. Finish exposed parts to match door finish.

B. Breakaway Device for Power-Operated Doors: Device that allows door to swing out in direction of egress to full 90 degrees from any operating position. Maximum force to open door shall be as stipulated in "Performance Requirements" Article. Interrupt powered operation of door operator while in breakaway mode.

C. Automatic Locking: Electrically controlled device mounted in header that automatically locks sliding door against sliding when in closed position. Provide fail safe operation if power fails.

1. Include concealed, vertical-rod exit devices, UL 305, with latching into threshold and overhead carrier assembly and released by push paddle; and that prevent emergency breakaway doors from swinging unless released to permit emergency egress.
2. Include locking devices for sidelites to prevent manual break out.

D. Weather Stripping: Replaceable components.

1. Sliding Type: AAMA 701, made of wool, polypropylene, or nylon woven pile with nylon-fabric or aluminum-strip backing.

2.8 FABRICATION

A. General: Factory fabricate automatic entrance components to designs, sizes, and thicknesses indicated and to comply with indicated standards.

1. Form aluminum shapes before finishing.
2. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.
3. Use concealed fasteners to greatest extent possible. Where exposed fasteners are required, use countersunk Phillips flat-head machine screws, fabricated from stainless steel.

a. Where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration, use self-locking devices.
b. Reinforce members as required to receive fastener threads.

4. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended by manufacturer for this purpose.

B. Framing: Provide automatic entrances as prefabricated assemblies. Complete fabrication, assembly, finishing, hardware application, and other work before shipment to Project site.

1. Fabricate tubular and channel frame assemblies with welded or mechanical joints. Provide subframes and reinforcement as required for a complete system to support required loads.
2. Perform fabrication operations in manner that prevents damage to exposed finish surfaces.
3. Form profiles that are sharp, straight, and free of defects or deformations.
4. Provide components with concealed fasteners and anchor and connection devices.
5. Fabricate components with accurately fitted joints with ends coped or mitered to produce hairline joints free of burrs and distortion.
6. Fabricate exterior components to drain condensation and water passing joints within system to the exterior.
7. Provide anchorage and alignment brackets for concealed support of assembly from building structure.
8. Allow for thermal expansion of exterior units.

C. Doors: Factory fabricated and assembled in profiles indicated. Reinforce as required to support imposed loads and for installing hardware.

D. Door Operators: Factory fabricated and installed in headers, including adjusting and testing.

E. Glazing: Fabricate framing with minimum glazing edge clearances for thickness and type of glazing indicated, according to GANA's "Glazing Manual."

F. Hardware: Factory install hardware to greatest extent possible; remove only as required for final finishing operation and for delivery to and installation at Project site. Cut, drill, and tap for factory-installed hardware before applying finishes.

1. Provide sliding-type weather stripping, mortised into door, at perimeter of doors and breakaway sidelites.

G. Controls:

1. General: Factory install activation and safety devices in doors and headers as required by BHMA A156.10 for type of door and direction of travel.
2. Install photoelectric beams in vertical jambs of sidelites, with dimension above finished floor as follows:

a. Top Beam: 48 inches (1219 mm).
b. Bottom Beam: 24 inches (610 mm).

2.9 GENERAL FINISH REQUIREMENTS

A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Apply anodic finishes to formed metal after fabrication unless otherwise indicated.

C. 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.

2.10 ALUMINUM FINISHES

A. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances, header support, and other conditions affecting performance of automatic entrances.

B. Examine roughing-in for electrical systems to verify actual locations of power connections before automatic entrance installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install automatic entrances according to manufacturer's written instructions and cited BHMA standard for direction of pedestrian travel, including signage, controls, wiring, and connection to the building's power supply.

1. Do not install damaged components. Fit frame joints to produce hairline joints free of burrs and distortion. Rigidly secure nonmovement joints. Seal joints watertight.
2. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended by manufacturer for this purpose.
3. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous coating.

B. Entrances: Install automatic entrances plumb and true in alignment with established lines and grades without warp or rack of framing members and doors. Anchor securely in place.

1. Install surface-mounted hardware using concealed fasteners to greatest extent possible.
2. Set headers, carrier assemblies, tracks, operating brackets, and guides level and true to location with anchorage for permanent support.
3. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within system to exterior.

C. Door Operators: Connect door operators to electrical power distribution system.

D. Access-Control Devices: Connect access-control devices to access-control system as specified in electrical documents.

E. Controls: Install and adjust activation and safety devices according to manufacturer's written instructions and cited BHMA standard for direction of pedestrian travel. Connect control wiring according to electrical documents.

F. Glazing: Install glazing as specified in Section 088000 "Glazing."

G. Sealants: Comply with requirements specified in Section 079200 "Joint Sealants" to provide weathertight installation.

1. Set framing members and flashings in full sealant bed.
2. Seal perimeter of framing members with sealant.

H. Signage: Apply signage on both sides of each door and breakaway sidelites as required by cited BHMA standard for direction of pedestrian travel.

I. Wiring within Automatic Entrance Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's written limitations on bending radii. Provide and use lacing bars and distribution spools.

3.3 FIELD QUALITY CONTROL

A. Certified Inspector: Engage a Certified Inspector to test and inspect components, assemblies, and installations, including connections.

B. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. Test and inspect each automatic entrance, using AAADM inspection forms, to determine compliance of installed systems with applicable BHMA standards.

C. Automatic entrances will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

3.4 ADJUSTING

A. Adjust hardware, moving parts, door operators, and controls to function smoothly, and lubricate as recommended by manufacturer; comply with requirements of applicable BHMA standards.

1. Adjust exterior doors for weathertight closure.

B. Readjust door operators and controls after repeated operation of completed installation equivalent to three days' use by normal traffic (100 to 300 cycles).

C. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

3.5 CLEANING

A. Clean glass and metal surfaces promptly after installation. Remove excess glazing and sealant compounds, dirt, and other substances. Repair damaged finish to match original finish.

1. Comply with requirements in Section 088000 "Glazing" for cleaning and maintaining glass.

3.6 MAINTENANCE SERVICE

A. Initial Maintenance Service: Beginning at Substantial Completion, maintenance service shall include 12 months' full maintenance by skilled employees of automatic entrance Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper automatic entrance operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.

1. Engage a Certified Inspector to perform safety inspection after each adjustment or repair and at end of maintenance period. Furnish completed inspection reports to Owner.

2. Include 24-hour-per-day, 7-day-per-week, emergency callback service.

3.7 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain automatic entrances.

END OF SECTION 084229.23

SECTION 084243 - INTENSIVE CARE UNIT/CRITICAL CARE UNIT (ICU/CCU) ENTRANCES

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 manually operated ICU/CCU entrances.

B. Related Section:

1. Section 084229.23 "Sliding Automatic Entrances" for entrances packaged with sliding automatic door operators and controls.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for ICU/CCU entrances.

B. Shop Drawings: For ICU/CCU entrances. Include plans, elevations, sections, details, hardware mounting heights, and attachments to other work.

C. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Warranties: Sample of special warranties.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation and maintenance of units required for this Project.

B. Source Limitations: Obtain ICU/CCU entrances from single source from single manufacturer.

C. Preinstallation Conference: Conduct conference at Project site.

1.6 PROJECT CONDITIONS

A. Field Measurements: Verify actual dimensions of openings to receive ICU/CCU entrances by field measurements before fabrication.

1.7 COORDINATION

A. Coordinate sizes and locations of recesses in concrete floors for recessed sliding tracks. Concrete, reinforcement, and formwork requirements are specified elsewhere.

B. Templates: Distribute for doors, frames, and other work specified to be factory prepared for installing ICU/CCU entrances.

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of ICU/CCU entrances that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including, but not limited to, excessive deflection.
b. Faulty operation of hardware.
c. Deterioration of metals, metal finishes, and other materials beyond normal use.

2. Warranty Period: Two years from date of Substantial Completion.

B. Special Finish Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components on which finishes fail within specified warranty period.

1. Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide **Dura-Glide 7500 TL-FBO** by **Stanley Access Technologies; Division of The Stanley Works** or comparable product by one of the following:

1. Besam Entrance Solutions; an ASSA ABLOY Group company.
2. Gildor, Inc.
3. Horton Automatics; a division of Overhead Door Corporation.
4. KM Systems, Inc.
5. Nabco Entrances, Inc.
6. Tormax Technologies, Inc.

2.2 MATERIALS

A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.

1. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221 (ASTM B 221M).
2. Sheet and Plate: ASTM B 209 (ASTM B 209M).

B. Sealants and Joint Fillers: As specified in Section 079200 "Joint Sealants."

C. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.3 ICU/CCU ENTRANCE ASSEMBLIES

A. General: Provide manufacturer's standard factory-glazed ICU/CCU entrances including door leaves, sidelites, framing, headers, carrier assemblies, roller tracks, and accessories required for a complete installation.

B. Opening-Force Requirement, Sliding: Not more than 5 lbf (22.2 N) to fully open door.

C. ICU/CCU Entrance:
1. Configuration: Single-telescoping three-panel door, with two operable leaves and one sidelite; with breakaway capability for sliding leaves and sidelite.
2. Mounting: Between jambs.
3. Floor Track Configuration: No track across sliding-door opening and at sidelites (trackless).
4. Finish: Finish framing, doors, sidelite, and header with Class II, clear anodic finish.

2.4 COMPONENTS

A. Framing Members: Manufacturer's standard extruded aluminum, minimum 0.125 inch (3.2 mm) thick and reinforced as required to support imposed loads.

1. Nominal Size: 1-3/4 by 6 inches (45 by 150 mm).
2. Extruded Glazing Stops and Applied Trim: Minimum 0.062-inch (1.6-mm) wall thickness.

B. Stile and Rail Doors: Manufacturer's standard 1-3/4-inch- (45-mm-) thick glazed doors with minimum 0.125-inch- (3.2-mm-) thick, extruded-aluminum tubular stile and rail members. Mechanically fasten corners with reinforcing brackets that are welded, or incorporate concealed tie rods that span full length of top and bottom rails.

1. Glazing Stops and Gaskets: Square, snap-on, extruded-aluminum stops and preformed gaskets for glazing indicated.
2. Stile Design: Narrow stile; 2-1/8-inch (55-mm) nominal width.
3. Rail Design: Minimum 4 inch (102-mm) nominal height.
4. Muntin Bars: None.

C. Sidelites: Manufacturer's standard 1-3/4-inch- (45-mm-) deep sidelites with minimum 0.125-inch- (3.2-mm-) thick, extruded-aluminum tubular stile and rail members matching door design and finish.

1. Glazing Stops and Gaskets: Same materials and design as for stile and rail door.
2. Muntin Bars: None.

D. Glazing: 6.0 mm (1/4-inch) fully tempered clear glass as specified in Section 088000 "Glazing."

E. Headers: Fabricated from minimum 0.125-inch- (3.2-mm-) thick extruded aluminum, and extending full width of ICU/CCU entrance units to conceal carrier assemblies and roller tracks. Provide hinged or removable access panels for service and adjustment. Secure panels to prevent unauthorized access.

1. Capacity: Capable of supporting doors up to 100 lb (45 kg) per leaf over spans up to 14 feet (4.3 m) without intermediate supports.
2. Provide sag rods for spans exceeding 14 feet (4.3 m).

F. Carrier Assemblies and Overhead Roller Tracks: Manufacturer's standard carrier assembly that allows vertical adjustment; consisting of nylon- or delrin-covered, ball-bearing-center steel wheels operating on a continuous roller track or of ball-bearing-center steel wheels operating on a nylon- or delrin-covered, continuous roller track. Support doors from carrier assembly by cantilever and pivot assembly. Provide minimum of two ball-bearing roller wheels and two antirise rollers for each active leaf.

G. Brackets and Reinforcements: Manufacturer's standard, high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

H. Fasteners and Accessories: Manufacturer's standard, corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.

2.5 HARDWARE

A. General: Provide units in sizes and types recommended by ICU/CCU entrance and hardware manufacturers for entrances and uses indicated. Finish exposed parts to match door finish unless otherwise indicated.

B. Breakaway Hardware: Provide release hardware that allows indicated panels to swing out in direction of egress to full 90 degrees from sliding mode.

1. Maximum Force to Open Panel: 50 lbf (222 N).
2. Release Position: At any point in sliding door travel.

C. Pulls: Manufacturer's standard recessed units on both sides of each operable door.

D. Positive Latch: Manufacturer's standard non-keyed, spring loaded, latch that can secure sliding door panels to adjacent panels or jambs. Latch shall engage by closing action of door.

E. Weather Stripping: Manufacturer's standard replaceable components.
1. Sliding Type: AAMA 701, wool, polypropylene, or nylon woven pile with nylon-fabric or aluminum-strip backing.

2.6 FABRICATION

A. General: Factory fabricate ICU/CCU entrance components to designs, sizes, and thicknesses indicated and to comply with indicated standards.

1. Fabricate aluminum components before finishing.
2. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.
3. Use concealed fasteners to greatest extent possible. Where exposed fasteners are required, use countersunk Phillips flat-head machine screws, finished to match framing.

a. Where fasteners are subject to loosening or turning out from structural movements or vibration, use self-locking devices.
b. Reinforce members as required to receive fastener threads.

4. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended by manufacturer for this purpose.

B. Framing: Provide ICU/CCU entrances as prefabricated assemblies. Complete fabrication, assembly, finishing, hardware application, and other work before shipment to Project site.

1. Fabricate tubular and channel frame assemblies with manufacturer's standard welded or mechanical joints. Provide subframes and reinforcement as required for a complete system to support required loads.
2. Perform fabrication operations in manner that prevents damage to exposed finish surfaces.
3. Form profiles that are straight and free of defects or deformations.
4. Provide components with concealed fasteners and anchor and connection devices.
5. Fabricate components with accurately fitted joints with ends coped or mitered to produce hairline joints free of burrs and distortion.
6. Provide anchorage and alignment brackets for concealed support of assembly from the building structure.

C. Doors: Factory fabricated and assembled in profiles indicated. Reinforce as required to support imposed loads and for installing hardware.

D. Glazing: Fabricate framing with minimum glazing edge clearances for thickness and type of glazing indicated, according to GANA's "Glazing Manual."

E. Hardware: Factory install hardware to the greatest extent possible; remove only as required for final finishing operation and for delivery to and installation at Project site. Cut, drill, and tap for factory-installed hardware before applying finishes.

1. Provide sliding weather stripping, mortised into door, at perimeter of sliding doors and breakaway sidelites.

2.7 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Apply anodic finishes to formed metal after fabrication unless otherwise indicated.

C. 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.

2.8 ALUMINUM FINISHES

A. Clear Anodic Finish: AAMA 611, AA-M12C22A31, Class II, 0.010 mm or thicker.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances, header support, and other conditions affecting performance of ICU/CCU entrances.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Do not install damaged components. Fit frame joints to produce hairline joints free of burrs and distortion. Rigidly secure nonmovement joints. Seal joints watertight.

1. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended by manufacturer for this purpose.
2. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous coating.

B. Install ICU/CCU entrances plumb and true in alignment with established lines and grades without warp or rack of framing members and doors. Anchor securely in place.

1. Install surface-mounted hardware using concealed fasteners to greatest extent possible.
2. Set headers, carrier assemblies, tracks, operating brackets, and guides level and true to location with anchorage for permanent support.

C. Glazing: Install glazing as specified in Section 088000 "Glazing."

D. Sealants: Comply with requirements in Section 079200 "Joint Sealants" for installing sealants, fillers, and gaskets.

1. Set framing members, floor tracks, and flashings in full sealant bed.
2. Seal perimeter of framing members with sealant.

3.3 ADJUSTING

A. Adjust operating hardware and moving parts for smooth and safe operation; lubricate as recommended by manufacturer.

B. Adjust force to open swing panels.

3.4 CLEANING AND PROTECTION

A. Clean glass and metal surfaces promptly after installation. Remove excess glazing and sealant compounds, dirt, and other substances. Repair damaged finish to match original finish.

B. Comply with requirements in Section 088000 "Glazing" for cleaning and protecting glass.

END OF SECTION 084243

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SECTION 087100 - DOOR HARDWARE

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. Mechanical door hardware for the following:

    a. Swinging doors.

2. Cylinders for door hardware specified in other Sections.
3. Electrified door hardware.

B. Related Sections:

1. Section 081113 "Hollow Metal Doors and Frames" for door silencers provided as part of hollow-metal frames.
2. Section 081416 "Flush Wood Doors" for astragals and integral intumescent seals provided as part of labeled fire-rated assemblies.
3. Section 083113 "Access Doors and Frames" for access door hardware.
4. Section 084113 "Aluminum-Framed Entrances and Storefronts" for entrance door hardware, except cylinders.
5. Section 084229.23 "Sliding Automatic Entrances" for entrance door hardware, except cylinders.
6. Section 084243 "Intensive Care Unit/Critical Care Unit (ICU/CCU) Entrances" for entrance door hardware.
7. Section 102600 "Wall and Door Protection" for plastic door protection units that match wall protection units.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include construction and installation details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: Details of electrified door hardware, indicating the following:

1. Wiring Diagrams: For power, signal, and control wiring and including the following:

    a. Details of interface of electrified door hardware and building safety and security systems.
    b. Schematic diagram of systems that interface with electrified door hardware.

c. Point-to-point wiring.
d. Risers.
e. Elevations doors controlled by electrified door hardware.

2. Operation Narrative: Describe the operation of doors controlled by electrified door hardware.

C. Other Action Submittals:

1. Door Hardware Schedule: Prepared by or under the supervision of Installer, detailing fabrication and assembly of door hardware, as well as installation procedures and diagrams. Coordinate final door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

a. Submittal Sequence: Submit door hardware schedule concurrent with submissions of Product Data, Samples, and Shop Drawings. Coordinate submission of door hardware schedule with scheduling requirements of other work to facilitate the fabrication of other work that is critical in Project construction schedule.
b. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule." Double space entries, and number and date each page. Use same scheduling sequence and format and use same door numbers as in the Contract Documents.
c. Content: Include the following information:

1) Identification number, location, hand, fire rating, size, and material of each door and frame.
2) Locations of each door hardware set, cross-referenced to Drawings on floor plans and to door and frame schedule.
3) Complete designations, including name and manufacturer, type, style, function, size, quantity, function, and finish of each door hardware product.
4) Description of electrified door hardware sequences of operation and interfaces with other building control systems.
5) Fastenings and other pertinent information.
6) Explanation of abbreviations, symbols, and codes contained in schedule.
7) Mounting locations for door hardware.
8) List of related door devices specified in other Sections for each door and frame.

2. Keying Schedule: Prepared by or under the supervision of Installer, detailing Owner's final keying instructions for locks. Include schematic keying diagram and index each key set to unique door designations that are coordinated with the Contract Documents.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and Architectural Hardware Consultant.

B. Product Certificates: For electrified door hardware, from the manufacturer.

1. Certify that door hardware approved for use on types and sizes of labeled fire-rated doors complies with listed fire-rated door assemblies.

C. Product Test Reports: For compliance with accessibility requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for door hardware on doors located in accessible routes.

D. Warranty: Special warranty specified in this Section.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of door hardware to include in maintenance manuals. Include final hardware and keying schedule.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Supplier of products and an employer of workers trained and approved by product manufacturers and an Architectural Hardware Consultant who is available during the course of the Work to consult with Contractor, Architect, and Owner about door hardware and keying.

1. Warehousing Facilities: In Project's vicinity.
2. Scheduling Responsibility: Preparation of door hardware and keying schedules.
3. Engineering Responsibility: Preparation of data for electrified door hardware, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.

B. Architectural Hardware Consultant Qualifications: A person who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project and who is currently certified by DHI as follows:

1. For door hardware, an Architectural Openings Consultant (AOC).

C. Source Limitations: Obtain each type of door hardware from a single manufacturer.

1. Provide electrified door hardware from same manufacturer as mechanical door hardware, unless otherwise indicated. Manufacturers that perform electrical modifications and that are listed by a testing and inspecting agency acceptable to authorities having jurisdiction are acceptable.

D. Fire-Rated Door Assemblies: Where fire-rated door assemblies are indicated, provide door hardware rated for use in assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C, unless otherwise indicated.

E. Smoke- and Draft-Control Door Assemblies: Where smoke- and draft-control door assemblies are required, provide door hardware that meet requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105.

1. Air Leakage Rate: Maximum air leakage of0.3 cfm/sq. ft. (3 cu. m per minute/sq. m) at the tested pressure differential of 0.3-inch wg (75 Pa) of water.

F. Electrified Door Hardware: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.

G. Means of Egress Doors: Latches do not require more than 15 lbf (67 N) to release the latch. Locks do not require use of a key, tool, or special knowledge for operation.

H. Accessibility Requirements: For door hardware on doors in an accessible route, comply with the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines, ICC/ANSI A117.1 and Illinois Accessibility Code.

1. Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf (22.2 N).
2. Comply with the following maximum opening-force requirements:

   a. Interior, Non-Fire-Rated Hinged Doors: 5 lbf (22.2 N) applied perpendicular to door.
   b. Sliding Doors: 5 lbf (22.2 N) applied parallel to door at latch.
   c. Fire Doors: Minimum opening force allowable by authorities having jurisdiction.

3. Bevel raised thresholds with a slope of not more than 1:2. Provide thresholds not more than 1/2 inch (13 mm) high.
4. Adjust door closer sweep periods so that, from an open position of 70 degrees, the door will take at least 3 seconds to move to a point 3 inches (75 mm) from the latch, measured to the leading edge of the door.

I. Keying Conference: Conduct conference at Project site to comply with requirements in Section 013100 "Project Management and Coordination." In addition to Owner, Contractor, and Architect, conference participants shall also include Installer's Architectural Hardware Consultant. Incorporate keying conference decisions into final keying schedule after reviewing door hardware keying system including, but not limited to, the following:

1. Function of building, flow of traffic, purpose of each area, degree of security required, and plans for future expansion.
2. Preliminary key system schematic diagram.
3. Requirements for key control system.
4. Requirements for access control.
5. Address for delivery of keys.

J. Preinstallation Conference: Conduct conference at Project site.

1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
2. Inspect and discuss preparatory work performed by other trades.
3. Inspect and discuss electrical roughing-in for electrified door hardware.
4. Review sequence of operation for each type of electrified door hardware.
5. Review required testing, inspecting, and certifying procedures.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up for door hardware delivered to Project site.

B. Tag each item or package separately with identification coordinated with the final door hardware schedule, and include installation instructions, templates, and necessary fasteners with each item or package.

1.8 COORDINATION

A. Installation Templates: Distribute for doors, frames, and other work specified to be factory prepared. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

B. Security: Coordinate installation of door hardware, keying, and access control with Owner's security consultant.

C. Electrical System Roughing-In: Coordinate layout and installation of electrified door hardware with connections to power supplies and building safety and security systems.

D. Existing Openings: Where hardware components are scheduled for application to existing construction or where modifications to existing door hardware are required, field verify existing conditions and coordinate installation of door hardware to suit opening conditions and to provide proper door operation.

1.9 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including excessive deflection, cracking, or breakage.
b. Faulty operation of doors and door hardware.
c. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.

2. Warranty Period: Three years from date of Substantial Completion, unless otherwise indicated.

a. Electromagnetic Locks: Five years from date of Substantial Completion.
b. Exit Devices: Two years from date of Substantial Completion.
c. Manual Closers: 10 years from date of Substantial Completion.

1.10 MAINTENANCE SERVICE

A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

B. Maintenance Service: Beginning at Substantial Completion, provide six months' full maintenance by skilled employees of door hardware Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper door and door hardware operation. Provide parts and supplies that are the same as those used in the manufacture and installation of original products.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

A. Provide door hardware for each door as scheduled on drawings to comply with requirements in this Section.

1. Door Hardware Sets: Provide quantity, item, size, finish or color indicated, and named manufacturers' products or products equivalent in function and comparable in quality to named products and complying with BHMA designations referenced.
2. Sequence of Operation: Provide electrified door hardware function, sequence of operation, and interface with other building control systems indicated.

B. Designations: Requirements for design, grade, function, finish, size, and other distinctive qualities of each type of door hardware are specified herein and indicated on drawings by manufacturer’s product designations. Products are identified by using door hardware designations, as follows:

1. Named Manufacturers' Products: Manufacturer and product designation are listed for each door hardware type required for the purpose of establishing minimum requirements. Manufacturers' names are abbreviated.
2. References to BHMA Designations: Provide products complying with these designations and requirements for description, quality, and function.

2.2 HINGES

A. Hinges: BHMA A156.1. Provide template-produced hinges for hinges installed on hollow-metal doors and hollow-metal frames.
1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on schedule or comparable product by one of the following:

a. Baldwin Hardware Corporation.
b. Bommer Industries, Inc.
c. Cal-Royal Products, Inc.
d. Hager Companies.
e. IVES Hardware; an Ingersoll-Rand company.
f. Lawrence Hardware Inc.
g. McKinney Products Company; an ASSA ABLOY Group company.
h. PBB, Inc.
i. Stanley Commercial Hardware; Div. of The Stanley Works.

2.3 MECHANICAL LOCKS AND LATCHES

A. Lock Functions: As indicated in door hardware schedule.

B. Lock Throw: Comply with testing requirements for length of bolts required for labeled fire doors, and as follows:

1. Bored Locks: Minimum 1/2-inch (13-mm) latchbolt throw.
2. Deadbolts: Minimum 1-inch (25-mm) bolt throw.

C. Lock Backset: 2-3/4 inches (70 mm), unless otherwise indicated.

D. Strikes: Provide manufacturer's standard strike for each lock bolt or latchbolt complying with requirements indicated for applicable lock or latch and with strike box and curved lip extended to protect frame; finished to match lock or latch.

1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.

E. Bored Locks: BHMA A156.2; Grade 1; Series 4000.
1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on schedule or comparable product by one of the following:
a. Corbin Russwin Architectural Hardware; an ASSA ABLOY Group Company.

2.4 SELF-CONTAINED ELECTRONIC LOCKS

A. Self-Contained Electronic Locks: BHMA A156.25, bored; with internal, battery-powered, self-contained electronic locks; consisting of complete lockset, motor-driven lock mechanism, and actuating device; enclosed in zinc-dichromate-plated, wrought-steel case, and strike that suits frame. Provide key override, low-battery detection and warning, LED status indicators, and ability to program at the lock. Provide keypad, proximity reader or other activation device as indicated.
1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on schedule or comparable product by one of the following:

a. Best Access Systems; Div. of Stanley Security Solutions, Inc.
b. Kaba Ilco Corp.; a Kaba Group company.
c. Marks USA.
d. SARGENT Manufacturing Company; an ASSA ABLOY Group company.
e. Schlage Commercial Lock Division; an Ingersoll-Rand company.
f. Trilogy.
g. Yale Security Inc.; an ASSA ABLOY Group company.

2.5 AUTOMATIC AND SELF-LATCHING FLUSH BOLTS

A. Automatic and Self-Latching Flush Bolts: BHMA A156.16; minimum 3/4-inch (19-mm) throw; designed for mortising into door edge.
1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on schedule or comparable product by one of the following:

a. Cal-Royal Products, Inc.
b. Door Controls International, Inc.
c. IVES Hardware; an Ingersoll-Rand company.
d. Trimco.

2.6 EXIT DEVICES AND AUXILIARY ITEMS

A. Exit Devices and Auxiliary Items: BHMA A156.3.
1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on schedule or comparable product by one of the following:

a. Adams Rite Manufacturing Co.; an ASSA ABLOY Group company.
b. Arrow USA; an ASSA ABLOY Group company.
c. Cal-Royal Products, Inc.
d. Corbin Russwin Architectural Hardware; an ASSA ABLOY Group company.
e. Door Controls International, Inc.
f. DORMA Architectural Hardware; Member of The DORMA Group North America.
g. Dor-O-Matic; an Ingersoll-Rand company.
h. K2 Commercial Hardware; a Black & Decker Corp. company.
i. Monarch Exit Devices & Panic Hardware; an Ingersoll-Rand company.
j. Precision Hardware, Inc.; Division of Stanley Security Solutions, Inc.
k. Rutherford Controls Int'l. Corp.
l. SARGENT Manufacturing Company; an ASSA ABLOY Group company.
m. Von Duprin; an Ingersoll-Rand company.
n. Yale Security Inc.; an ASSA ABLOY Group company.

2.7 LOCK CYLINDERS

A. Lock Cylinders: Tumbler type, constructed from brass or bronze, stainless steel, or nickel silver.

1. Manufacturer: Same manufacturer as for locking devices.

B. Lock Cylinders: BHMA A156.5; Grade and cores to match Owner's existing, face finished to match lockset.

2.8 KEYING

A. Keys: Nickel silver or brass.

1. Stamping: Permanently inscribe each key with a visual key control number and include the following notation:

a. Notation: "DO NOT DUPLICATE."

2. Quantity: In addition to one extra key blank for each lock, provide the following:

a. Cylinder Change Keys: Three.
b. Master Keys: Five.
c. Grand Master Keys: Five.
d. Great-Grand Master Keys: Five.

B. Coordinate new keys with Owner's existing key control system. Update existing key control system for new keys. Furnish labels, key tags, key-gathering envelopes, and temporary and permanent markers.

2.9 OPERATING TRIM

A. Operating Trim: BHMA A156.6, unless otherwise indicated.
1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on schedule or comparable product by one of the following:

a. Burns Manufacturing Incorporated.
b. Don-Jo Mfg., Inc.
c. Forms + Surfaces.
d. Hager Companies.
e. Hiawatha, Inc.
f. IVES Hardware; an Ingersoll-Rand company.
g. Rockwood Manufacturing Company.
h. Trimco.

2.10 ACCESSORIES FOR PAIRS OF DOORS

A. Coordinators: BHMA A156.3; consisting of active-leaf, hold-open lever and inactive-leaf release trigger; fabricated from steel with nylon-coated strike plates; with built-in, adjustable safety release.

B. Astragals: BHMA A156.22.

2.11 SURFACE CLOSERS

A. Surface Closers: BHMA A156.4; rack-and-pinion hydraulic type with adjustable sweep and latch speeds controlled by key-operated valves and forged-steel main arm. Comply with manufacturer's written recommendations for size of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force.
1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on schedule or comparable product by one of the following:

a. Arrow USA; an ASSA ABLOY Group company.
b. Corbin Russwin Architectural Hardware; an ASSA ABLOY Group company.
c. DORMA Architectural Hardware; Member of The DORMA Group North America.
d. Dor-O-Matic; an Ingersoll-Rand company.
e. K2 Commercial Hardware; a Black & Decker Corp. company.
f. LCN Closers; an Ingersoll-Rand company.
g. Norton Door Controls; an ASSA ABLOY Group company.
h. Rixson Specialty Door Controls; an ASSA ABLOY Group company.
i. SARGENT Manufacturing Company; an ASSA ABLOY Group company.
j. Yale Security Inc.; an ASSA ABLOY Group company.

2.12 MECHANICAL STOPS AND HOLDERS

A. Wall- and Floor-Mounted Stops: BHMA A156.16.
1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on schedule or comparable product by one of the following:

a. Architectural Builders Hardware Mfg., Inc.
b. Baldwin Hardware Corporation.
c. Burns Manufacturing Incorporated.
d. Cal-Royal Products, Inc.
e. Don-Jo Mfg., Inc.
f. Door Controls International, Inc.

g. Hager Companies.
h. Hiawatha, Inc.
i. IVES Hardware; an Ingersoll-Rand company.
j. Rockwood Manufacturing Company.
k. Stanley Commercial Hardware; Div. of The Stanley Works.
l. Trimco.

2.13 OVERHEAD STOPS AND HOLDERS

A. Overhead Stops and Holders: BHMA A156.8.
1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on schedule or comparable product by one of the following:

a. Architectural Builders Hardware Mfg., Inc.
b. Glynn-Johnson; an Ingersoll-Rand company.
c. Rockwood Manufacturing Company.
d. SARGENT Manufacturing Company; an ASSA ABLOY Group company.

2.14 DOOR GASKETING

A. Door Gasketing: BHMA A156.22; air leakage not to exceed 0.50 cfm per foot (0.000774 cu. m/s per m) of crack length for gasketing other than for smoke control, as tested according to ASTM E 283; with resilient or flexible seal strips that are easily replaceable and readily available from stocks maintained by manufacturer.
1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on schedule or comparable product by one of the following:

a. Hager Companies.
b. M-D Building Products, Inc.
c. National Guard Products.
d. Pemko Manufacturing Co.; an ASSA ABLOY Group company.
e. Reese Enterprises, Inc.
f. Sealeze; a unit of Jason Incorporated.
g. Zero International.

2.15 AUXILIARY DOOR HARDWARE

A. Auxiliary Hardware: BHMA A156.16.
1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on schedule or comparable product by one of the following:

a. Baldwin Hardware Corporation.
b. Cal-Royal Products, Inc.
c. Don-Jo Mfg., Inc.
d. Hager Companies.
e. Rockwood Manufacturing Company.
f. Stanley Commercial Hardware; Div. of The Stanley Works.
g. Trimco.

2.16 AUXILIARY ELECTRIFIED DOOR HARDWARE

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on schedule or comparable product by one of the following:

1. DynaLock Corp.
2. GE Security, Inc.
3. SARGENT Manufacturing Company; an ASSA ABLOY Group company.
4. Schlage Commercial Lock Division; an Ingersoll-Rand company.
5. Securitron Magnalock Corporation; an ASSA ABLOY Group company.
6. Security Door Controls.

2.17 FABRICATION

A. Manufacturer's Nameplate: Do not provide products that have manufacturer's name or trade name displayed in a visible location except in conjunction with required fire-rated labels and as otherwise approved by Architect.

1. Manufacturer's identification is permitted on rim of lock cylinders only.

B. Base Metals: Produce door hardware units of base metal indicated, fabricated by forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness. Furnish metals of a quality equal to or greater than that of specified door hardware units and BHMA A156.18.

C. Fasteners: Provide door hardware manufactured to comply with published templates prepared for machine, wood, and sheet metal screws. Provide screws that comply with commercially recognized industry standards for application intended, except aluminum fasteners are not permitted. Provide Phillips flat-head screws with finished heads to match surface of door hardware, unless otherwise indicated.

1. Concealed Fasteners: For door hardware units that are exposed when door is closed, except for units already specified with concealed fasteners. Do not use through bolts for installation where bolt head or nut on opposite face is exposed unless it is the only means of securely attaching the door hardware. Where through bolts are used on hollow door and frame construction, provide sleeves for each through bolt.
2. Fire-Rated Applications:

a. Wood or Machine Screws: For the following:

1) Hinges mortised to doors or frames; use threaded-to-the-head wood screws for wood doors and frames.
2) Strike plates to frames.
3) Closers to doors and frames.

b. Steel Through Bolts: For the following unless door blocking is provided:

1) Surface hinges to doors.
2) Closers to doors and frames.
3) Surface-mounted exit devices.

3. Spacers or Sex Bolts: For through bolting of hollow-metal doors.

4. Fasteners for Wood Doors: Comply with requirements in DHI WDHS.2, "Recommended Fasteners for Wood Doors."
5. Gasketing Fasteners: Provide noncorrosive fasteners for exterior applications and elsewhere as indicated.

2.18 FINISHES

A. Provide finishes complying with BHMA A156.18 as indicated in door hardware schedule.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting performance.

B. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Steel Doors and Frames: For surface applied door hardware, drill and tap doors and frames according to ANSI/SDI A250.6.

B. Wood Doors: Comply with DHI WDHS.5 "Recommended Hardware Reinforcement Locations for Mineral Core Wood Flush Doors."

3.3 INSTALLATION

A. Mounting Heights: Mount door hardware units at heights to comply with the following unless otherwise indicated or required to comply with governing regulations.

1. Standard Steel Doors and Frames: ANSI/SDI A250.8.
2. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."

B. Install each door hardware item to comply with manufacturer's 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. Do not install surface-mounted items until finishes have been completed on substrates involved.

1. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
2. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.

C. Hinges: Install types and in quantities indicated in door hardware schedule but not fewer than the number recommended by manufacturer for application indicated or one hinge for every 30 inches (750 mm) of door height, whichever is more stringent, unless other equivalent means of support for door, such as spring hinges or pivots, are provided.

D. Intermediate Offset Pivots: Where offset pivots are indicated, provide intermediate offset pivots in quantities indicated in door hardware schedule but not fewer than one intermediate offset pivot per door and one additional intermediate offset pivot for every 30 inches (750 mm) of door height greater than 90 inches (2286 mm).

E. Lock Cylinders: Install construction cores to secure building and areas during construction period.

F. Boxed Power Supplies: Locate power supplies as indicated or, if not indicated, above accessible ceilings or in equipment room. Verify location with Architect.

1. Configuration: Provide one power supply for each door opening with electrified door hardware.

G. Thresholds: Set thresholds for exterior doors and other doors indicated in full bed of sealant complying with requirements specified in Section 079200 "Joint Sealants."

H. Stops: Provide floor stops for doors unless wall or other type stops are indicated in door hardware schedule. Do not mount floor stops where they will impede traffic.

I. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.

J. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.

3.4 FIELD QUALITY CONTROL

A. Independent Architectural Hardware Consultant: Engage a qualified Architectural Hardware Consultant to perform inspections and to prepare inspection reports.

1. Architectural Hardware Consultant will inspect door hardware and state in each report whether installed work complies with or deviates from requirements, including whether door hardware is properly installed 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.
   1. Door Closers: Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.

B. Occupancy Adjustment: Approximately six months after date of Substantial Completion, Installer's Architectural Hardware Consultant shall examine and readjust each item of door hardware, including adjusting operating forces, as necessary to ensure function of doors, door hardware, and electrified door hardware.

3.6 CLEANING AND PROTECTION

A. Clean adjacent surfaces soiled by door hardware installation.

B. Clean operating items as necessary to restore proper function and finish.

C. Provide final protection and maintain conditions that ensure that door hardware is without damage or deterioration at time of Substantial Completion.

3.7 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain door hardware and door hardware finishes.

3.8 DOOR HARDWARE SCHEDULE

A. Although the Hardware Schedule on drawings is intended to cover all doors and to establish a type and standard of quality, it shall be the specific duty and responsibility of the Door Hardware Supplier and their Architectural Hardware Consultant to examine the Contract Documents and furnish the proper hardware for all openings, whether scheduled or not.

END OF SECTION 087100

SECTION 087113 - AUTOMATIC DOOR OPERATORS

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. Power door operators for interior swinging doors.
2. Power door operators for exterior swinging doors.

B. Related Requirements:
1. Section 084229.23 "Sliding Automatic Entrances" for sliding doors and frames packaged with automatic door operators.

1.3 DEFINITIONS

A. AAADM: American Association of Automatic Door Manufacturers.

B. Activation Device: A control that, when actuated, sends an electrical signal to the door operator to open the door.

C. Safety Device: A control that, to avoid injury, prevents a door from opening or closing.

D. For automatic door terminology, see BHMA A156.10 and BHMA A156.19 for definitions of terms.

1.4 COORDINATION

A. Templates: Distribute for doors, frames, and other work specified to be factory prepared and reinforced for installing automatic door operators. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing automatic door operators to comply with indicated requirements.

B. Coordinate hardware for doors with operators to ensure proper size, thickness, hand, function, and finish.

C. Electrical System Roughing-in: Coordinate layout and installation of automatic door operators with connections to power supplies and access-control system.

1.5 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.6 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for automatic door operators.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: For automatic door operators.

1. Include plans, elevations, sections, hardware mounting heights, and attachment details.
2. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Indicate locations of activation and safety devices.
4. Include diagrams for power, signal, and control wiring.

1.7 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer, manufacturer and Certified Inspector.

B. Product Certificates: For each type of automatic door operator. For each operator for fire-rated door assemblies, certify that operator is listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction for use on types and sizes of labeled fire doors required.

C. Field quality-control reports.

D. Sample Warranties: For manufacturer's special warranties.

1.8 CLOSEOUT SUBMITTALS

A. Maintenance Data: For automatic door operators, safety devices, and control systems, to include in maintenance manuals.

1.9 QUALITY ASSURANCE

A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer for installation and maintenance of units required for this Project and who employs a Certified Inspector.

1. Maintenance Proximity: Not more than two hours' normal travel time from Installer's place of business to Project site.

B. Manufacturer Qualifications: Company certificate issued by AAADM.

C. Certified Inspector Qualifications: Certified by AAADM.

1.10 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of automatic door operators that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Faulty or sporadic operation of automatic door operator, including controls.
b. Deterioration of metals, metal finishes, and other materials beyond normal weathering or use.

2. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide **Magic-Force Series Swing Door Operator Visible Application Full Energy** by **Stanley Access Technologies, LLC: Div. of Stanley Security Solutions** or comparable product by one of the following:

1. Besam Entrance Solutions; Subsidiary of ASSA ABLOY Entrance Systems.
2. Horton Automatics; a division of Overhead Door Corporation.

B. Source Limitations: Obtain automatic door operators, including activation and safety devices, from single source from single manufacturer.

2.2 AUTOMATIC DOOR OPERATORS, GENERAL

A. General: Provide operators of size recommended by manufacturer for door size, weight, and movement; for condition of exposure; and for long-term, maintenance-free operation under normal traffic load for occupancy type indicated; and according to UL 325. Coordinate operator mechanisms with door operation, hinges, and activation and safety devices.

1. Emergency Breakaway: Where indicated for center-pivoted doors, provide emergency breakaway feature for reverse swing of doors. Equip system to discontinue power to automatic door operator when door is in emergency breakaway position, to return door to closed position after breakaway, and to automatically reset.
2. Fire-Rated Doors: Provide door operators for fire-rated door assemblies that comply with NFPA 80 for fire-rated door components and are listed and labeled by a qualified testing agency.
3. Wind Load: Provide door operators on exterior doors that will open and close doors and maintain them in fully closed position when subjected to wind load.

B. Electromechanical Operating System: Self-contained unit powered by permanent-magnet dc motor; with closing speed controlled mechanically by gear train and dynamically by braking ac-

tion of electric motor, connections for power and activation- and safety-device wiring, and manual operation including spring closing when power is off.

C. Hinges: See Section 087100 "Door Hardware" for hinge type for each door that door operator shall accommodate.

D. Cover for Surface-Mounted Operators: Fabricated from 0.125-inch- (3.2-mm-) thick, extruded or formed aluminum continuous over full width of door opening including door jambs; with enclosed end caps, provision for maintenance access, and fasteners concealed when door is in closed position.

E. Brackets and Reinforcements: Fabricated from aluminum with nonstaining, nonferrous shims for aligning system components.

F. Fire-Door Package: Consisting of UL-listed latch mechanism, power-reset box, and caution signage for fire-rated doors. Latch mechanism shall allow door to swing free during automatic operation; when fire is detected, latch actuator shall cause exit hardware to latch when door closes. Provide latch actuators with fail-secure design.

G. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.3 POWER DOOR OPERATORS

A. Standard: BHMA A156.10.

B. Performance Requirements:

1. Opening Force:

   a. Power-Operated Doors: Not more than 50 lbf (222 N) required to manually set door in motion if power fails; not more than 15 lbf (67 N) required to open door to minimum required width.
   b. Power-Operated Swinging Doors: Not more than 30 lbf (133 N) required to manually open door if power fails.
   c. Breakaway Device for Power-Operated Doors: Not more than 50 lbf (222 N) required for breakaway door or panel to open.

2. Entrapment-Prevention Force: Not more than 40 lbf (178 N) required to prevent stopped door in the last 10 degrees of opening from moving in the direction of opening; not more than 30 lbf (133 N) required to prevent stopped door from moving in direction of closing.

C. Configuration: Operator to control single swinging door, pair of swinging doors.

1. Traffic Pattern: Two way, Double swing, Double egress.
2. Operator Mounting: Surface.

D. Operation: Power opening and spring closing. Provide time delay for door to remain open before initiating closing cycle as required by BHMA A156.10.

E. Operating System: Electromechanical.

F. Microprocessor Control Unit: Solid-state controller.

G. Features:

1. Adjustable opening and closing speed.
2. Adjustable opening and closing force.
3. Adjustable backcheck.
4. Adjustable hold-open time from zero to 30 seconds.
5. Adjustable time delay.
6. Adjustable acceleration.
7. Adjustable limit switch.
8. Obstruction recycle.
9. Automatic door re-open if stopped while closing.
10. On-off/hold-open switch to control electric power to operator; key operated.

H. Controls: Activation and safety devices as specified below, as indicated on Drawings and according to BHMA standards.
   1. General: Provide controls, including activation and safety devices, according to BHMA standards; for condition of exposure; and for long-term, maintenance-free operation under normal traffic load for occupancy type indicated. Coordinate activation and safety devices with door operation and door operator mechanisms.
   2. Activation Device: Push-plate switch on each side of door to activate door operator.
      a. Push-Plate Switch: Momentary-contact door control switch with flat push-plate actuator with contrasting-colored, engraved message.
         1) Configuration: Round or square, matching hospital standard, push plate with 4-by-4-inch (100-by-100-mm) junction box.
         2) Mounting: Recess mounted, semiflush in wall.
      b. Push-Plate Material: Stainless steel as selected by Architect from manufacturer's full range.
      c. Message: International symbol of accessibility and "Push to Open."
      d. Provide proximity reader or key-pad where indicated.
   3. Safety Device: Presence sensors mounted on door and door header to detect pedestrians in presence zone and to prevent door from closing.
      a. Presence Sensors: Self-contained, active-infrared scanner units; adjustable to provide detection field sizes and functions required by BHMA A156.10. Sensors shall remain active at all times.
      b. Door Mounted: Provide focused active infrared type specifically designed to sense moving or stationary objects in the swing zone, each side, of a moving door leaf and not be affected by ultrasonic, ambient light or radio frequencies within the vicinity of the door.
      c. Overhead Mounted: Provide diffused active infrared type capable of sensing moving or stationary targets within the swing zone, programmable to accommodate various door and environmental conditions.
   4. Key Switch: Recess-mounted, door control switch with key-controlled actuator; enclosed in 2-by-4-inch (50-by-100-mm) junction box. Provide faceplate engraved with text indicating switch functions.
      a. Faceplate Material: Stainless steel as selected by Architect from manufacturer's full range.
      b. Functions: Two-way automatic, hold open, one-way exit, and off.
      c. Mounting: Recess mounted, semiflush in wall.

I. Electrical Interlocks: Unless units are equipped with self-protecting devices or circuits, provide electrical interlocks to prevent activation of operator when door is locked, latched, or bolted.

2.4 MATERIALS

A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.

1. Extrusions: ASTM B 221 (ASTM B 221M).
2. Sheet: ASTM B 209 (ASTM B 209M).

B. Fasteners and Accessories: Corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.

2.5 FABRICATION

A. Factory fabricate automatic door operators to comply with indicated standards.

B. Form aluminum shapes before finishing.

C. Fabricate exterior components to drain condensation and water passing joints within operator enclosure to the exterior.

D. Use concealed fasteners to greatest extent possible. Where exposed fasteners are required, use countersunk Phillips flat-head machine screws, finished to match operator.

2.6 ACCESSORIES

A. Signage: As required by cited BHMA standard for type of door and its operation.

1. Application Process: Operator manufacturer's standard process.
2. Provide sign materials with instructions for field application when operators are installed.

2.7 GENERAL FINISH REQUIREMENTS

A. Protect mechanical finishes on exposed surfaces from damage by applying strippable, temporary protective covering before shipping.

B. Apply anodic finishes to formed metal after fabrication unless otherwise indicated.

C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within range of approved Samples and are assembled or installed to minimize contrast.

2.8 ALUMINUM FINISHES

A. Clear Anodic Finish: AAMA 611, AA-M12C22A31, Class II, 0.010 mm or thicker.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances, door and frame preparation and reinforcements, and other conditions affecting performance of automatic door operators.

B. Examine roughing-in for electrical systems to verify actual locations of power connections before automatic door operator installation.

C. Verify that full-height finger guards are installed at each door with pivot hinges where door has a clearance at hinge side greater than 1/4 inch (6 mm) and less than 3/4 inch (19 mm) with door in any position.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install automatic door operators according to manufacturer's written instructions and cited BHMA standard for type of door operation and direction of pedestrian travel, including signage, controls, wiring, remote power units if any, and connection to building's power supply.

1. Do not install damaged components. Fit joints to produce hairline joints free of burrs and distortion.
2. Install operators true in alignment with established lines and door geometry without warp or rack. Anchor securely in place.

B. Controls: Install activation and safety devices according to manufacturer's written instructions and cited BHMA standard for operator type and direction of pedestrian travel. Connect control wiring according to electrical documents.
1. Access-Control System: Connect proximity readers and keypads to access-control system.

C. Signage: Apply on both sides of each door as required by cited BHMA standard for type of door operator and direction of pedestrian travel.

3.3 FIELD QUALITY CONTROL

A. Certified Inspector: Engage a Certified Inspector to test and inspect components, assemblies, and installations, including connections.

B. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. Test and inspect each automatic door operator installation, using AAADM inspection forms, to determine compliance of installed systems with applicable BHMA standards.

C. Automatic door operators will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

3.4 ADJUSTING

A. Adjust automatic door operators to function smoothly, and lubricate as recommended by manufacturer; comply with requirements of applicable BHMA standards.

1. Adjust operators on exterior doors for weathertight closure.

B. After completing installation of automatic door operators, inspect exposed finishes on doors and operators. Repair damaged finish to match original finish.

C. Readjust automatic door operators and controls after repeated operation of completed installation equivalent to three days' use by normal traffic (100 to 300 cycles).

D. Occupancy Adjustment: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

3.5 MAINTENANCE SERVICE

A. Initial Maintenance Service: Beginning at Substantial Completion, maintenance service shall include 12 months' full maintenance by skilled employees of automatic door operator Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper door operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.

1. Engage a Certified Inspector to perform safety inspection after each adjustment or repair and at end of maintenance period. Furnish completed inspection reports to Owner.
2. Perform maintenance, including emergency callback service, during normal working hours.

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain automatic door operators.

END OF SECTION 087113

SECTION 088000 - GLAZING

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 glazing for the following products and applications, including those specified in other Sections where glazing requirements are specified by reference to this Section:
   1. Doors.
   2. Storefront framing.
   3. Glazed entrances.
   4. Interior borrowed lites.
   5. Decorative acid etched (frosted) glass.
   6. Decorative film overlay.

B. Related Sections:
   1. Section 088300 "Mirrors."

1.3 DEFINITIONS

A. Glass Manufacturers: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.

B. Glass Thicknesses: Indicated by thickness designations in millimeters according to ASTM C 1036.

C. Interspace: Space between lites of an insulating-glass unit.

1.4 PERFORMANCE REQUIREMENTS

A. General: Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

   1. Design Wind Pressures: As indicated on Drawings as directed by Project Structural Engineer of Record.
   2. Vertical Glazing: For glass surfaces sloped 15 degrees or less from vertical, design glass to resist design wind pressure based on glass type factors for short-duration load.

3. 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 (25 mm), whichever is less.

B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.

1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

1.5 ACTION SUBMITTALS

A. Product Data: For each glass product and glazing material indicated.

B. Glass Samples: For the following products, 12 inches (300 mm) square:

1. Each type of acid-etched decorative glass.
2. Each decorative film overlay on glass.

C. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For installers, fabricators and manufacturers of insulating-glass units with sputter-coated, low-e coatings.

B. Product Certificates: For glass and glazing products, from manufacturer.

C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for insulating glass, glazing sealants and glazing gaskets.

1. For glazing sealants, provide test reports based on testing current sealant formulations within previous 36-month period.

D. Warranties: Sample of special warranties.

1.7 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of decorative acid-etched glass and each decorative film overlay to include in maintenance manuals.

1.8 QUALITY ASSURANCE

A. Manufacturer Qualifications for Insulating-Glass Units with Sputter-Coated, Low-E Coatings: A qualified insulating-glass manufacturer who is approved and certified by coated-glass manufacturer.

B. 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.

C. Glass Testing Agency Qualifications: A qualified independent testing agency accredited according to the NFRC CAP 1 Certification Agency Program.

D. Source Limitations for Glass: Obtain coated glass and insulating glass from single source from single manufacturer for each glass type.

E. Source Limitations for Glazing Accessories: Obtain from single source from single manufacturer for each product and installation method.

F. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.

1. GANA Publications: GANA's "Glazing Manual."
2. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."

G. Safety Glazing Labeling: Where safety glazing labeling is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction or the manufacturer. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.

H. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of IGCC.

I. Preinstallation Conference: Conduct conference at Project site.

1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
2. Review temporary protection requirements for glazing during and after installation.

1.9 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.

1.10 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. Do not install glazing sealants when ambient and substrate temperature conditions are outside limits permitted by sealant manufacturer or below 40 deg F (4.4 deg C).

1.11 WARRANTY

A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer's standard form in which coated-glass manufacturer agrees to replace coated-glass units that deteriorate within specified warranty period. Deterioration of coated glass is defined as 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. Defects include peeling, cracking, and other indications of deterioration in coating.

1. Warranty Period: 10 years from date of Substantial Completion.

B. Manufacturer's Special Warranty on Insulating Glass: Manufacturer's standard form in which insulating-glass manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as 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. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.

1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GLASS PRODUCTS, GENERAL

A. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass lites in thicknesses as needed to comply with requirements indicated.

1. Minimum Glass Thickness for Exterior Lites: Not less than 6.0 mm.

B. Strength: Where float glass is indicated, provide annealed float glass, Kind HS heat-treated float glass, or Kind FT heat-treated float glass as needed to comply with "Performance Requirements" Article or as indicated. Where heat-strengthened glass is indicated, provide Kind HS heat-treated float glass or Kind FT heat-treated float glass. Where fully tempered glass is indicated, provide Kind FT heat-treated float glass.

C. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:

1. For monolithic-glass lites, properties are based on units with lites 6.0 mm thick.
2. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.
3. U-Factors: Center-of-glazing values, according to NFRC 100 and based on LBL's WINDOW 5.2 computer program, expressed as Btu/sq. ft. x h x deg F (W/sq. m x K).
4. Solar Heat-Gain Coefficient and Visible Transmittance: Center-of-glazing values, according to NFRC 200 and based on LBL's WINDOW 5.2 computer program.
5. Visible Reflectance: Center-of-glazing values, according to NFRC 300.

2.2 GLASS PRODUCTS

A. Float Glass: ASTM C 1036, Type I, Quality-Q3, Class I (clear) unless otherwise indicated.

B. 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).

C. Low-E-Coated Vision Glass: Heat-treated float glass, Condition C; with Low-E coating applied by vacuum deposit (sputter-coating) process and complying with other requirements specified.
1. Basis-of-Design Product: Subject to compliance with requirements, provide **PPG Industries, Inc.; Solarban 60 Solar Control** or comparable product by one of the following:
a. AFG Industries, Inc.; Spotless Ti.
b. Cardinal Glass Industries; LoE2 Plus.
c. Pilkington North America; Activ.
2. Glass: Clear heat-strengthened or fully tempered float glass as indicated.

D. Decorative Acid-Etched (Frosted) Glass: Acid-etched glass with decorative pattern etched into glass with hydrofluoric and hydrochloric acids, evenly applied, according to manufacturer's standard process.

1. Glass Type: Clear heat-strengthened float glass.
2. Glass Thickness: 6.0 mm.
3. Patterns: As selected by Architect from manufacturer's full range.

2.3 INSULATING GLASS

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. Oldcastle Glass.

B. 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: Manufacturer's standard spacer material and construction.
3. Desiccant: Molecular sieve or silica gel, or blend of both.

C. Glass: Comply with applicable requirements in "Glass Products" Article as indicated by designations in "Insulating-Glass Types" Article.

2.4 GLAZING GASKETS

A. Dense Compression Gaskets: Molded or extruded gaskets of profile and hardness required to maintain watertight seal, made from one of the 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 gaskets complying with ASTM C 509, Type II, black; of profile and hardness required to maintain watertight seal.

1. Application: Use where soft compression gaskets will be compressed by inserting dense compression gaskets on opposite side of glazing or pressure applied by means of pressure-glazing stops on opposite side of glazing.

2.5 GLAZING SEALANTS

A. General:

1. Compatibility: Provide glazing sealants that are compatible with one another and with other materials they will contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
3. Sealants used inside the weatherproofing system, shall have a VOC content of not more than 250 g/L when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
4. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range.

B. Glazing Sealant: Neutral-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 25, Use NT.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Dow Corning Corporation; 799.
b. GE Advanced Materials - Silicones; UltraGlaze SSG4000 or UltraGlaze SSG4000AC.
c. May National Associates, Inc.; Bondaflex Sil 200 GPN or Bondaflex Sil 201 FC.
d. Polymeric Systems, Inc.; PSI-631.
e. Schnee-Morehead, Inc., an ITW company; SM5731 Poly-Glaze Plus.
f. Tremco Incorporated; Proglaze SSG or Tremsil 600.

2. Applications: Where glazing sealant is indicated.

2.6 MISCELLANEOUS GLAZING MATERIALS

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. Decorative Glass Film Overlay. Use translucent, dimensionally stable, cast PVC film, 2-mil-(0.05-mm-) minimum thickness, with pressure-sensitive, clear adhesive back for adhering to glass and releasable protective backing designed for field application to installed glass.

1. Products: Subject to compliance with requirements, provide decorative film product indicated on Room Finish Legend on Drawings.
2. Use: Suitable for interior applications.

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.

2.8 MONOLITHIC-GLASS TYPES

A. Clear Glass: Clear heat-strengthened float glass.

1. Thickness: 6.0 mm.

B. Clear Tempered Glass: Clear fully tempered float glass.

1. Thickness: 6.0 mm.
2. Provide safety glazing labeling.

2.9 INSULATING-GLASS TYPES

A. Clear Insulating Glass: Low-e-coated, clear insulating glass.

1. Overall Unit Thickness: 1 inch (25 mm).
2. Thickness of Each Glass Lite: 6.0 mm.
3. Outdoor Lite: Heat-strengthened float glass.
   a. Low-E Coating: Sputtered on second surface.
4. Interspace Content: Air.
5. Indoor Lite: Heat-strengthened float glass.
6. Visible Light Transmittance: 60 percent minimum.
7. Winter Nighttime U-Factor: 0.31 maximum.
8. Summer Daytime U-Factor: 0.31 maximum.
9. Provide safety glazing labeling.

B. Tempered Insulating Glass: Low-e-coated, tempered, clear insulating glass.

1. Overall Unit Thickness: 1 inch (25 mm).
2. Thickness of Each Glass Lite: 6.0 mm.
3. Outdoor Lite: Fully tempered float glass.
   a. Low-E Coating: Sputtered on second surface.
4. Interspace Content: Air.
5. Indoor Lite: Fully tempered float glass.
6. Visible Light Transmittance: 60 percent minimum.
7. Winter Nighttime U-Factor: 0.31 maximum.
8. Summer Daytime U-Factor: 0.31 maximum.
9. Solar Heat Gain Coefficient: 0.40 maximum.
10. Provide safety glazing labeling.

C. Decorative Acid Etched (Frosted) Insulating Glass: Acid-etched, clear insulating glass.

1. Overall Unit Thickness: 1 inch (25 mm).
2. Thickness of Each Glass Lite: 6.0 mm.
3. Outdoor Lite: Acid-etched clear heat-strengthened float glass.
   a. Full glass acid-etching on second surface.
4. Interspace Content: Air.
5. Indoor Lite: Heat-strengthened float glass.
6. Provide safety glazing labeling.

PART 3 - EXECUTION

3.1 EXAMINATION

A. 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 off-sets 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.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

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, GENERAL

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

B. 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 (1270 mm).

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 (3-mm) 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 SEALANT GLAZING (WET)

A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.

B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.

C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

3.5 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.

3.6 INSTALLATION OF DECORATIVE FILM OVERLAY

A. Decorative Film Overlay: Apply squarely aligned to glass edges, uniformly smooth, and free from tears, air bubbles, wrinkles, and rough edges, in single sheet completely overlaying the back face of clean glass, according to manufacturer's written instructions, including surface preparation and application temperature limitations.

3.7 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 non-permanent 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.

E. Wash glass on both exposed surfaces in each area of Project not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

END OF SECTION 088000

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SECTION 088300 - MIRRORS

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 the following types of silvered flat glass mirrors:

1. Annealed monolithic glass mirrors.

1.3 ACTION SUBMITTALS

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

1. Mirrors. Include description of materials and process used to produce each type of silvered flat glass mirror specified that indicates sources of glass, glass coating components, edge sealer, and quality-control provisions.

B. Shop Drawings: Include mirror elevations, edge details, mirror hardware, and attachments to other work.

C. Samples: For each type of the following products:
1. Mirror Clips: Full size.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Product Certificates: For each type of mirror, from manufacturer.

C. Warranty: Sample of special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For mirrors to include in maintenance manuals.

1.6 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 Mirrors: Obtain mirrors from single source from single manufacturer.

C. Source Limitations for Mirror Accessories: Obtain mirror glazing accessories from single source.

D. Glazing Publications: Comply with the following published recommendations:

1. GANA's "Glazing Manual" unless more stringent requirements are indicated. Refer to this publication for definitions of glass and glazing terms not otherwise defined in this Section or in referenced standards.
2. GANA Mirror Division's "Mirrors, Handle with Extreme Care: Tips for the Professional on the Care and Handling of Mirrors."

1.7 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.

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Do not install mirrors until ambient temperature and humidity conditions are maintained at levels indicated for final occupancy.

1.9 WARRANTY

A. Special Warranty: Manufacturer's standard form in which mirror manufacturer agrees to replace mirrors that deteriorate within specified warranty period. Deterioration of mirrors is defined as defects developed from normal use that are not attributed to mirror breakage or to maintaining and cleaning mirrors contrary to manufacturer's written instructions. Defects include discoloration, black spots, and clouding of the silver film.

1. Warranty Period: Five years from date of manufacture.

PART 2 - PRODUCTS

2.1 SILVERED FLAT GLASS MIRRORS

A. Glass Mirrors, General: ASTM C 1503; manufactured using copper-free, low-lead mirror coating process.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Arch Aluminum & Glass Co., Inc.

b. Avalon Glass and Mirror Company.
c. Binswanger Mirror; a division of Vitro America, Inc.
d. D & W Incorporated
e. Donisi Mirror Company.
f. Gardner Glass, Inc.
g. Gilded Mirrors, Inc.
h. Guardian Industries.
i. Head West.
j. Independent Mirror Industries, Inc.
k. Lenoir Mirror Company.
l. Maran-Wurzell Glass & Mirror.
m. National Glass Industries.
n. Stroupe Mirror Co., Inc.
o. Sunshine Mirror; Westshore Glass Corp.
p. Virginia Mirror Company, Inc.
q. Walker Glass Co., Ltd.

B. Clear Glass: Mirror Select Quality.

1. Nominal Thickness: 6.0 mm.

2.2 MISCELLANEOUS MATERIALS

A. Edge Sealer: Coating compatible with glass coating and approved by mirror manufacturer for use in protecting against silver deterioration at mirrored glass edges.

2.3 MIRROR HARDWARE

A. Mirror Clips: Nickel plated, ½-inch wide with channel for mirror thickness indicated and with 1-ich high mounting leg.
1. Basis-of-Design Product: Subject to compliance with requirements, **provide 100A14/062C14 by** Laurence, C. R. Co. or comparable products by one of the following manufacturers:
a. Andscot Company, Inc.
b. Stylmark, Inc.

2. Finish: Brushed nickel.

B. Fasteners: Fabricated of same basic metal and alloy as fastened metal and matching it in finished color and texture where fasteners are exposed.

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 Sizes: To suit Project conditions, cut mirrors to final sizes and shapes.

B. Mirror Edge Treatment: Flat polished.

1. Seal edges of mirrors with edge sealer after edge treatment to prevent chemical or atmospheric penetration of glass coating.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, over which mirrors are to be mounted, with Installer present, for compliance with installation tolerances, substrate preparation, and other conditions affecting performance of the Work.

B. Verify compatibility with and suitability of substrates, including compatibility of mirror mastic with existing finishes or primers.

C. Proceed with installation only after unsatisfactory conditions have been corrected and surfaces are dry.

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. General: Install mirrors to comply with mirror manufacturer's written instructions and with referenced GANA publications. Mount mirrors accurately in place in a manner that avoids distorting reflected images.

B. Provide a minimum air space of 1/8 inch (3 mm) between back of mirrors and mounting surface for air circulation between back of mirrors and face of mounting surface.

C. Wall-Mounted Mirrors: Install mirrors with 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. Mirror Clips: Place a felt or plastic pad between mirror and each clip to prevent spalling of mirror edges. Locate clips so they are symmetrically placed and evenly spaced.

3.4 CLEANING AND 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.

C. Maintain environmental conditions that will prevent mirrors from being exposed to moisture from condensation or other sources for continuous periods of time.

D. Wash exposed surface of mirrors not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash mirrors as recommended in writing by mirror manufacturer.

END OF SECTION 088300

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SECTION 092216 - NON-STRUCTURAL METAL FRAMING

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 non-load-bearing steel framing members for the following applications:

1. Interior framing systems (e.g., supports for partition walls, framed soffits, furring, etc.).
2. Interior suspension systems (e.g., supports for ceilings, suspended soffits, etc.).

1.3 SUBMITTALS

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

1.4 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.

B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated, according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

PART 2 - PRODUCTS

2.1 NON-LOAD-BEARING STEEL FRAMING, GENERAL

A. Framing Members, General: Comply with ASTM C 754 for conditions indicated.

1. Steel Sheet Components: Comply with ASTM C 645 requirements for metal, unless otherwise indicated.
2. Protective Coating: Manufacturer's standard corrosion-resistant zinc coating, unless otherwise indicated.

2.2 SUSPENSION SYSTEM COMPONENTS

A. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.0625-inch- (1.59-mm-) diameter wire, or double strand of 0.0475-inch- (1.21-mm-) diameter wire.

B. Hanger Attachments to Concrete:

1. Anchors: Fabricated from corrosion-resistant materials with holes or loops for attaching wire hangers 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 an independent testing agency.

a. Type: Postinstalled, chemical anchor or expansion anchor.

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 an independent testing agency.

C. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.162-inch (4.12-mm) diameter.

D. Carrying Channels: Cold-rolled, commercial-steel sheet with a base-metal thickness of 0.0538 inch (1.37 mm) and minimum 1/2-inch- (12.7-mm-) wide flanges.

1. Depth: 1-1/2 inches (38 mm).

E. Furring Channels (Furring Members):

1. Cold-Rolled Channels: 0.0538-inch (1.37-mm) bare-steel thickness, with minimum 1/2-inch- (12.7-mm-) wide flanges, 3/4 inch (19.1 mm) deep.
2. Steel Studs: ASTM C 645.

a. Minimum Base Metal Thickness: 0.0179 inch (0.45 mm).
b. Depth: 2-1/2 inches (63.5 mm).

3. Hat-Shaped, Rigid Furring Channels: ASTM C 645, 7/8 inch (22.2 mm) deep.

a. Minimum Base Metal Thickness: 0.0179 inch (0.45 mm).

4. Resilient Furring Channels: 1/2-inch- (12.7-mm-) deep members designed to reduce sound transmission.

a. Configuration: Asymmetrical or hat shaped.

F. Grid Suspension System for Ceilings: ASTM C 645, direct-hung system composed of main beams and cross-furring members that interlock.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

a. Armstrong World Industries, Inc.; Drywall Grid Systems.
b. Chicago Metallic Corporation; 640-C Drywall Furring System.
c. USG Corporation; Drywall Suspension System.

2.3 STEEL FRAMING FOR FRAMED ASSEMBLIES

A. Steel Studs and Runners: ASTM C 645.

a. Minimum Base Metal Thickness: 0.0179 inch (0.45 mm).

B. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.

a. Minimum Base Metal Thickness: 0.0179 inch (0.45 mm).

C. Hat-Shaped, Rigid Furring Channels: ASTM C 645.

1. Minimum Base Metal Thickness: 0.0179 inch (0.45 mm).
2. Depth: 7/8 inch (22.2 mm).

D. Resilient Furring Channels: 1/2-inch- (12.7-mm-) deep, steel sheet members designed to reduce sound transmission.

1. Configuration: Asymmetrical or hat shaped.

2.4 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards.

1. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

B. Isolation Strip at Exterior Walls: Provide one of the following:

1. Asphalt-Saturated Organic Felt: ASTM D 226, Type I (No. 15 asphalt felt), nonperforated.
2. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch (3.2 mm) thick, in width to suit steel stud size.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Coordination with Sprayed Fire-Resistive Materials:

1. Before sprayed fire-resistive materials are applied, attach offset anchor plates or ceiling runners (tracks) to surfaces indicated to receive sprayed fire-resistive materials. Where offset anchor plates are required, provide continuous plates fastened to building structure not more than 24 inches (600 mm) o.c.
2. After sprayed fire-resistive materials are applied, remove them only to extent necessary for installation of non-load-bearing steel framing. Do not reduce thickness of fire-resistive materials below that required for fire-resistance ratings indicated. Protect adjacent fire-resistive materials from damage.

3.3 INSTALLATION, GENERAL

A. Installation Standard: ASTM C 754.

1. Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.

B. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.

C. Install bracing at terminations in assemblies.

D. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

3.4 INSTALLING SUSPENSION SYSTEMS

A. Install suspension system components in sizes and spacings indicated on Drawings, but not less than those required by referenced installation standards for assembly types and other assembly components indicated.

B. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.

C. Suspend hangers from building structure as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.

a. 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 locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.

a. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced installation standards.

3. Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.
4. Do not attach hangers to steel roof deck.
5. Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
6. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.
7. Do not connect or suspend steel framing from ducts, pipes, or conduit.

D. Fire-Resistance-Rated Assemblies: Wire tie furring channels to supports.

E. Seismic Bracing: Sway-brace suspension systems with hangers used for support.

F. Grid Suspension Systems: Attach perimeter wall track or angle where grid suspension systems meet vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.

G. Installation Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet (3 mm in 3.6 m)measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

3.5 INSTALLING FRAMED ASSEMBLIES

A. Install studs so flanges within framing system point in same direction.

B. Install tracks (runners) at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings, except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts penetrating partitions above ceiling.

1. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.

a. Install two studs at each jamb, unless otherwise indicated.
b. At doors over 36 inches wide install two studs of minimum 18-gage at each jamb, unless otherwise indicated
c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.

2. Other Framed Openings: Frame openings other than door openings the same as required for door openings, unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
3. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.
4. Curved Partitions:

a. Bend track to uniform curve and locate straight lengths so they are tangent to arcs.

b. Begin and end each arc with a stud, and space intermediate studs equally along arcs. On straight lengths of not less than 2 studs at ends of arcs, place studs 6 inches (150 mm) o.c.

5. Framing for support of High-Performance Coatings: Use studs of sufficient stiffness to meet deflection requirements indicated for high-performance coatings.

C. Direct Furring: Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches (610 mm) o.c

D. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch (3 mm) from the plane formed by faces of adjacent framing.

END OF SECTION 092216

SECTION 092900 - GYPSUM BOARD

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Interior gypsum board.
2. Tile backing panels.

1.3 SUBMITTALS

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

1.4 QUALITY ASSURANCE

A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.

1.5 STORAGE AND HANDLING

A. Store materials inside under cover and keep them dry and protected against damage from weather, condensation, direct sunlight, construction traffic, and other causes. Stack panels flat to prevent sagging.

1.6 PROJECT CONDITIONS

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

B. Do not install interior products until installation areas are enclosed and conditioned.

C. Do not install panels that are wet, those that are moisture damaged, and those that are mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.

2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 PANELS, GENERAL

A. Size: Provide in maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.2 INTERIOR GYPSUM BOARD

A. General: Complying with ASTM C 36/C 36M or ASTM C 1396/C 1396M, as applicable to type of gypsum board indicated and whichever is more stringent.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. American Gypsum Co.
b. BPB America Inc.
c. G-P Gypsum.
d. Lafarge North America Inc.
e. National Gypsum Company.
f. PABCO Gypsum.
g. Temple.
h. USG Corporation.

B. Type X:

1. Thickness: 5/8 inch (15.9 mm).
2. Long Edges: Tapered and featured (rounded or beveled) for prefilling.

C. Flexible Type: Manufactured to bend to fit radii and to be more flexible than standard regular-type gypsum board of same thickness.

1. Thickness: 1/4 inch (6.4 mm).
2. Long Edges: Tapered.

D. Moisture- and Mold-Resistant Type: With moisture- and mold-resistant core and surfaces.

1. Core: 5/8 inch (15.9 mm), Type X.
2. Long Edges: Tapered.

2.3 TILE BACKING PANELS

A. Cementitious Backer Units: ANSI A118.9.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

    a. Custom Building Products; Wonderboard.
    b. FinPan, Inc.; Util-A-Crete Concrete Backer Board.
    c. USG Corporation; DUROCK Cement Board.

2. Thickness: As indicated on Drawings.

2.4 TRIM ACCESSORIES

A. Interior Trim: ASTM C 1047.

1. Material: Galvanized or aluminum-coated steel sheet, rolled zinc, or paper-faced galvanized steel sheet.
2. Shapes:

    a. Cornerbead.
    b. LC-Bead: J-shaped; exposed long flange receives joint compound.
    c. L-Bead: L-shaped; exposed long flange receives joint compound.
    d. Expansion (control) joint.
    e. Curved-Edge Cornerbead: With notched or flexible flanges.

2.5 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C 475/C 475M.

B. Joint Tape:

1. Interior Gypsum Wallboard: Paper.
2. Tile Backing Panels: As recommended by panel manufacturer.

C. Joint Compound for Interior Gypsum Wallboard: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.

1. Prefilling: At open joints[rounded or beveled panel edges,]and damaged surface areas, use setting-type taping compound.
2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping or drying-type, all-purpose compound.

    a. Use setting-type compound for installing paper-faced metal trim accessories.

3. Fill Coat: For second coat, use setting-type, sandable topping or drying-type, all-purpose compound.
4. Finish Coat: For third coat, use setting-type, sandable topping or drying-type, all-purpose compound.
5. Skim Coat: For final coat of Level 5 finish, use setting-type, sandable topping compound or drying-type, all-purpose compound.

D. Joint Compound for Tile Backing Panels:

1. Cementitious Backer Units: As recommended by backer unit manufacturer.

2.6 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.

B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.

1. Use adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.

1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch (0.84 to 2.84 mm) thick.
2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.

D. Sound Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.

1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.

E. Acoustical Sealant: As specified in Division 7 Section "Joint Sealants."

F. Thermal Insulation: As specified in Division 7 Section "Building Insulation."

G. Vapor Retarder: As specified in Division 7 Section "Building Insulation."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames and framing, for compliance with requirements and other conditions affecting performance.

B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLYING AND FINISHING PANELS, GENERAL

A. Comply with ASTM C 840.

B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.

C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch (1.5 mm) of open space between panels. Do not force into place.

D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.

E. Form control and expansion joints with space between edges of adjoining gypsum panels.

F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.

1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. (0.7 sq. m) in area.
2. Fit gypsum panels around ducts, pipes, and conduits.
3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch- (6.4- to 9.5-mm-) wide joints to install sealant.

G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch- (6.4- to 12.7-mm-) wide spaces at these locations, and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

3.3 APPLYING INTERIOR GYPSUM BOARD

A. Install interior gypsum board in the following locations:

1. Type X: All surfaces, unless otherwise indicated.
2. Flexible Type: Apply in double layer at curved assemblies.
3. Moisture- and Mold-Resistant Type: At wall surfaces containing wall-mounted plumbing fixtures.

B. Single-Layer Application:

1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing, unless otherwise indicated.
2. On partitions/walls, apply gypsum panels vertically (parallel to framing) unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.

a. Stagger abutting end joints not less than one framing member in alternate courses of panels.

b. At stairwells and other high walls, install panels horizontally, unless otherwise indicated or required by fire-resistance-rated assembly.

3. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

C. Multilayer Application:

1. On ceilings, apply gypsum board indicated for base layers before applying base layers on walls/partitions; apply face layers in same sequence. Apply base layers at right angles to framing members and offset face-layer joints 1 framing member, 16 inches (400 mm) minimum, from parallel base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly.
2. On partitions/walls, apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.
3. Fastening Methods: Fasten base layers with screws; fasten face layers with adhesive and supplementary fasteners.

D. Laminating to Substrate: Where gypsum panels are indicated as directly adhered to a substrate (other than studs, joists, furring members, or base layer of gypsum board), comply with gypsum board manufacturer's written recommendations and temporarily brace or fasten gypsum panels until fastening adhesive has set.

E. Curved Surfaces:

1. Install panels horizontally (perpendicular to supports) and unbroken, to extent possible, across curved surface plus 12-inch- (300-mm-) long straight sections at ends of curves and tangent to them.
2. For double-layer construction, fasten base layer to studs with screws 16 inches (400 mm) o.c. Center gypsum board face layer over joints in base layer, and fasten to studs with screws spaced 12 inches (300 mm) o.c.

3.4 APPLYING TILE BACKING PANELS

A. Cementitious Backer Units: ANSI A108.11, at locations indicated to receive tile.

B. Where tile backing panels abut other types of panels in same plane, shim surfaces to produce a uniform plane across panel surfaces.

3.5 INSTALLING TRIM ACCESSORIES

A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

B. Control Joints: Install control joints according to ASTM C 840 and in specific locations approved by Architect for visual effect.

C. Interior Trim: Install in the following locations:

1. Cornerbead: Use at outside corners.

2. LC-Bead: Use at exposed panel edges.
3. L-Bead: Use where indicated.
4. Curved-Edge Cornerbead: Use at curved openings.

3.6 FINISHING GYPSUM BOARD

A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.

B. Prefill open joints, rounded or beveled edges, and damaged surface areas.

C. Apply joint tape over gypsum board joints, except those with trim having flanges not intended for tape.

D. Gypsum Board Finish Levels: Finish panels to levels indicated below:

1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
2. Level 4: At panel surfaces that will be exposed to view, unless otherwise indicated.

a. Primer and its application to surfaces are specified in other Division 9 Sections.

E. Cementitious Backer Units: Finish according to manufacturer's written instructions.

3.7 IDENTIFICATION

A. Identify fire-resistance-rated and smoke-tight partitions with paint-stenciled labels. Provide stenciled labels above ceilings on both sides of fire-resistance-rated and smoke- tight partitions and located to be readable when ceiling plenum is accessed. Label partitions at a minimum of 12 feet on center using the applicable label from the following:

1. 2-HOUR WALL.
2. 1-HOUR WALL.
3. 1-HOUR SMOKE BARRIER.
4. SMOKE-TIGHT CORRIDOR PARTITION.

3.8 PROTECTION

A. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.
B. Remove and replace panels that are wet, moisture damaged, and mold damaged.
1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 092900

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SECTION 093000 - TILING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Tile.
2. Waterproof membrane for thinset applications.
3. Metal edge strips.

B. Related Requirements:
1. Section 092900 "Gypsum Board" for cementitious backer units.

1.3 DEFINITIONS

A. General: Definitions in the ANSI A108 series of tile installation standards and in ANSI A137.1 apply to Work of this Section unless otherwise specified.

B. ANSI A108 Series: ANSI A108.01, ANSI A108.02, ANSI A108.1A, ANSI A108.1B, ANSI A108.1C, ANSI A108.4, ANSI A108.5, ANSI A108.6, ANSI A108.8, ANSI A108.9, ANSI A108.10, ANSI A108.11, ANSI A108.12, ANSI A108.13, ANSI A108.14, ANSI A108.15, ANSI A108.16, and ANSI A108.17, which are contained in "American National Standard Specifications for Installation of Ceramic Tile."

C. Module Size: Actual tile size plus joint width indicated.

D. Face Size: Actual tile size, excluding spacer lugs.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review requirements in ANSI A108.01 for substrates and for preparation by other trades.

1.5 PERFORMANCE REQUIREMENTS

A. Static Coefficient of Friction: For tile installed on walkway surfaces, provide products with the following values as determined by testing identical products per ASTM C 1028:

1. Level Surfaces: Minimum 0.6.
2. Step Treads: Minimum 0.6.
3. Ramp Surfaces: Minimum 0.8.

1.6 ACTION SUBMITTALS

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

B. Shop Drawings: Show locations of each type of tile and tile pattern. Show widths, details, and locations of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces.

C. Samples for Verification:

1. Full-size units of each type and composition of tile and for each color and finish required.
2. Full-size units of each type of trim and accessory for each color and finish required.
3. Metal edge strips in 6-inch (150-mm) lengths.

1.7 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Master Grade Certificates: For each shipment, type, and composition of tile, signed by tile manufacturer and Installer.

C. Product Certificates: For each type of product.

D. Product Test Reports: For tile-setting and -grouting products.

1.8 QUALITY ASSURANCE

A. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Build mockup of each type of floor and wall tile installation.
2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

B. Source Limitations for Tile: Obtain all tile of same type and color or finish from one source or producer.

1. Obtain tile from same production run and of consistent quality in appearance and physical properties for each contiguous area.

C. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from a single manufacturer and each aggregate from one source or producer.

D. Source Limitations for Other Products: Obtain each of the following products specified in this Section through one source from a single manufacturer for each product:

1. Joint sealants.
2. Waterproof membrane.
3. Metal edge strips.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirement in ANSI A137.1 for labeling sealed tile packages.

B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.

C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

D. Store liquid latexes and emulsion adhesives in unopened containers and protected from freezing.

E. Handle tile that has temporary protective coating on exposed surfaces to prevent coated surfaces from contacting backs or edges of other units. If coating does contact bonding surfaces of tile, remove coating from bonding surfaces before setting tile.

1.10 PROJECT CONDITIONS

A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide the products indicated in the Room Finish Legend included on Drawings.

2.2 PRODUCTS, GENERAL

A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1, "Specifications for Ceramic Tile," for types, compositions, and other characteristics indicated.

1. Provide tile complying with Standard grade requirements, unless otherwise indicated.

B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced in other Part 2 articles, ANSI standards referenced by TCNA installation methods specified in tile installation schedules, and other requirements specified.

C. Colors, Textures, and Patterns: Where manufacturer's standard products are indicated for tile, grout, and other products requiring selection of colors, surface textures, patterns, and other

appearance characteristics, provide specific products or materials complying with the following requirements:

1. As indicated by manufacturer's designations.

D. Factory Blending: For tile exhibiting color variations within ranges selected during Sample submittals, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.

E. Mounting: For factory-mounted tile, provide back- or edge-mounted tile assemblies as standard with manufacturer, unless otherwise indicated.

2.3 TILE PRODUCTS

A. Trim Units: Matching characteristics of adjoining flat tile and coordinated with sizes and coursing of adjoining flat tile where applicable. Provide shapes as follows, unless noted otherwise on Room Finish Schedule and Legend, selected from manufacturer's standard shapes:

1. Wainscot Cap and Base Cap for Glazed Wall Tile: As indicated on the Room Finish Schedule and Legend.
2. Internal Corners: Field-butted square corners. For coved base and cap, use angle pieces designed to fit with stretcher shapes.

2.4 WATERPROOF MEMBRANE

A. General: Manufacturer's standard product that complies with ANSI A118.10 and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.

B. Schluter – KERDI

1. Description: 0.008 inch (0.2 mm), orange polyethylene membrane, with polyethylene fleece laminated on both sides, which meets or exceeds the requirements of the “American National Standard Specifications for load bearing, bonded, waterproof membranes for thin-set ceramic tile and dimension stone installation A118.10,” and is listed by cUPC, and is evaluated by ICC-ES (see Report No. ESR-2467).

2. Provide KERDI in 0.004 inch (0.1 mm) thick, 5 inch (125 mm), 7-1/4 inch (185 mm), and 10 inch (250 mm) wide bands for seams, corners, and pre-fabricated seals (Schluter-KERDI-BAND and Schluter-KERDI-SEAL-PS/-MV), as required.

2.5 SETTING MATERIALS

A. Latex-Portland Cement Mortar (Thin Set): ANSI A118.4.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Boiardi Products; a QEP company.
b. Bonsal American; an Oldcastle company.

c. Bostik, Inc.
d. C-Cure.
e. Custom Building Products.
f. Jamo Inc.
g. Laticrete International, Inc.
h. MAPEI Corporation.
i. Mer-Kote Products, Inc.
j. Southern Grouts & Mortars, Inc.
k. Summitville Tiles, Inc.
l. TEC; a subsidiary of H. B. Fuller Company.

2. For wall applications, provide mortar that complies with requirements for nonsagging mortar in addition to the other requirements in ANSI A118.4.

2.6 GROUT MATERIALS

A. Polymer-Modified Tile Grout: ANSI A118.7.

1. Manufacturers: Subject to compliance with requirements, [provide products by one of the following:

a. Boiardi Products; a QEP company.
b. Bonsal American; an Oldcastle company.
c. Bostik, Inc.
d. C-Cure.
e. Custom Building Products.
f. Jamo Inc.
g. Laticrete International, Inc.
h. MAPEI Corporation.
i. Southern Grouts & Mortars, Inc.
j. Summitville Tiles, Inc.
k. TEC; a subsidiary of H. B. Fuller Company.

B. Water-Cleanable Epoxy Grout: ANSI A118.3.

1. Manufacturers: Subject to compliance with requirements, [provide products by one of the following:

a. Atlas Minerals & Chemicals, Inc.
b. Boiardi Products; a QEP company.
c. Bonsal American; an Oldcastle company.
d. Bostik, Inc.
e. C-Cure.
f. Custom Building Products.
g. Jamo Inc.
h. Laticrete International, Inc.
i. MAPEI Corporation.
j. Mer-Kote Products, Inc.
k. Southern Grouts & Mortars, Inc.
l. Summitville Tiles, Inc.
m. TEC; a subsidiary of H. B. Fuller Company.

2.7 ELASTOMERIC SEALANTS

A. General: Provide sealants, primers, backer rods, and other sealant accessories that comply with the following requirements and with the applicable requirements in Division 07 Section "Joint Sealants."

1. Use primers, backer rods, and sealant accessories recommended by sealant manufacturer.

B. Colors: Provide colors of exposed sealants to match colors of grout in tile adjoining sealed joints unless otherwise indicated.

C. One-Part, Mildew-Resistant Silicone Sealant: ASTM C 920; Type S; Grade NS; Class 25; Uses NT, G, A, and, as applicable to nonporous joint substrates indicated, O; formulated with fungicide, intended for sealing interior ceramic tile joints and other nonporous substrates that are subject to in-service exposures of high humidity and extreme temperatures.

1. Products: Subject to compliance with requirements, provide one of the following:

a. DAP Inc.; Titanium Enriched Kitchen and Bath Sealant or 100 percent Silicone Kitchen and Bath Sealant.
b. Dow Corning Corporation; Dow Corning 786.
c. GE Silicones; a division of GE Specialty Materials; Sanitary 1700.
d. Laticrete International, Inc.; Latasil Tile & Stone Sealant.
e. Pecora Corporation; Pecora 898 Sanitary Silicone Sealant.
f. Tremco Incorporated; Tremsil 600 White.

2.8 MISCELLANEOUS MATERIALS

A. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.

B. Metal Edge Strips: Angle or L-shape, height to match tile and setting-bed thickness, metallic or combination of metal and PVC or neoprene base, designed specifically for flooring applications; white zinc alloy exposed-edge material.

1. Manufacturer: Provide ceramic tile trims pieces as manufactured by the following:

a. Schluter Systems.

C. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.

D. Grout Sealer: Manufacturer's standard silicone product for sealing polymer-modified grout joints that does not change color or appearance of grout.

1. Products:

a. Bonsal, W. R., Company; Grout Sealer.
b. Bostik; CeramaSeal Grout Sealer.

c. C-Cure; Penetrating Sealer 978.
d. Custom Building Products; Grout Sealer.
e. Jamo Inc.; Penetrating Sealer.
f. MAPEI Corporation; KER 003, Silicone Spray Sealer for Cementitious Tile Grout or 004, Keraseal Penetrating Sealer for Unglazed Grout and Tile.
g. Southern Grouts & Mortars, Inc.; Silicone Grout Sealer.
h. Summitville Tiles, Inc.; SL-15, Invisible Seal Penetrating Grout and Tile Sealer.
i. TEC Specialty Products Inc.; TA-256 Penetrating Silicone Grout Sealer.

2.9 MIXING MORTARS AND GROUT

A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.

B. Add materials, water, and additives in accurate proportions.

C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of installed tile.

1. Verify that substrates for setting tile are firm; dry; clean; free of oil, waxy films, and curing compounds; and within flatness tolerances required by referenced ANSI A108 Series of tile installation standards for installations indicated.
2. Verify that concrete substrates for tile floors installed with thinset mortar comply with surface finish requirements in ANSI A108.01 for installations indicated.

    a. Verify that surfaces that received a steel trowel finish have been mechanically scarified.
    b. Verify that protrusions, bumps, and ridges have been removed by sanding or grinding.
3. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed before installing tile.
4. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Remove coatings, including curing compounds and other substances that contain soap, wax, oil, or silicone, that are incompatible with tile-setting materials.

B. Provide concrete substrates for tile floors installed with thin-set mortar that comply with flatness tolerances specified in referenced ANSI A108 Series of tile installation standards.

1. Fill cracks, holes, and depressions with trowelable leveling and patching compound according to tile-setting material manufacturer's written instructions. Use product specifically recommended by tile-setting material manufacturer.
2. Remove protrusions, bumps, and ridges by sanding or grinding.

C. Blending: For tile exhibiting color variations within ranges selected during Sample submittals, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

3.3 INSTALLATION, GENERAL

A. ANSI Tile Installation Standards: Comply with parts of ANSI A108 Series "Specifications for Installation of Ceramic Tile" that apply to types of setting and grouting materials and to methods indicated in ceramic tile installation schedules.

B. Comply with TCNA's "Handbook for Ceramic, Glass, and Stone Tile Installation" for TCNA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108 series "Specifications for Installation of Ceramic Tile" that are referenced in TCNA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.

1. For the following installations, follow procedures in the ANSI A108 series of tile installation standards for providing 95 percent mortar coverage:
   a. Tile floors in wet areas.
   b. Tile floors consisting of tiles 8 by 8 inches (200 by 200 mm) or larger.
   c. Tile floors consisting of rib-backed tiles.

C. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions, unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.

D. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.

E. Jointing Pattern: Lay tile in grid pattern, unless otherwise indicated. Align joints when adjoining tiles on floor, base, walls, and trim are same size. Lay out tile work and center tile fields in both directions in each space or on each wall area. Adjust to minimize tile cutting. Provide uniform joint widths, unless otherwise indicated.

1. For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets so joints between sheets are not apparent in finished work.

F. Lay out tile wainscots to next full tile beyond dimensions indicated.

G. Expansion Joints: Locate expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.

1. Locate joints in tile surfaces directly above joints in concrete substrates.
2. Prepare joints and apply sealants to comply with requirements in Section 079200 "Joint Sealants."

H. Grout tile to comply with requirements of the following tile installation standards:

1. For ceramic tile grouts (sand-portland cement; dry-set, commercial portland cement; and latex-portland cement grouts), comply with ANSI A108.10.

I. Grout Sealer: Apply grout sealer to grout joints in walls indicated according to grout-sealer manufacturer's written instructions. As soon as grout sealer has penetrated grout joints, remove excess sealer and sealer from tile faces by wiping with soft cloth.

3.4 WATERPROOF MEMBRANE INSTALLATION

A. Install waterproofing to comply with ANSI A108.13 and manufacturer's written instructions to produce waterproof membrane of uniform thickness and bonded securely to substrate.

B. Do not install tile or setting materials over waterproofing until waterproofing has cured and been tested to determine that it is watertight.

3.5 WALL TILE INSTALLATION

A. Install types of tile designated for wall installations to comply with requirements in the Wall Tile Installation Schedule, including those referencing TCA installation methods and ANSI setting-bed standards.

B. Joint Widths: Install tile on walls with the following joint widths:

1. Glazed Wall Tile: 1/8 inch (1.6 mm).

3.6 CLEANING AND PROTECTING

A. Remove and replace tile that is damaged or that does not match adjoining tile. Provide new matching units, installed as specified and in a manner to eliminate evidence of replacement.

B. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.

1. Remove epoxy and latex-portland cement grout residue from tile as soon as possible.

2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions, but no sooner than 10 days after installation. 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. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.

C. When recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear.

D. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.

E. Before final inspection, remove protective coverings and rinse neutral cleaner from tile surfaces.

3.7 INTERIOR TILE INSTALLATION SCHEDULE

A. Interior Floor Installations, Concrete Subfloor:

1. Ceramic Tile Installation: TCNA F115; thinset mortar; epoxy grout.

   a. Ceramic Tile Type: As indicated on drawings.
   b. Thinset Mortar: Latex-portland cement mortar.
   c. Grout: Water-cleanable epoxy grout.

2. Ceramic Tile Installation: TCNA F122; thinset mortar on waterproof membrane.

   a. Ceramic Tile Type: As indicated on drawings.
   b. Thinset Mortar: Latex- portland cement mortar.
   c. Grout: Water-cleanable epoxy grout.

3. Tile Installation F125A: Thin-set mortar on crack isolation membrane; TCA F125A.

   a. Tile Type: As indicated on drawings.
   b. Thin-Set Mortar: Latex-portland cement mortar.
   c. Grout: Water-cleanable epoxy grout.

B. Interior Wall Installations:

1. Tile Installation W244: Thin-set mortar on cementitious backer units; TCA W244.

   a. Tile Type: Glazed wall tile.
   b. Thin-Set Mortar: Latex-portland cement mortar.
   c. Grout: Polymer-modified unsanded grout with clear sealer.
   d. Accessories: Schluter Systems Quadec Trim Cap (vertically) at all outside corners.

END OF SECTION 093000

SECTION 095113 - ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes acoustical panels and exposed suspension systems for ceilings.

1.3 SUBMITTALS

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

B. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:

1. Ceiling suspension system members.
2. Method of attaching hangers to building structure.
3. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
4. Minimum Drawing Scale: 1/8 inch = 1 foot (1:96).

C. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of size indicated below.

1. Acoustical Panel: Set of 6-inch- (150-mm-) square Samples of each type, color, pattern, and texture.
2. Exposed Suspension System Members, Moldings, and Trim: Set of 12-inch- (300-mm-) long Samples of each type, finish, and color.

D. Maintenance Data: For finishes to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Source Limitations:

1. Acoustical Ceiling Panel: Obtain each type through one source from a single manufacturer.
2. Suspension System: Obtain each type through one source from a single manufacturer.

B. Fire-Test-Response Characteristics: Provide acoustical panel ceilings that comply with the following requirements:

1. Surface-Burning Characteristics: Provide acoustical panels with the following surface-burning characteristics complying with ASTM E 1264 for Class A materials as determined by testing identical products per ASTM E 84:

   a. Smoke-Developed Index: 450 or less.

C. Seismic Standard: Provide acoustical panel ceilings designed and installed to withstand the effects of earthquake motions according to the following:

1. CISCA's Guidelines for Systems Requiring Seismic Restraint: Comply with CISCA's "Guidelines for Seismic Restraint of Direct-Hung Suspended Ceiling Assemblies--Seismic Zones 3 & 4."
2. ASCE 7, "Minimum Design Loads for Buildings and Other Structures": Section 9, "Earthquake Loads."

1.5 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.

1.6 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.

1.7 COORDINATION

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

1.8 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Acoustical Ceiling Panels: Full-size panels equal to 2.0 percent of quantity installed.

PART 2 - PRODUCTS

2.1 ACOUSTICAL PANELS, GENERAL

A. Products: Subject to compliance with requirements, provide one of the products listed in Finish Legend located in the Drawings.

B. Broad Spectrum Antimicrobial Fungicide and Bactericide Treatment: Provide acoustical panels treated with manufacturer's standard antimicrobial formulation that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria and showing no mold, mildew, or bacterial growth when tested according to ASTM D 3273 and evaluated according to ASTM D 3274 or ASTM G 21.

2.2 METAL SUSPENSION SYSTEMS, GENERAL

A. Metal Suspension System Standard: Provide manufacturer's standard direct-hung metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C 635.

B. Finishes and Colors, General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Provide manufacturer's standard factory-applied finish for type of system indicated.

1. High-Humidity Finish: Comply with ASTM C 635 requirements for "Coating Classification for Severe Environment Performance" where high-humidity finishes are indicated.

C. Attachment Devices: Size for five times the design load indicated in ASTM C 635, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.

1. Anchors in Concrete: Anchors of type and material indicated below, with holes or loops for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to five times that imposed by ceiling construction, as determined by testing per ASTM E 488 or ASTM E 1512 as applicable, conducted by a qualified testing and inspecting agency.

a. Type: Postinstalled expansion or postinstalled bonded anchors.
b. Corrosion Protection: Carbon-steel components zinc plated to comply with ASTM B 633, Class Fe/Zn 5 (0.005 mm) for Class SC 1 service condition.

2. Power-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 hangers of type indicated, and with capability to sustain, without failure, a load equal to 10 times that imposed by ceiling construction, as determined by testing per ASTM E 1190, conducted by a qualified testing and inspecting agency.

D. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:

1. Zinc-Coated, Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.

2. Size: Select wire diameter so its stress at 3 times hanger design load (ASTM C 635, Table 1, "Direct Hung") will be less than yield stress of wire, but provide not less than 0.106-inch- (2.69-mm-) diameter wire.

E. Hanger Rods: Mild steel, zinc coated or protected with rust-inhibitive paint.

F. Seismic Struts: Manufacturer's standard compression struts designed to accommodate seismic forces.

G. Seismic Clips: Manufacturer's standard seismic clips designed to prevent spreading and displacement of perimeter grid members.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Armstrong World Industries, Inc., BERC2 seismic clips or a comparable product approved by governing authorities for use to eliminate stabilizer/spreader bars and 2-inch wide wall molding for seismic installations.

2.3 SUSPENSION SYSTEM FOR CEILING DESIGNATION

A. Products: Non-Fire Resistance Rated Wide-Face Steel Suspension Systems as manufactured by the following:

1. Armstrong World Industries, Inc.

B. Structural Classification: Heavy-duty system.

C. Face Finish: Painted white.

D. Face Width: 15/16 inches.

E. End Condition of Cross-Runners: Override or butt-edge type.

2.4 METAL EDGE MOLDINGS AND TRIM

A. Products: Subject to compliance with requirements, provide metal edge moldings and trim as manufactured by one of the following:

1. Armstrong World Industries, Inc.
2. Chicago Metallic Corporation.
3. USG Interiors, Inc.

B. Roll-Formed, Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that comply with seismic design requirements; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension system runners.

1. Provide manufacturer's standard edge moldings that fit acoustical panel edge details and suspension systems indicated and that match width and configuration of exposed runners, unless otherwise indicated.
2. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.

2.5 ACOUSTICAL SEALANT

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

1. Acoustical Sealant for Exposed and Concealed Joints:

a. Pecora Corporation; AC-20 FTR Acoustical and Insulation Sealant.
b. USG Corporation; SHEETROCK Acoustical Sealant.

2. Acoustical Sealant for Concealed Joints:

a. OSI Sealants, Inc.; Pro-Series SC-175 Rubber Base Sound Sealant.
b. Pecora Corporation; BA-98.
c. Tremco, Inc.; Tremco Acoustical Sealant.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

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

3.3 INSTALLATION

A. General: Install acoustical panel ceilings to comply with ASTM C 636 and seismic design requirements indicated, per manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."

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. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, postinstalled mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
6. 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.
7. Do not attach hangers to steel deck tabs.
8. Do not attach hangers to steel roof deck. Attach hangers to structural members.
9. Space hangers not more than 48 inches (1200 mm) o.c. along each member supported directly from hangers, unless otherwise indicated; provide hangers not more than 8 inches (200 mm) from ends of each member.
10. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.

C. In addition to requirements above, at rooms and ceiling areas greater than 144 square feet install suspension system with seismic restraints per CISCA's "Guidelines for Seismic Restraint of Direct-Hung Suspended Ceiling Assemblies--Seismic Zones 3 & 4" and ASCE 7, "Minimum Design Loads for Buildings and Other Structures": Section 9, "Earthquake Loads."

1. Space hangers not more than 48 inches (1200 mm) o.c. along each member supported directly from hangers using No. 12 gage wire. Attach each vertical wire to ceiling suspension member and to structure with a minimum of three tight turns.
2. Provide perimeter hangers at the terminal ends of each cross runner and main runner a maximum of 8 inches from each wall or ceiling discontinuity with No. 12 gauge wire or approved wall support.
3. Attach main runners and cross runners to wall molding or other perimeter member along two adjacent walls of a room or area. Maintain a 3/4-inch clearance between terminal ends of runners and perimeter member on the remaining two adjacent walls and attach to perimeter wall molding with Armstrong BERC2 seismic clips.
4. Attach light fixtures to the ceiling grid with attachments capable of carrying one hundred per cent of the weight of the light fixture. Provide two additional hanger wires from fixture to structure within 3 inches of each corner of each fixture where light fixture is 56 pounds or less. Tandem fixtures may use common hangers. Support light fixture weighing over 56 pounds independently from structure above.
5. Attach air terminals weighing less than 20 pounds to the ceiling grid with attachments capable of carrying one hundred per cent of the weight. Provide two additional hanger wires from air terminal to structure where air terminal is 56 pounds or less. Support air terminals weighing over 56 pounds independently from structure above.
6. Provide a 2-inch oversize ring, sleeve, or adaptor at sprinkler heads and other penetrations to allow 1-inch horizontal movement in all directions.

D. In rooms and areas greater than 1000 square feet install suspension system with seismic restraints per ASCE 7, "Minimum Design Loads for Buildings and Other Structures": Section 9, "Earthquake Loads." Provide horizontal force restraints consisting of four No. 12 gauge wires secured to the main runner within 2 inches of the cross runner intersection and splayed 90 degrees form each other at an angle not exceeding 45 degrees from the plane of the ceiling. Fasten a strut to the main runner and extend vertically to fasten to the structural member supporting the floor or roof above. This strut shall be adequate to resist the vertical forces induced by

the bracing wires. Locate horizontal force restraints a maximum of 12 feet on center in each direction and a maximum distance from ceiling perimeter of 6 feet.

E. 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.

F. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.

1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
2. Screw attach moldings to substrate at intervals not more than 16 inches (400 mm) o.c. and not more than 3 inches (75 mm) from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet (3.2 mm in 3.6 m). Miter corners accurately and connect securely.
3. Do not use exposed fasteners, including pop rivets, on moldings and trim except as required for seismic restraint.

G. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

H. 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 follows:

a. Install panels with pattern running in one direction parallel to long axis of space.

2. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension system runners and moldings.

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 095113

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SECTION 096010 TOPICAL MOISTURE VAPOR MITIGATION SYSTEMS FOR FLOORING

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 topical moisture mitigation system installed over concrete substrates below interior floor coverings. System consists of single coat, epoxy-based moisture control system layer and cement based underlayment topcoat.
   1. Work of this Section includes concrete substrate preparation and testing of substrates prior to system installation.

B. Related Sections:

   1. Section 012100 “Allowances” for floor preparation allowance requirements.
   2. Section 012200 “Unit Prices” for floor preparation unit price requirements.
   3. Section 033000 “Concrete & Reinforcing” for water vapor transmission inhibiting admixture installed with new concrete floor substrates.

1.3 ACTION SUBMITTALS

A. Product Data and Installation Instructions: For each type of product and system indicated. Include Material Safety Data Sheets.

B. Shop Drawings: For topical moisture vapor mitigation systems indicating type and extent of installation, type of substrate, details for treating substrate joints and cracks, penetrations, and other termination conditions.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Manufacturer and Installer.

B. Product certificates, including compatibility certification from both topical moisture vapor mitigation system manufacturer and from floor covering manufacturer.

C. Product and field test reports.

D. Sample warranty.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Topical moisture vapor mitigation system manufacturer with minimum of five years successful experience in manufacturing systems specified herein for applications indicated. The water vapor mitigation system shall be specifically formulated and marketed for water vapor mitigation and alkalinity control. System shall provide protection from vapor emission rates less than or equal to 20 pounds per 1000 square feet per 24 hours and/or 98% relative humidity.

B. Installer Qualifications: Installer who is approved by manufacturer for application of topical moisture vapor mitigation systems and products required for this Project.
   1. Installer's responsibilities include testing or any other documentation required by manufacturer to provide warranty specified.

C. Product Compatibility: Manufacturers of topical moisture mitigation systems and floor-covering systems certify in writing that products are compatible.

D. Source Limitations: Obtain topical moisture vapor mitigation system and components from a single source from single manufacturer.

E. Mockups: Build mockups to verify surface preparation techniques, demonstrate workmanship and set quality standards for materials and execution.

   1. Build mockups for topical moisture vapor mitigation systems.

      a. Size: Minimum 100 sq. ft. (9 sq. m) of typical floor area.

   2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

1.6 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver system components and products in manufacturer's original packaging, labeled with product identification, manufacturer, batch number and shelf life.

B. Store system components and installation materials in dry spaces protected from the weather and from direct sunlight, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F (10 deg C) or more than 85 deg F (29 deg C).

C. Handle products in accordance with manufacturer's printed recommendations.

1.8 FIELD CONDITIONS

A. Maintain ambient and surface temperatures within range recommended by manufacturer, but not less than 50 deg F (10 deg C) or more than 85 deg F (29 deg C), in spaces to receive topical moisture vapor mitigation systems during the following time periods:

1. 48 hours before installation.
2. During installation.
3. 48 hours after installation.

B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F (13 deg C) or more than 95 deg F (35 deg C).

C. Close spaces to traffic during system installation.

D. Close spaces to traffic for 48 hours after system installation.

1.9 WARRANTY

A. Special Project Specific Warranty for Topical Moisture Vapor Mitigation System: System manufacturer's standard warranty in which manufacturer agrees to repair or replace moisture vapor mitigation systems that fail in materials or workmanship within specified warranty period.

1. Warranty shall include moisture related failures and shall include removal of floor coverings, moisture remediation of the concrete substrate, and replacement materials and installation of all floor finishes.

2. Warranty Period:

a. Ten years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Material Compatibility: Provide primers; moisture control system, cement-based underlayment and accessory materials that are compatible with one another and with substrate under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.

2.2 TOPICAL MOISTURE VAPOR MITIGATION SYSTEM

A. Moisture Control System Layer for Concrete Substrates: Single-coat, fast curing, self-leveling, 100% solids epoxy moisture management system formulated to suppress excessive moisture vapor emissions in new or existing concrete and designed to be installed below cement-based underlayment.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Ardex; MC Rapid.
b. H.B. Fuller Construction Products; Chapco Defender.

B. Underlayment Topcoat: Hydraulic-cement-based, polymer-modified, self-leveling product that can be applied in minimum uniform thickness of 1/4 inch (6 mm) and that can be feathered at edges to match adjacent floor elevations.

1. Basis-of-Design Products: Subject to compliance with requirements, provide **K-15 Self-Leveling Underlayment** with **P 82 Ultra Prime primer** or **K-55 Microtec** with **P 82 Ultra Prime primer** by **Ardex** or comparable products, approved in writing by topical moisture system manufacturer, by the following manufacturer:
   a. Specialty Construction Brands, Inc., an H.B. Fuller company.

2. Cement Binder: ASTM C 150, portland cement, or hydraulic or blended hydraulic cement as defined by ASTM C 219.
3. Compressive Strength: Not less than 4000 psi (27.6 MPa) at 28 days when tested according to ASTM C 109/C 109M.

C. Water: Potable and at a temperature of not more than 70 deg F (21 deg C).

D. Primer: Product of underlayment manufacturer recommended in writing for substrate, conditions, and application indicated.

1. Primer shall have a VOC content of 200 g/L or less when calculated according to 40 CFR 59, Subpart D.

PART 3 - EXECUTION

3.1 PREPARATION

A. General: Prepare and clean substrate according to manufacturer's written instructions.

1. Treat nonmoving substrate cracks to prevent cracks from telegraphing (reflecting) through topical moisture vapor mitigation system.
2. Prepare expansion, control and isolation joints in concrete substrate in accordance with system manufacturer’s written instructions.
3. Fill substrate voids to prevent system components from leaking.
4. Installation of topical moisture vapor mitigation system indicates acceptance of surfaces and conditions.

B. Concrete Substrates: Mechanically abrade surface to a uniform profile acceptable to manufacturer, according to ASTM D 4259.

1. Remove grease, oil, paints, and other penetrating contaminants from concrete.
2. Remove concrete fins, ridges, and other projections.
3. Remove laitance, glaze, efflorescence, curing compounds, concrete hardeners, form-release agents, and other incompatible materials that might affect coating adhesion.
4. Remove remaining loose material to provide a sound surface, and clean surfaces according to ASTM D 4258.
5. Moisture and Alkalinity Testing: Perform moisture and alkalinity testing as required by system manufacturer. Proceed with installation only after substrates do not exceed a

maximum relative humidity required by manufacturer for installation and warranty specified.

C. Adhesion Tests: After substrate preparation, test substrate for adhesion with system components.

3.2 TOPICAL MOISTURE VAPOR MITIGATION SYSTEM APPLICATION

A. Mix components and install in a single coat in thickness required for installation indicated in accordance with manufacturer's written instructions. Allow to cure prior to installation of cement-based underlayment.

B. Mix and apply cement-based underlayment over moisture control system according to manufacturer's written instructions.

1. Close areas to traffic during underlayment application and for time period after application recommended in writing by manufacturer.
2. Coordinate application of components to provide optimum underlayment-to-substrate and intercoat adhesion.
3. At substrate expansion, isolation, and other moving joints, allow joint of same width to continue through underlayment.
4. Apply primer over prepared substrate at manufacturer's recommended spreading rate.
5. Apply underlayment to produce uniform, level surface.
   a. Feather edges to match adjacent floor elevations.
6. Cure underlayment. Prevent contamination during application and curing processes.

C. Do not install floor coverings over topical moisture vapor mitigation system until after time period recommended in writing by system manufacturer.

D. Remove and replace areas that evidence lack of bond with substrate, including areas that emit a "hollow" sound when tapped.

3.3 PROTECTING AND CLEANING

A. Protect topical moisture vapor mitigation system from damage and wear during remainder of construction period.

END OF SECTION 096010

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SECTION 096513 - RESILIENT WALL BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Wall base.
2. Molding accessories.

1.3 SUBMITTALS

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

B. Samples for Verification: For each type of product indicated, in manufacturer's standard-size Samples but not less than 12 inches (300 mm) long, of each resilient product color, texture, and pattern required.

1.4 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: Provide resilient accessories with a critical radiant flux classification of Class I, not less than 0.45 W/sq. cm, as determined by testing identical products per ASTM E 648 by a testing and inspecting agency acceptable to authorities having jurisdiction.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F (10 deg C) or more than 90 deg F (32 deg C).

1.6 PROJECT CONDITIONS

A. Maintain temperatures within range recommended by manufacturer, but not less than 70 deg F (21 deg C) or more than 95 deg F (35 deg C) in spaces to receive floor tile during the following time periods:

1. 48 hours before installation.
2. During installation.

3. 48 hours after installation.

B. After post installation period, maintain temperatures within range recommended by manufacturer, but not less than 55 deg F (13 deg C) or more than 95 deg F (35 deg C).

C. Install resilient products after other finishing operations, including painting, have been completed.

1.7 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Base and Accessories: Full-size items equal to 2.0 percent of quantity installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide the wall base products listed in the Room Finish Legend located in the Drawings.

2.2 COLORS AND PATTERNS

A. Colors and Patterns: As indicated in Room Finish Legend by manufacturer's designations.

2.3 RESILIENT MOLDING ACCESSORY

A. Description: Transition strips between ceramic floor tile and resilient floor coverings.

1. Johnsonite; ‘CTA’ vinyl transition moldings unless otherwise shown.

B. Material: Vinyl.

C. Profile and Dimensions: 2-1/2-inches wide with heights to correlate with abutting flooring thicknesses.

D. Color: As selected from manufacturer’s standard colors.

2.4 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic cement based formulation provided or approved by resilient product manufacturers for applications indicated.

B. Adhesives: Water-resistant type recommended by manufacturer to suit resilient products and substrate conditions indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for installation tolerances, moisture content, and other conditions affecting performance.

1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.
2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare substrates according to manufacturer's written recommendations to ensure adhesion of resilient products.

B. Concrete Substrates testing: Prepare according to ASTM F 710.

1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
2. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.
3. Moisture Testing:

a. Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m) in 24 hours.
b. Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.

C. 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.

D. Use trowelable leveling and patching compound to fill cracks, holes, and depressions in substrates.

E. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.

1. Do not install resilient products until they are the same temperature as the space where they are to be installed.

F. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation. After cleaning, examine substrates for moisture, alkaline salts, carbonation, and dust. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 RESILIENT WALL BASE INSTALLATION

A. Apply wall 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 wall base in lengths as long as practicable without gaps at seams and with tops of adjacent pieces aligned.

C. Tightly adhere wall base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

D. Do not stretch wall base during installation.

E. On masonry surfaces or other similar irregular substrates, fill voids along top edge of wall base with manufacturer's recommended adhesive filler material.

F. Job-Formed Corners:

1. Outside Corners: Use straight pieces of maximum lengths possible. Form without producing discoloration (whitening) at bends. Shave back of base at points where bends occur and remove strips perpendicular to length of base that are only deep enough to produce a snug fit without removing more than half the wall base thickness.
2. Inside Corners: Use straight pieces of maximum lengths possible. Form by cutting an inverted V-shaped notch in toe of wall base at the point where corner is formed. Shave back of base where necessary to produce a snug fit to substrate.

3.4 RESILIENT ACCESSORY INSTALLATION

A. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of floor coverings that would otherwise be exposed.

3.5 CLEANING AND PROTECTION

A. Perform the following operations immediately after completing resilient product installation:

1. Remove adhesive and other blemishes from exposed surfaces.
2. Sweep and vacuum surfaces thoroughly.
3. Damp-mop surfaces to remove marks and soil.

    a. Do not wash surfaces until after time period recommended by manufacturer.

B. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period. Use protection methods recommended in writing by manufacturer.

END OF SECTION 096513

SECTION 096516 - RESILIENT SHEET FLOORING

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. Resilient sheet floor covering installed with manufacturer’s standard recommended full spread adhesives (Base Bid).

B. Related Requirements:

1. Section 012100 “Allowances” for spray-applied flooring adhesive allowance requirements.
2. Section 012200 “Unit Prices” for spray-applied flooring adhesive unit price requirements.
3. Section 024119 "Selective Demolition" for removing existing floor coverings.
4. Section 033000 “Concrete & Reinforcing” for water vapor transmission inhibiting admixture installed with new concrete floor substrates and for testing associated with this admixture.
5. Section 096010 “Topical Moisture Vapor Mitigation Systems for Flooring” for mitigation system installed over concrete substrates as part of work of an Allowance or Unit Price.
6. Section 096513 Resilient Base and Accessories.
7. Section 096519 Resilient Tile Flooring.

1.3 ACTION SUBMITTALS

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

B. Shop Drawings: For each type of flooring. Include flooring layouts, locations of seams, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.

1. Show details of special patterns.

C. Samples for Verification: In manufacturer's standard size, but not less than 6-by-9-inch (150-by-230-mm) sections of each different color and pattern of floor covering required.

1. For heat-welding bead, manufacturer's standard-size Samples, but not less than 9 inches (230 mm) long, of each color required.

D. Welded-Seam Samples: For seamless-installation technique indicated and for each resilient sheet flooring product, color, and pattern required; with seam running lengthwise and in center

of 6-by-9-inch (150-by-230-mm) Sample applied to a rigid backing and prepared by Installer for this Project.

E. Product Schedule: For resilient sheet flooring. Use same designations indicated on Drawings.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Field Test Reports: For moisture, alkalinity and adhesion testing.

C. Provide the following additional submittals when spray-applied adhesives are used:
1. Product Certificates: For each kind of spray-applied adhesive, from manufacturer.
2. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating that spray-applied adhesives comply with requirements.
3. Warranties: Samples of Special warranties specified in this Section.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of resilient sheet flooring and adhesive to include in maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Resilient Sheet Flooring: Furnish not less than 10 linear feet (3 linear m) for every 500 linear feet (150 linear m) or fraction thereof, in roll form and in full roll width for each type, color, and pattern of flooring installed.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs workers for this Project who are competent in techniques required by manufacturer for floor covering installation and seaming method indicated.

1. Engage an installer who employs workers for this Project who are trained or certified by resilient sheet flooring manufacturer for installation techniques required.

B. Spray-Applied Adhesive Testing Agency Qualifications: An independent testing agency with the experience and capability to conduct the testing indicated, meeting requirements of ISO/IEC Standard 17025 or ASTM E699 and ASTM E329.

C. Source Limitations: Obtain each kind of adhesive from single source from single manufacturer.

D. Preinstallation Conference: Conduct conference at Project site.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Store floor coverings and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F (10 deg C) or more than 90 deg F (32 deg C). Store rolls upright.

1.9 FIELD CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F (21 deg C) or more than 85 deg F (29 deg C), in spaces to receive floor coverings during the following time periods:

1. 48 hours before installation.
2. During installation.
3. 48 hours after installation.

B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F (13 deg C) or more than 95 deg F (35 deg C).

C. Close spaces to traffic during floor covering installation.

D. Close spaces to traffic as recommended by manufacturer.

E. Install floor coverings after other finishing operations, including painting, have been completed.

1.10 WARRANTY

A. Special Warranty for Resilient Sheet Flooring Installed with Spray-Applied Adhesive: Manufacturer's standard form in which manufacturer agrees to repair or replace components of resilient sheet flooring installation that fail in materials or workmanship within specified warranty period. Failure includes delamination of resilient sheet flooring from substrate.
   1. Special warranty is in addition to standard warranties provided by the manufacturer of resilient sheet flooring material and manufacturer of adhesive.
   2. Special Warranty at Concrete Floor Slabs using Spray-Applied Adhesive:
      a. Special Warranty for Aerosol Materials and Workmanship:
         1) Warranty Period: 2 years from date of Substantial Completion.
      b. Special Warranty for Delamination:
         1) No delamination of resilient sheet flooring from substrate, subject to slab moisture testing results prior to installation as follows:
            a) Moisture vapor emissions do not exceed 90 percent RH when tested in accordance with ASTM F2170
            b) Moisture in concrete slab does not exceed 8 lb per 1,000 sf per 24 hours when tested with a prepackaged calcium chloride crystal kit performed in accordance with ASTM F1869.
            c) pH does not exceed 11 when tested in accordance with ASTM F710.
         2) Warranty Period for Delamination: 5 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: For resilient sheet flooring, as determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.

1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

2.2 RESILIENT SHEET FLOOR COVERING

A. Products: Subject to compliance with requirements, provide products, colors, and patterns listed in Finish Legend located in the Drawings.

B. Seaming Method: Heat welded, per seaming diagram shown on **Sheet I103.**

2.3 INSTALLATION MATERIALS

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, General: Water-resistant type recommended by flooring and adhesive manufacturers to suit resilient sheet flooring and substrate conditions indicated.

1. Adhesives shall have a VOC content of 50 g/L or less.

C. Spray-Applied Adhesive (Refer to Allowances and Unit Prices): Aerosol, water-based, pressure sensitive adhesive specifically formulated for installing resilient sheet flooring on concrete.
1. Basis-of-Design Product: Subject to compliance with requirements, provide **Spray-Lock adhesive by Interlock Industries, Inc.** or a comparable product by another approved manufacturer.

D. Seamless-Installation Accessories:

1. Heat-Welding Bead: Manufacturer's solid-strand product for heat welding seams.

a. Color: As indicated in Room Finish Legend.

E. Integral-Flash-Cove-Base Accessories:

1. Cove Strip: 1-inch (25-mm) radius provided or approved by manufacturer.
2. Cap Strip: **Quadec Trim** cap as manufactured by **Schluter Systems.**

F. Floor Polish: Provide protective, liquid floor-polish products recommended by resilient sheet flooring manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient sheet flooring.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare substrates according to resilient sheet flooring manufacturer's written instructions to ensure adhesion of resilient sheet flooring.

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.
3. Verify that existing floor surfaces scheduled to receive new resilient sheet flooring have been prepared in accordance with resilient sheet flooring manufacturer’s and adhesive manufacturer’s written instructions and as follows:
   a. All existing flooring has been removed.
   b. Surfaces are dry and free of sealers, hardeners or other materials that may interfere with adhesive bond.
   c. Cracks, arises, depressions, voids and other surface irregularities have been removed and repaired and the sources of the irregularities have been corrected.
4. Perform the following testing at installations utilizing manufacturer’s standard recommended full spread adhesives:
   a. Alkalinity and Adhesion Testing: Perform tests recommended by resilient sheet flooring manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 9 pH.
   b. Moisture Testing: Proceed with installation only after substrates pass testing according to resilient sheet flooring manufacturer's written recommendations, but not less stringent than all of the following:
      1) Perform anhydrous calcium chloride test according to ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m) in 24 hours.
      2) Perform relative humidity test using in situ probes according to ASTM F 2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level.
5. Perform the following testing at installations utilizing spray-applied adhesives:
   a. Alkalinity and Adhesion Testing: Perform tests recommended by resilient sheet flooring manufacturer and by adhesive manufacturer. Proceed with installation

only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 11 pH.

b. Bond Testing: Perform bond testing per ASTM F710 to determine compatibility of adhesive to concrete substrate.

c. Moisture Testing: Proceed with installation only after substrates pass testing according to resilient sheet flooring manufacturer's and adhesive manufacturer's written recommendations, but not less stringent than all of the following:

1) Perform anhydrous calcium chloride test according to ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 8 lb of water/1000 sq. ft. (3.18 kg of water/92.9 sq. m) in 24 hours.

2) Perform relative humidity test using in situ probes according to ASTM F 2170. Proceed with installation only after substrates have a maximum 90 percent relative humidity level.

6. At installations utilizing spray-applied adhesive, mechanically abrade concrete slab in accordance with adhesive manufacturer's written recommendations utilizing a 350-400 rpm machine buffer using 16 grit sandpaper. Remove debris by sweeping, brushing and vacuuming substrate. Require adhesive manufacturer's representative to inspect prepared floor. Correct any deficiencies prior to installation.

C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.

D. Do not install resilient sheet flooring until it is the same temperature as the space where it is to be installed.

1. At least 48 hours in advance of installation, move flooring and installation materials into spaces where they will be installed.

E. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient sheet flooring.

3.3 RESILIENT SHEET FLOORING INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient sheet flooring.

B. Unroll resilient sheet flooring and allow it to stabilize before cutting and fitting.

C. Lay out resilient sheet flooring as follows:

1. Maintain uniformity of flooring direction.
2. Minimize number of seams; place seams in inconspicuous and low-traffic areas, at least 6 inches (152 mm) away from parallel joints in flooring substrates.
3. Match edges of flooring for color shading at seams.
4. Avoid cross seams.

D. Scribe and cut floor coverings to butt neatly and tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, and door frames.

E. Extend floor coverings beneath casework, and into toe spaces, door reveals, closets, and similar openings.

F. Maintain reference markers, holes, or openings that are in place or marked for future cutting by repeating on floor coverings as marked on substrates. Use chalk or other nonpermanent marking device.

G. Adhere resilient sheet flooring to substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

H. Spray-Applied Adhesive Installations (Refer to Allowances and Unit Prices): Adhere resilient sheet flooring to concrete flooring substrates using spray-applied adhesive. Apply to substrate in accordance with adhesive manufacturer's written instructions to produce a completed installation without open cracks, voids, raising and puckering at joints and other surface imperfections.
1. Do not place finish flooring until adhesive applied to substrate is ready to receive it in accordance with adhesive manufacturer's written instructions.
2. Close space to traffic for 2 hours before installation.
3. Mark floor complying with adhesive manufacturer's recommended area for size of container used. Apply no more or less adhesive than what manufacturer recommends.
4. Outline perimeter of the room with a 4-5 inch (100mm to 125mm) wide band of adhesive. Spray apply adhesive from 8-12 inches (200mm to 300mm) above the substrate.
5. Install finish flooring material, adjust and reset until layout placement is final.
6. Following installation of finish flooring, within one hour or as otherwise recommended by adhesive manufacturer, roll entire installed floor area with a 75 to 100 lb (34 to 45 kg) roller to ensure proper bonding with instant shear strength.
7. Following installation, inspect floor finish system installation for non-conforming work including, but not limited to, the following:
    a. Lack of adequate adhesion.
    b. Adhesive overspray.
        1) Clean off water-based adhesive overspray with a damp cloth.
    c. Improper substrate preparation as indicated by:
        1) Telegraphing of joints, dirt, or debris through the finish flooring
        2) Air blisters
        3) Buckling

I. Seamless Installation:

1. Heat-Welded Seams: Comply with ASTM F 1516. Rout joints and heat weld with welding bead to permanently fuse sections into a seamless flooring. Prepare, weld, and finish seams to produce surfaces flush with adjoining flooring surfaces.

J. Integral-Flash-Cove Base: Cove floor coverings 4 inches (102 mm) up vertical surfaces. Support floor coverings at horizontal and vertical junction by cove strip. Butt at top against cap strip.

3.4 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protecting resilient sheet flooring.

B. Perform the following operations immediately after completing resilient sheet flooring installation:

1. Remove adhesive and other blemishes from surfaces.

2. Sweep and vacuum surfaces thoroughly.
3. Damp-mop surfaces to remove marks and soil.

C. Protect resilient sheet flooring from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Floor Polish: Remove soil, adhesive, and blemishes from flooring surfaces before applying liquid floor polish. Apply polish per manufacturer's recommendations.

E. Cover resilient sheet flooring until Substantial Completion.

END OF SECTION 096516

SECTION 096519 - RESILIENT TILE FLOORING

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. This Section includes the following:

1. Luxury Vinyl Tile (LVP) installed with manufacturer's standard recommended ful spread adhesives (Base Bid).

B. Related Sections:

1. Section 012100 "Allowances" for spray-applied flooring adhesive allowance requirements.
2. Section 012200 "Unit Prices" for spray-applied flooring adhesive unit price requirements.
3. Section 024119 "Selective Demolition" for removing existing floor coverings.
4. Section 033000 "Concrete & Reinforcing" for water vapor transmission inhibiting admixture installed with new concrete floor substrates and for testing associated with this admixture.
5. Section 096010 "Topical Moisture Vapor Mitigation Systems for Flooring" for mitigation system installed over concrete substrates as part of work of an Allowance or Unit Price.
6. Section 096513 Resilient Base and Accessories.
7. Section 096516 Resilient Sheet Flooring.

1.3 ACTION SUBMITTALS

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

B. Samples for Verification: Full-size units of each color and pattern of resilient floor tile required.

C. Product Schedule: For floor tile. Use same designations indicated on Drawings.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Field Test Reports: For moisture, alkalinity and adhesion testing.

C. Provide the following additional submittals when spray-applied adhesives are used:
1. Product Certificates: For each kind of spray-applied adhesive, from manufacturer.

2. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating that spray-applied adhesives comply with requirements.
3. Warranties: Samples of Special warranties specified in this Section.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of floor tile and adhesive to include in maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Floor Tile: Furnish one box for every 50 boxes or fraction thereof, of each type, color, and pattern of floor tile installed.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who is certified by the International Certified Floorcovering Installers Association

B. Spray-Applied Adhesive Testing Agency Qualifications: An independent testing agency with the experience and capability to conduct the testing indicated, meeting requirements of ISO/IEC Standard 17025 or ASTM E699 and ASTM E329.

C. Source Limitations: Obtain each kind of adhesive from single source from single manufacturer.

D. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Build mockups for floor tile including resilient base and accessories at locations and in sizes shown on Drawings.
2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

E. Preinstallation Conference: Conduct conference at Project site.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Store floor tile and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F (10 deg C) or more than 90 deg F (32 deg C). Store floor tiles on flat surfaces.

1.9 FIELD CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F (21 deg C) or more than 95 deg F (35 deg C), in spaces to receive floor tile during the following time periods:

1. 48 hours before installation.
2. During installation.
3. 48 hours after installation.

B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F (13 deg C) or more than 95 deg F (35 deg C).

C. Close spaces to traffic during floor tile installation.

D. Close spaces to traffic for 48 hours after floor tile installation.

E. Install floor tile after other finishing operations, including painting, have been completed.

1.10 WARRANTY

A. Special Warranty for Resilient Tile Installed with Spray-Applied Adhesive: Manufacturer's standard form in which manufacturer agrees to repair or replace components of resilient tile flooring installation that fail in materials or workmanship within specified warranty period. Failure includes delamination of resilient tile from substrate.
1. Special warranty is in addition to standard warranties provided by the manufacturer of resilient tile flooring material and manufacturer of adhesive.
2. Special Warranty at Concrete Floor Slabs using Spray-Applied Adhesive:
   a. Special Warranty for Aerosol Materials and Workmanship:
      1) Warranty Period: 2 years from date of Substantial Completion.
   b. Special Warranty for Delamination:
      1) No delamination of resilient tile flooring from substrate, subject to slab moisture testing results prior to installation as follows:
         a) Moisture vapor emissions do not exceed 90 percent RH when tested in accordance with ASTM F2170
         b) Moisture in concrete slab does not exceed 8 lb per 1,000 sf per 24 hours when tested with a prepackaged calcium chloride crystal kit performed in accordance with ASTM F1869.
         c) pH does not exceed 11 when tested in accordance with ASTM F710.
      2) Warranty Period for Delamination: 5 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: For resilient tile flooring, as determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.

1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

2.2 FLOOR TILE

A. Products: Subject to compliance with requirements, provide products, colors, and patterns listed in Finish Legend located in the Drawings.

2.3 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic cement based formulation provided or approved by resilient product manufacturer for applications indicated.

B. Adhesives, General: Water-resistant type recommended by floor tile and adhesive manufacturers to suit floor tile and substrate conditions indicated.

1. Adhesives shall comply with the following limits for VOC content:

a. Vinyl Composition Tile Adhesives: 50 g/L or less.
b. Rubber Floor Adhesives: 60 g/L or less.

C. Spray-Applied Adhesive: Aerosol, water-based, pressure sensitive adhesive specifically formulated for installing resilient tile on concrete.

1. Basis-of-Design Product: Subject to compliance with requirements, provide **Spray-Lock adhesive by Interlock Industries, Inc.** or a comparable product by another approved manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of floor tile.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare substrates according to floor tile manufacturer's and adhesive manufacturer’s written instructions to ensure adhesion of resilient products.

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 floor tile manufacturer. Do not use solvents.
3. Verify that existing floor surfaces scheduled to receive new resilient tile have been prepared in accordance with resilient tile manufacturer's and adhesive manufacturer's written instructions and as follows:
   a. All existing flooring has been removed.
   b. Surfaces are dry and free of sealers, hardeners or other materials that may interfere with adhesive bond.
   c. Cracks, arises, depressions, voids and other surface irregularities have been removed and repaired and the sources of the irregularities have been corrected.
4. Perform the following testing at installations utilizing manufacturer's standard recommended full spread adhesives:
   a. Alkalinity and Adhesion Testing: Perform tests recommended by floor tile manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 9 pH.
   b. Moisture Testing: Proceed with installation only after substrates pass testing according to floor tile manufacturer's written recommendations, but not less stringent than all of the following:
      1) Perform anhydrous calcium chloride test according to ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m) in 24 hours.
      2) Perform relative humidity test using in situ probes according to ASTM F 2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level.
5. Perform the following testing at installations utilizing spray-applied adhesives:
   a. Alkalinity and Adhesion Testing: Perform tests recommended by floor tile manufacturer and by adhesive manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 11 pH.
   b. Bond Testing: Perform bond testing per ASTM F710 to determine compatibility of adhesive to concrete substrate.
   c. Moisture Testing: Proceed with installation only after substrates pass testing according to floor tile manufacturer's and adhesive manufacturer's written recommendations, but not less stringent than all of the following:
      1) Perform anhydrous calcium chloride test according to ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 8 lb of water/1000 sq. ft. (3.18 kg of water/92.9 sq. m) in 24 hours.
      2) Perform relative humidity test using in situ probes according to ASTM F 2170. Proceed with installation only after substrates have a maximum 90 percent relative humidity level.
6. At installations utilizing spray-applied adhesive, mechanically abrade concrete slab in accordance with adhesive manufacturer's written recommendations utilizing a 350-400 rpm machine buffer using 16 grit sandpaper. Remove debris by sweeping, brushing and vacuuming substrate. Require adhesive manufacturer's representative to inspect prepared floor. Correct any deficiencies prior to installation.

C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.

D. Do not install floor tiles until they are the same temperature as the space where they are to be installed.

1. At least 48 hours in advance of installation, move resilient floor tile and installation materials into spaces where they will be installed.

E. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient floor tile.

3.3 FLOOR TILE INSTALLATION

A. Comply with manufacturer's written instructions for installing floor tile.

B. Lay out tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.

1. Lay tiles square with room axis.

C. Match tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles.

1. Lay tiles with grain running in one direction.

D. Scribe, cut, and fit tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, edgings, door frames, thresholds, and nosings.

E. Extend floor tiles into toe spaces, door reveals, closets, and similar openings. Extend floor tiles to center of door openings.

F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent, nonstaining marking device.

G. Adhere floor tiles to flooring substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

H. Spray-Applied Adhesive Installations (Refer to Allowances and Unit Prices): Adhere floor tiles to concrete flooring substrates using glue down installation method, installing every tile using spray-applied adhesive. Apply to substrate in accordance with adhesive manufacturer’s written instructions to produce a completed installation without open cracks, voids, raising and puckering at joints and other surface imperfections.
1. Do not place finish flooring until adhesive applied to substrate is ready to receive it in accordance with adhesive manufacturer’s written instructions.
2. Close space to traffic for 2 hours before installation.
3. Mark floor complying with adhesive manufacturer’s recommended area for size of container used. Apply no more or less adhesive than what manufacturer recommends.
4. Outline perimeter of the room with a 4-5 inch (100mm to 125mm) wide band of adhesive. Spray apply adhesive from 8-12 inches (200mm to 300mm) above the substrate.
5. Install finish flooring material, adjust and reset until layout placement is final.

6. Following installation of finish flooring, within one hour or as otherwise recommended by adhesive manufacturer, roll entire installed floor area with a 75 to 100 lb (34 to 45 kg) roller to ensure proper bonding with instant shear strength.
7. Following installation, inspect floor finish system installation for non-conforming work including, but not limited to, the following:
    a. Lack of adequate adhesion.
    b. Adhesive overspray.
        1) Clean off water-based adhesive overspray with a damp cloth.
    c. Improper substrate preparation as indicated by:
        1) Telegraphing of joints, dirt, or debris through the finish flooring
        2) Air blisters
        3) Buckling

3.4 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protecting floor tile.

B. Perform the following operations immediately after completing floor tile installation:

1. Remove adhesive and other blemishes from exposed surfaces.
2. Sweep and vacuum surfaces thoroughly.
3. Damp-mop surfaces to remove marks and soil.

    a. Do not wash surfaces until after time period recommended by manufacturer.

C. Protect floor tile from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period. Use protection methods recommended in writing by manufacturer.

1. Cover products installed on horizontal surfaces with undyed, untreated building paper until Substantial Completion.
2. Do not move heavy and sharp objects directly over surfaces. Place hardboard or plywood panels over flooring and under objects while they are being moved. Slide or roll objects over panels without moving panels.

END OF SECTION 096519

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SECTION 096813 - TILE CARPETING

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 modular carpet tile installed with manufacturer's standard recommended pressure-sensitive adhesive.

B. Related Requirements:

1. Section 012100 "Allowances" for spray-applied flooring adhesive allowance requirements.
2. Section 012200 "Unit Prices" for spray-applied flooring adhesive unit price requirements.
3. Section 024119 "Selective Demolition" for removing existing floor coverings.
4. Section 033000 "Concrete & Reinforcing" for water vapor transmission inhibiting admixture installed with new concrete floor substrates and for testing associated with this admixture.
5. Section 096010 "Topical Moisture Vapor Mitigation Systems for Flooring" for mitigation system installed over concrete substrates as part of work of an Allowance or Unit Price.
6. Section 096513 Resilient Base and Accessories
7. Section 096519 Resilient Tile Flooring for resilient wall base and accessories installed with carpet tile.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at project site with GC, Architect/Designer, Owner's Representative, and Flooring Subcontractor.

1. Review methods and procedures related to carpet tile installation including, but not limited to, the following:

a. Review delivery, storage, and handling procedures.
b. Review ambient conditions and ventilation procedures.
c. Review subfloor preparation procedures.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include manufacturer's written data on physical characteristics, durability, and fade resistance.

2. Include installation recommendations for each type of substrate.

B. Shop Drawings: Show the following:

1. Columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required in carpet tiles.
2. Carpet tile type, color, and dye lot.
3. Type of subfloor.
4. Type of installation.
5. Pattern of installation.
6. Pattern type, location, and direction.
7. Pile direction.
8. Type, color, and location of insets and borders.
9. Type, color, and location of edge, transition, and other accessory strips.
10. Transition details to other flooring materials.

C. Samples: For each of the following products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in schedules.

1. Carpet Tile: Full-size Sample.
2. Exposed Edge, Transition, and Other Accessory Stripping: 12-inch- (300-mm-) long Samples.

D. Product Schedule: For carpet tile. Use same designations indicated on Drawings.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Test Reports: For carpet tile, for tests performed by a qualified testing agency.

C. Field Test Reports: For moisture, alkalinity and adhesion testing.

D. Sample Warranty: For special warranty.

E. Provide the following additional submittals when spray-applied adhesives are used:
1. Product Certificates: For each kind of spray-applied adhesive, from manufacturer.
2. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating that spray-applied adhesives comply with requirements.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For carpet tiles and adhesive to include in maintenance manuals. Include the following:

1. Methods for maintaining carpet tile, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.
2. Precautions for cleaning materials and methods that could be detrimental to carpet tile.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Carpet Tile: Full-size units equal to 5 percent of amount installed for each type indicated, but not less than 1 carton.

1.8 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who is certified by the International Certified Floorcovering Installers Association

B. Spray-Applied Adhesive Testing Agency Qualifications: An independent testing agency with the experience and capability to conduct the testing indicated, meeting requirements of ISO/IEC Standard 17025 or ASTM E699 and ASTM E329.

C. Source Limitations: Obtain each kind of adhesive from single source from single manufacturer.

D. Fire-Test-Response Ratings: Where indicated, provide carpet tile identical to those of assemblies tested for fire response according to NFPA 253 by a qualified testing agency.

E. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.

1. Build mockups at locations and in sizes shown on Drawings.
2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Comply with CRI 104.

1.10 FIELD CONDITIONS

A. Comply with CRI 104 for temperature, humidity, and ventilation limitations.

B. Environmental Limitations: Do not deliver or install carpet tiles until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at occupancy levels during the remainder of the construction period.

C. Do not install carpet tiles over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive and concrete slabs have pH range recommended by carpet tile manufacturer.

D. Where demountable partitions or other items are indicated for installation on top of carpet tiles, install carpet tiles before installing these items.

1.11 WARRANTY

A. Special Warranty for Carpet Tiles: Manufacturer agrees to repair or replace components of carpet tile installation that fail in materials or workmanship within specified warranty period.

1. Warranty does not include deterioration or failure of carpet tile due to unusual traffic, failure of substrate, vandalism, or abuse.
2. Failures include, but are not limited to, more than 10 percent edge raveling, snags, runs, dimensional stability, excess static discharge, loss of tuft bind strength, loss of face fiber, and delamination.
3. Warranty Period: 10 years from date of Substantial Completion.
4. Special Warranty at Concrete Floor Slabs using Spray-Applied Adhesive:
    a. Special Warranty for Aerosol Materials and Workmanship:
        1) Warranty Period: 2 years from date of Substantial Completion.
    b. Special Warranty for Delamination:
        1) No delamination of carpet tile flooring from substrate, subject to slab moisture testing results prior to installation as follows:
            a) Moisture vapor emissions do not exceed 90 percent RH when tested in accordance with ASTM F2170
            b) Moisture in concrete slab does not exceed 8 lb per 1,000 sf per 24 hours when tested with a prepackaged calcium chloride crystal kit performed in accordance with ASTM F1869.
            c) pH does not exceed 11 when tested in accordance with ASTM F710.
        2) Warranty Period for Delamination: 5 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 CARPET TILE

A. Products: Subject to compliance with requirements, provide products, colors, and patterns listed in Finish Legend located in the Drawings.

2.2 INSTALLATION ACCESSORIES

A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet tile manufacturer.

B. Adhesives, General: Water-resistant, mildew-resistant, nonstaining, pressure-sensitive type to suit products and subfloor conditions indicated, that complies with flammability requirements for installed carpet tile and is recommended by carpet tile manufacturer for releasable installation.

1. Adhesives shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. Spray-Applied Adhesive (Refer to Allowances and Unit Prices): Aerosol, water-based, pressure sensitive adhesive specifically formulated for installing carpet tile on concrete.

1. Basis-of-Design Product: Subject to compliance with requirements, provide **Spray-Lock adhesive by Interlock Industries, Inc.** or a comparable product by another approved manufacturer.

D. Metal Edge/Transition Strips: Extruded aluminum with clear anodized finish of profile and width shown, of height required to protect exposed edge of carpet, and of maximum lengths to minimize running joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet tile performance. Examine carpet tile for type, color, pattern, and potential defects.

B. Concrete Subfloors: Verify that concrete slabs comply with ASTM F 710 and the following:

1. Slab substrates are dry and free of curing compounds, sealers, hardeners, and other materials that may interfere with adhesive bond. Determine adhesion and dryness characteristics by performing bond and moisture tests recommended by carpet tile manufacturer.
2. Subfloor finishes comply with requirements specified in Section 033000 "Cast-in-Place Concrete" for slabs receiving carpet tile.
3. Subfloors are free of cracks, ridges, depressions, scale, and foreign deposits.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. General: Comply with CRI 104, Section 6.2, "Site Conditions; Floor Preparation," and with carpet tile manufacturer's written installation instructions for preparing substrates indicated to receive carpet tile installation.

B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8 inch (3 mm) wide or wider and protrusions more than 1/32 inch (0.8 mm) unless more stringent requirements are required by manufacturer's written instructions.

C. Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by carpet tile manufacturer.

D. Concrete Substrates: Prepare according to ASTM F 710.
1. Perform the following testing at installations utilizing spray-applied adhesives:
   a. Alkalinity and Adhesion Testing: Perform tests recommended by carpet tile manufacturer and by adhesive manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 11 pH.
   b. Bond Testing: Perform bond testing per ASTM F710 to determine compatibility of adhesive to concrete substrate.

c. Moisture Testing: Proceed with installation only after substrates pass testing according to carpet tile manufacturer's and adhesive manufacturer's written recommendations, but not less stringent than the following:
   1) Perform anhydrous calcium chloride test according to ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 8 lb of water/1000 sq. ft. (3.18 kg of water/92.9 sq. m) in 24 hours.
   2) Perform relative humidity test using in situ probes according to ASTM F 2170. Proceed with installation only after substrates have a maximum 90 percent relative humidity level.

2. At installations utilizing spray-applied adhesive, mechanically abrade concrete slab in accordance with adhesive manufacturer's written recommendations utilizing a 350-400 rpm machine buffer using 16 grit sandpaper. Remove debris by sweeping, brushing and vacuuming substrate. Require adhesive manufacturer's representative to inspect prepared floor. Correct any deficiencies prior to installation.

E. Clean metal substrates of grease, oil, soil and rust, and prime if directed by adhesive manufacturer. Rough sand painted metal surfaces and remove loose paint. Sand aluminum surfaces, to remove metal oxides, immediately before applying adhesive.

F. Broom and vacuum clean substrates to be covered immediately before installing carpet tile.

3.3 INSTALLATION

A. General: Comply with CRI 104, Section 14, "Carpet Modules," and with carpet tile manufacturer's written installation instructions.

B. Installation Method: Glue down; install every tile with full-spread, releasable, pressure-sensitive adhesive.

C. Spray-Applied Adhesive Installations (Refer to Allowances and Unit Prices): Glue down; install every tile with spray-applied adhesive. Apply adhesive to substrate in accordance with adhesive manufacturer's written instructions to produce a completed installation without open cracks, voids, raising and puckering at joints and other surface imperfections.
1. Do not place finish flooring until adhesive applied to substrate is ready to receive it in accordance with adhesive manufacturer's written instructions.
2. Close space to traffic for 2 hours before installation.
3. Mark floor complying with adhesive manufacturer's recommended area for size of container used. Apply no more or less adhesive than what manufacturer recommends.
4. Outline perimeter of the room with a 4-5 inch (100mm to 125mm) wide band of adhesive. Spray apply adhesive from 8-12 inches (200mm to 300mm) above the substrate.
5. Install finish flooring material, adjust and reset until layout placement is final.
6. Following installation of finish flooring, within one hour or as otherwise recommended by adhesive manufacturer, roll entire installed floor area with a 75 to 100 lb (34 to 45 kg) roller to ensure proper bonding with instant shear strength.
7. Following installation, inspect floor finish system installation for non-conforming work including, but not limited to, the following:
   a. Lack of adequate adhesion.
   b. Adhesive overspray.
      1) Clean off water-based adhesive overspray with a damp cloth.
   c. Improper substrate preparation as indicated by:
      1) Telegraphing of joints, dirt, or debris through the finish flooring
      2) Air blisters

3) Buckling

D. Maintain dye lot integrity. Do not mix dye lots in same area.

E. Cut and fit carpet tile 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 carpet tile manufacturer.

F. Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.

G. 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.

H. Install pattern parallel to walls and borders.

I. Stagger joints of carpet tiles so carpet tile grid is offset from access flooring panel grid. Do not fill seams of access flooring panels with carpet adhesive; keep seams free of adhesive.

3.4 CLEANING AND PROTECTION

A. Perform the following operations immediately after installing carpet tile:

1. Remove excess adhesive, seam sealer, and other surface blemishes using cleaner recommended by carpet tile manufacturer.
2. Remove yarns that protrude from carpet tile surface.
3. Vacuum carpet tile using commercial machine with face-beater element.

B. Protect installed carpet tile to comply with CRI 104, Section 16, "Protecting Indoor Installations."

C. Protect carpet tile against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet tile manufacturer.

END OF SECTION 096813

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SECTION 099113 - EXTERIOR PAINTING

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 surface preparation and the application of paint systems on the following exterior substrates:
   1. Steel.
   2. Galvanized metal.

B. Related Requirements:

   1. Section 051200 "Structural Steel Framing" for shop priming of metal substrates with primers specified in this Section.
   2. Section 099123 "Interior Painting" for surface preparation and the application of paint systems on interior substrates.

1.3 DEFINITIONS

A. Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D 523.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.

B. Samples for Initial Selection: For each type of topcoat product.

C. Samples for Verification: For each type of paint system and each color and gloss of topcoat.

   1. Submit Samples on rigid backing, 8 inches (200 mm) square.
   2. Step coats on Samples to show each coat required for system.
   3. Label each coat of each Sample.
   4. Label each Sample for location and application area.

D. Product List: For each product indicated, include the following:

   1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Paint: 2 percent, but not less than 1 gal. (3.8 L) of each material and color applied.

1.6 QUALITY ASSURANCE

A. MPI Standards:

1. Products: Complying with MPI standards indicated
2. Preparation and Workmanship: Comply with requirements in "MPI Architectural Painting Specification Manual" for products and paint systems indicated.

B. Mockups: Apply mockups of each paint system indicated and each color and finish selected to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Architect will select one surface to represent surfaces and conditions for application of each paint system specified in Part 3.
   a. Items: Architect will designate items or areas required.

2. Final approval of color selections will be based on mockups.

   a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.

3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F (7 deg C).

1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.

1.8 FIELD CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F (10 and 35 deg C).

B. Do not apply paints in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Cloverdale Paint.
   2. M.A.B. Paints.
   3. Samhwa Paint Ind. Co. Ltd.
   4. Sherwin-Williams Company (The).

B. Products: Subject to compliance with requirements, provide one of the products listed in other Part 2 articles for the paint category indicated.

2.2 PAINT, GENERAL

A. MPI Standards: Provide products that comply with MPI standards indicated and that are listed in its "MPI Approved Products List."

B. Material Compatibility:

   1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
   2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.

C. VOC Content: Provide materials that comply with VOC limits of authorities having jurisdiction.

D. Colors: As selected by Architect from manufacturer's full range.

2.3 METAL PRIMERS

A. Primer, Alkyd, Anti-Corrosive for Metal: MPI #79.
   1. Products:
      a. MAB: Rust-O-Lastic Anti-Corrosive Interior/Exterior Alkyd Metal Primer, MB273W132.
      b. Sherwin-Williams: Protective & Marine, Kem Kromik Universal Primer B50WZ1
      c. Sherwin-Williams: Protective & Marine, Kem Bond HS B50WZ4

B. Primer, Galvanized, Cementitious: MPI #26.
   1. Products:
      a. Cloverdale Paint: Cementitious Alkyd Primer 15930.
      b. Samhwa Paint Ind. Co. Ltd.: MPI 26 Metal Primer 3200170.

2.4 SOLVENT-BASED PAINTS

A. Alkyd, Exterior Gloss (Gloss Level 6): MPI #9.
   1. Products:

a. Sherwin-Williams: Seaguard 1000 Marine N41W00620.

2.5 SOURCE QUALITY CONTROL

A. Testing of Paint Materials: Owner reserves the right to invoke the following procedure:

1. Owner will engage the services of a qualified testing agency to sample paint materials. Contractor will be notified in advance and may be present when samples are taken. If paint materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.
2. Testing agency will perform tests for compliance with product requirements.
3. Owner may direct Contractor to stop applying paints if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

C. Proceed with coating application only after unsatisfactory conditions have been corrected.

1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Manual" applicable to substrates and paint systems indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection.

C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.

1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.

D. Steel Substrates: Remove rust, loose mill scale, and shop primer if any. Clean using methods recommended in writing by paint manufacturer**.**

E. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.

F. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.

3.3 APPLICATION

A. Apply paints according to manufacturer's written instructions and recommendations in "MPI Manual."

1. Use applicators and techniques suited for paint and substrate indicated.
2. Paint surfaces behind movable items same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed items with prime coat only.
3. Paint both sides and edges of exterior doors and entire exposed surface of exterior door frames.
4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
5. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.

B. Tint undercoats same color as topcoat, but tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Provide sufficient difference in shade of undercoats to distinguish each separate coat.

C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

3.4 FIELD QUALITY CONTROL

A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.

1. Contractor shall touch up and restore painted surfaces damaged by testing.
2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.5 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.6 EXTERIOR PAINTING SCHEDULE

A. Steel Substrates: MPI EXT 5.1D

1. Alkyd System:

a. Prime Coat: Primer, alkyd, anticorrosive for metal, MPI #79, if unprimed.
b. Intermediate Coat: Exterior alkyd enamel matching topcoat.
c. Topcoat: Alkyd, exterior, gloss (Gloss Level 6), MPI #9.

B. Galvanized-Metal Substrates: MPI EXT 5.3B

1. Alkyd System:

a. Prime Coat: Primer, galvanized metal, cementitious and as recommended in writing by topcoat manufacturer for exterior use on galvanized-metal substrates with topcoat indicated, (MPI #26).
b. Intermediate Coat: Exterior alkyd enamel matching topcoat.
c. Topcoat: Alkyd, exterior, gloss (Gloss Level 5), MPI #9.

END OF SECTION 099113

SECTION 099123 - INTERIOR PAINTING

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 surface preparation and the application of paint systems on the following interior substrates:

1. Steel.
2. Gypsum board.

1.3 SUBMITTALS

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

B. Samples for Verification: For each type of paint system and in each color and gloss of topcoat indicated.

1. Submit Samples on rigid backing, 8 inches (200 mm) square.
2. Label each Sample for location and application area.

C. Product List: For each product indicated, include the following:

1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.
2. VOC Content.

1.4 QUALITY ASSURANCE

A. MPI Standards:

1. Products: Complying with MPI standards indicated
2. Preparation and Workmanship: Comply with requirements in "MPI Architectural Painting Specification Manual" for products and paint systems indicated.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F (7 deg C).

1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.

1.6 PROJECT CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F (10 and 35 deg C).

B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.

1.7 EXTRA MATERIALS

A. Furnish extra materials described below that are from same production run (batch mix) as materials applied and that are packaged for storage and identified with labels describing contents.

1. Quantity: Furnish an additional 2 percent, but not less than 1 gal. (3.8 L) of each material and color applied.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. M.A.B. Paints.
2. Sherwin-Williams Company (The).

2.2 PAINT, GENERAL

A. Material Compatibility:

1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.

B. Colors: As indicated in Room Finish Legend located on the Drawings.

2.3 PRIMERS/SEALERS

A. Interior Latex Primer/Sealer: MPI #50.

B. Products:

1. Sherwin- Williams: PrepRite 200 Latex Primer B28.

2. MAB: Rich Lux Prime Fast 037-138.

2.4 METAL PRIMERS

A. Alkyd Anticorrosive Metal Primer: MPI #79.

B. Products:

1. Sherwin- Williams: Kem Kromik Metal Primer - White B50WZ1
2. MAB: Rust-O-Lastic Anti-Corrosive Primer 073 line.

2.5 LATEX PAINTS

A. Interior Latex (Satin): MPI #43 (Gloss Level 4).

B. Products:

1. Sherwin-Williams: ProMar 200 Interior Latex Semi-Gloss B31W251.
2. MAB: Rich Lux Low Lustre Latex Enamel 028 line.

2.6 EPOXY COATINGS

A. High-Build Epoxy Marine Coating, Low Gloss: MPI #108.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

a. Sherwin-Williams Company (The); Industrial & Marine, Macropoxy 646, B58W6 Series.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of work.

B. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

C. Begin coating application only after unsatisfactory conditions have been corrected and surfaces are dry.

1. Beginning coating application constitutes Contractor's acceptance of substrates and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates indicated.

B. Remove plates, machined surfaces, and similar items already in place that are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
2. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.

C. Clean substrates of substances that could impair bond of paints, including dirt, oil, grease, and incompatible paints and encapsulants.

1. Remove incompatible primers and reprime substrate with compatible primers as required to produce paint systems indicated.

D. Steel Substrates: Remove rust and loose mill scale. Clean using methods recommended in writing by paint manufacturer.

E. Gypsum Board Substrates: Do not begin paint application until finishing compound is dry and sanded smooth.

3.3 APPLICATION

A. Apply paints according to manufacturer's written instructions.

1. Use applicators and techniques suited for paint and substrate indicated.
2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.

B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.

C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

E. Painting Mechanical and Electrical Work: Paint items exposed in equipment rooms and occupied spaces including, but not limited to, the following:

1. Mechanical Work:

    a. Uninsulated metal piping.
    b. Uninsulated plastic piping.
    c. Pipe hangers and supports.
    d. Tanks that do not have factory-applied final finishes.
    e. Visible portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets.
    f. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
    g. Mechanical equipment that is indicated to have a factory-primed finish for field painting.

3.4 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.5 INTERIOR PAINTING SCHEDULE

A. Steel Substrates:

1. Latex Over Alkyd Primer System: MPI INT 5.1Q.

    a. Prime Coat: Alkyd anticorrosive metal primer, if unprimed.
    b. Intermediate Coat: Interior latex matching topcoat.
    c. Topcoat: Interior latex (satin).

B. Gypsum Board Substrates:

1. Latex System: MPI INT 9.2A.

    a. Prime Coat: Interior latex primer/sealer.
    b. Intermediate Coat: Interior latex matching topcoat.
    c. Topcoat: Interior latex (satin).

2. Epoxy System: MPI #108.

    a. Prime Coat: Interior latex primer/sealer.
    b. Topcoat: High-Build Epoxy Marine Coating, Low Gloss.

C. Previously Painted Substrates:

1. Latex System: MPI INT 9.2A.

a. Intermediate Coat: Interior latex matching topcoat.
b. Topcoat: Interior latex (satin).

END OF SECTION 099123

SECTION 101010 - ACOUSTICAL WALL PANELS

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 back-mounted acoustical, tackable wall panels.

1.3 DEFINITIONS

A. NRC: Noise reduction coefficient.

1.4 SUBMITTALS

A. Product Data: For each type of panel edge, core material, and mounting indicated.

B. Shop Drawings: For acoustical wall panels. Include mounting devices and details; and details at panel head, base, joints, and corners. Include elevations showing panel sizes and direction of fabric weave and pattern matching. Indicate panel edge and core materials.

C. Samples for Verification: For the following products. Prepare Samples from same material to be used for the Work.

1. Fabric: Full-width by 36-inch- (914-mm-) long Sample from dye lot to be used for the Work.
2. Panel Edge: 12-inch- (300-mm-) long Sample showing edge profile, corner, and finish.
3. Core Material: 12-inch- (300-mm-) square Sample showing corner.
4. Mounting Device: Full-size Sample.
5. Sample Panels: No larger than 36 by 36 inches (914 by 914 mm). Show joints and mounting methods.

D. Maintenance Data: For acoustical wall panels to include in maintenance manuals. Include fabric manufacturers' written cleaning and stain-removal recommendations.

1.5 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.

B. Source Limitations: Obtain acoustical wall panels through one source from a single manufacturer.

C. Fire-Test-Response Characteristics: Provide acoustical wall panels with the following surface-burning characteristics as determined by testing identical products per ASTM E 84 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:

1. Flame-Spread Index: 25 or less.
2. Smoke-Developed Index: 450 or less.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Comply with fabric and acoustical wall panel manufacturers' written instructions for minimum and maximum temperature and humidity requirements for shipment, storage, and handling.

B. Deliver materials and panels in unopened bundles and store in a temperature-controlled dry place with adequate air circulation.

C. Protect panel edges from crushing and impact.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not install acoustical wall panels 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.

B. Air-Quality Limitations: Protect acoustical wall panels from exposure to airborne odors, such as tobacco smoke, and install panels under conditions free from odor contamination of ambient air.

C. Field Measurements: Verify locations of acoustical wall panels by field measurements before fabrication and indicate measurements on Shop Drawings.

1.8 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Panels: Full-size panels equal to 2.0 percent of quantity installed.

PART 2 - PRODUCTS

2.1 CORE MATERIALS

A. Glass-Fiber Board: ASTM C 612, Type IA or Types IA and IB; density as specified, unfaced, dimensionally stable, molded rigid board, with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively.

B. Tackable, Impact-Resistant, High-Density Face Layer: 1/8-inch- (3.2-mm-) thick layer of compressed molded glass-fiber board with a minimum nominal density of 16 to 18 lb/cu. ft. (256 to 288 kg/cu. m) laminated to face of core.

2.2 BACK-MOUNTED, EDGE-REINFORCED ACOUSTICAL WALL PANELS WITH GLASS-FIBER BOARD CORE (FABRIC WRAPPED PANEL)

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Product: Golterman & Sabo; Acousti-Tack ATF.

B. Panel Construction: Manufacturer's standard panel construction consisting of facing material laminated to front face, edges, and back border of dimensionally stable, rigid glass-fiber board core; with edges chemically hardened or impact resistant and resilient to reinforce panel perimeter against warpage and damage.

C. Nominal Core Density: 6 to 7 lb/cu. ft. (96 to 112 kg/cu. m).

D. Core-Face Layer: Tackable, impact-resistant, high-density board.

E. Facing Material: Fabric from same dye lot; and as indicated below:

1. Manufacturer: Momentum.
2. Product Line/Pattern: Meander
3. Width: 66”
4. Repeat: 16-1/8”L, 16-1/8”W
5. Color: Agate Taupe

F. Nominal Core Thickness and Overall System NRC: 3/4 inch (25 mm) and not less than NRC 0.80 for Type A mounting per ASTM E 795.

G. Panel Width and Height: As indicated on Drawings.

H. Panel Edge Detail: Eased Square.

I. Corner Detail: Square to form continuous profile to match edge detail.

2.3 ADHESIVE-MOUNTED FABRIC WRAPPED PANELS AT CASEWORK

A. Fabric-Wrapped Panels: Fabric-wrapped, tackable panels for installation with architectural casework.
1. Fabric: As indicated in room Finish Legend located on the Drawings.

B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Product: Golterman & Sabo, Inc.; TW Tackable Wall Panel.

2.4 FABRICATION

A. Sound-Absorption Performance: Provide acoustical wall panels with minimum NRCs indicated, as determined by testing per ASTM C 423 for mounting type specified.

B. Acoustical Wall Panels: Panel construction consisting of facing material adhered to face, edges and back border of dimensionally stable core; with rigid edges to reinforce panel perimeter against warpage and damage.

1. Glass-Fiber Board: Resin harden areas of core for attachment of mounting devices.

C. Fabric Facing: Stretched straight, on the grain, tight, square, and free from puckers, ripples, wrinkles, sags, blisters, seams, adhesive, or other foreign matter. Applied with visible surfaces fully covered.

1. Where square corners are indicated, tailor corners.

D. Core-Face Layer: Evenly stretched over core face and edges and securely attached to core; free from puckers, ripples, wrinkles, sags.

E. Dimensional Tolerances of Finished Units: Plus or minus 1/16 inch (1.6 mm) for the following:

1. Thickness.
2. Edge straightness.
3. Overall length and width.
4. Squareness from corner to corner.

F. Back-Mounting Devices: Concealed on backside of panel, recommended to support weight of panel, and as follows:

1. Adhesive.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine fabric, substrates, and conditions, with Installer present, for compliance with requirements, installation tolerances, and other conditions affecting performance of acoustical wall panels.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. 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.

B. Comply with acoustical wall panel manufacturer's written instructions for installation of panels using type of concealed mounting accessories indicated or, if not indicated, as recommended by manufacturer. Anchor panels securely to supporting substrate.

C. Match and level fabric pattern and grain among adjacent panels.

D. Installation Tolerances: As follows:

1. Variation from Level and Plumb: Plus or minus 1/16 inch (1.6 mm).
2. Variation of Panel Joints from Hairline: Not more than 1/32 inch (0.79 mm) 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.

B. Replace acoustical wall panels that cannot be cleaned and repaired, in a manner approved by Architect, before time of Substantial Completion.

END OF SECTION 101010

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SECTION 102123 – CUBICLE CURTAINS AND TRACKS

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. This Section includes the following:

1. Cubicle curtain tracks and carriers.
2. Refer to Section 012300 “Alternates” for work of this Section affected by Alternates.

B. Cubicle curtains provided by Owner.

1.3 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 01 Specification Sections.

B. Product Data including durability, fade resistance, and fire-test-response characteristics for each type of curtain fabric specified.

C. Shop Drawings showing layout and types of cubicles, size of curtains, number of carriers, anchorage details, and conditions requiring accessories. Indicate dimensions taken from field measurements.

D. Coordination Drawings for reflected ceiling plans drawn accurately to scale and coordinating penetrations and ceiling-mounted items. Show the following:

1. Method of attaching cubicle curtain track hangers to building structure.
2. Ceiling-mounted items including light fixtures, diffusers, grilles, speakers, sprinklers, and access panels.

E. Schedule of cubicles using same room designations indicated on Drawings.

1.4 PROJECT CONDITIONS

A. Field Measurements: Verify dimensions by field measurements. Verify that tracks and curtains may be installed to comply with the original design and referenced standard.

B. Space Enclosure and Environmental Limitations: Do not install tracks and curtains until space is enclosed and weatherproof, wet-work in space is completed and nominally dry, and work above ceilings is complete.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide cubicles by one of the following:

1. InPro Corporation (Clickeze).

2.2 CUBICLE TRACK

A. Track: Extruded aluminum with white baked acrylic enamel finish.

B. Track Mounting: Ceiling mounted; clipped to suspended ceiling grid.

C. Track Accessories: Provide end caps, connectors, end stops, coupling sleeves, wall brackets, and other accessories as required for secure and operational installation. Provide a quantity of carriers for 6-inch (150-mm) spacing the full length of the curtain plus 1 additional carrier.

1. Carriers: One-piece nylon glide with chrome-plated steel hook.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine ceilings for suitable conditions where cubicle track is to be installed.

B. Do not proceed until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install cubicle curtain track level and plumb, according to manufacturer's written instructions and original design.

B. Install ceiling-mounted tracks at intervals of not less than 24 inches (610 mm).

C. Center fastener in track to insure unencumbered carrier operation.

END OF SECTION 10190

SECTION 102600 - IMPACT-RESISTANT WALL PROTECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Wall guards.
2. Corner guards.
3. Impact-resistant wall coverings.
4. Door Frame Protection
5. Door-protection systems.

1.3 SUBMITTALS

A. Product Data: Include construction details, material descriptions, impact strength, fire-test-response characteristics, dimensions of individual components and profiles, and finishes for each impact-resistant wall-protection unit.

B. Shop Drawings: For each impact-resistant wall-protection unit showing locations and extent. Include sections, details, and attachments to other work.

C. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below. Include Samples of accent strips to verify color selected.

1. Wall and Corner Guards: 12 inches (300 mm) long.
2. Impact-Resistant Wall Covering: 6 by 6 inches (150 by 150 mm) square.
3. Door- Frame Protectors: 12 inches (300 mm) long.

D. Maintenance Data: For each impact-resistant wall-protection unit to include in maintenance manuals.

1. Include recommended methods and frequency of maintenance for maintaining optimum condition of plastic covers under anticipated traffic and use conditions. Include precautions against using cleaning materials and methods that may be detrimental to plastic finishes and performance.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain impact-resistant wall-protection units through one source from a single manufacturer.

B. Product Options: Drawings indicate size, profiles, and dimensional requirements of impact-resistant wall-protection units and are based on the specific system indicated. Refer to Section 016000 "Product Requirements."

1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.

C. Fire-Test-Response Characteristics: Provide impact-resistant, plastic wall-protection units with surface-burning characteristics as determined by testing identical products per ASTM E 84, NFPA 255, or UL 723 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store impact-resistant wall-protection units in original undamaged packages and containers inside well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.

1. Maintain room temperature within storage area at not less than 70 deg F (21 deg C) during the period plastic materials are stored.
2. Keep plastic sheet material out of direct sunlight.
3. Store plastic wall-protection components for a minimum of 72 hours, or until plastic material attains a minimum room temperature of 70 deg F (21 deg C).

a. Store corner-guard covers in a vertical position.
b. Store wall-guard and handrail covers in a horizontal position.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install impact-resistant wall-protection units until building is enclosed and weatherproof, wet work is complete and dry, and HVAC system is operating and maintaining temperature at 70 deg F (21 deg C) for not less than 72 hours before beginning installation and for the remainder of the construction period.

B. Field Measurements: Verify actual locations of walls, columns, and other construction contiguous with impact-resistant wall-protection units by field measurements before fabrication and indicate measurements on Shop Drawings.

1.7 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Wall and door protection: Full-size items equal to 2.0 percent of quantity installed of each item.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

1. As indicated on Room Finish Legend and in this specification.

2.2 MATERIALS

A. Extruded Rigid Plastic: ASTM D 1784, Class 1, textured, chemical- and stain-resistant, high-impact-resistant PVC or acrylic-modified vinyl plastic with integral color throughout; thickness as indicated.

1. Impact Resistance: Minimum 25.4 ft-lbf/in. (1356 J/m) of notch when tested according to ASTM D 256, Test Method A.
2. Chemical and Stain Resistance: Tested according to ASTM D 543.
3. Self-extinguishing when tested according to ASTM D 635.
4. Flame-Spread Index: 25 or less.
5. Smoke-Developed Index: 450 or less.

B. Plastic Sheet Wall Covering Material: ASTM D 1784, Class 1, textured, chemical- and stain-resistant, semirigid, high-impact-resistant PVC or acrylic-modified vinyl plastic sheet with integral color throughout; thickness as indicated.

1. Impact Resistance: Minimum 25.4 ft-lbf/in. (1356 J/m) of notch when tested according to ASTM D 256, Test Method A.
2. Chemical and Stain Resistance: Tested according to ASTM D 543.
3. Self-extinguishing when tested according to ASTM D 635.
4. Flame-Spread Index: 25 or less.
5. Smoke-Developed Index: 450 or less.

C. Aluminum Extrusions: Alloy and temper recommended by manufacturer for type of use and finish indicated but with not less than strength and durability properties specified in ASTM B 221 (ASTM B 221M) for Alloy 6063-T5.

D. Stainless-Steel Sheet: ASTM A 240/A 240M.

E. Fasteners: Aluminum, nonmagnetic stainless-steel, or other noncorrosive metal screws, bolts, and other fasteners compatible with items being fastened. Use security-type fasteners where exposed to view.

F. Adhesive: Type recommended by manufacturer for use with material being adhered to substrate indicated.

2.3 WALL GUARDS

A. Crash Rail CR-1: Heavy-duty assembly consisting of continuous snap-on plastic cover installed over continuous retainer; with continuous rubber or vinyl bumper cushion(s) centered in the retainer; designed to withstand impacts.

1. Basis-of-Design Product: Subject to compliance with requirements, provide **IPC Door and Wall Protection Systems; Model 1800 Wall Guard (to match existing standard)** or comparable product by one of the following:

    a. Balco, Inc.
    b. Construction Specialties, Inc.
    c. IPC Door and Wall Protection Systems; Division of InPro Corporation.
    d. Korogard Wall Protection Systems; a division of RJF International Corporation.
    e. Pawling Corporation.

2. Cover: Extruded rigid plastic, minimum 0.100-inch (2.5-mm) wall thickness; as follows:

    a. Profile: Flat profile, nominal 8 inches high by 1 inch (200 mm high by 25 mm) deep.
    b. Color and Texture: Taupe.

3. Retainer: Minimum 0.080-inch- (2.0-mm-) thick, 1-piece, extruded aluminum.

    a. Mounting: Surface mounted directly to wall.

4. End Caps and Corners: Prefabricated, injection-molded plastic; color matching cover; field adjustable for close alignment with snap-on cover.
5. Accessories: Concealed splices and mounting hardware.

B. Handrail (HR-1) Assembly consisting of continuous snap-on plastic cover installed over concealed, continuous retainer; designed to withstand impacts.

1. Basis-of-Design Product: Subject to compliance with requirements, provide **IPC Door and Wall Protection Systems; Model 1200 Hand Rail (to match existing standard)** or comparable product by one of the following:

    a. Balco, Inc.
    b. Construction Specialties, Inc.
    c. IPC Door and Wall Protection Systems; Division of InPro Corporation.
    d. Korogard Wall Protection Systems; a division of RJF International Corporation.
    e. Pawling Corporation.

2. Cover: Extruded rigid plastic, minimum 0.100-inch (2.5-mm) wall thickness; as follows:

    a. Profile: Flat profile, nominal 4 inches high by 1 inch (100 mm high by 25 mm) deep.
    b. Color and Texture: As indicated by manufacturer's designations.

3. Continuous Retainer: Minimum 0.080-inch- (2.0-mm-) thick, one-piece, extruded aluminum.
4. End Caps and Corners: Prefabricated, injection-molded plastic; matching color cover; field adjustable for close alignment with snap-on cover.
5. Accessories: Concealed splices and mounting hardware.
6. Mounting: Surface mounted directly to wall.

2.4 CORNER GUARDS

A. Surface-Mounted, Resilient, Plastic Corner Guards CG-1, CG-3: Assembly consisting of snap-on plastic cover installed over continuous retainer; including mounting hardware; fabricated with 90- or 135-degree turn to match wall condition.

1. Basis-of-Design Product: Subject to compliance with requirements, provide **IPC Door and Wall Protection Systems; Model 160 Corner Guard** or comparable product by one of the following:

a. Balco, Inc.
b. Construction Specialties, Inc.
c. IPC Door and Wall Protection Systems; Division of InPro Corporation.
d. Korogard Wall Protection Systems; a division of RJF International Corporation.
e. Pawling Corporation.

2. Cover: Extruded rigid plastic, minimum 0.078-inch (2.0-mm).

a. Profile: Nominal 2-inch- (50-mm-) long leg and 1/4-inch (6-mm) corner radius.
b. Height:
1) CG-1, CG-3: Align top of corner guard with wainscot or with crash rail. At other locations locate top of corner guard at 48 inches above the floor unless otherwise indicated.
2) CG-2: Full Height
c. Color and Texture: As indicated on Room Finish Legend, and Wall Protection Plans I201, I202.

3. Retainer: Minimum 0.060-inch- (1.5-mm-) thick, 1-piece, extruded aluminum.
4. Top and Bottom Caps: Prefabricated, injection-molded plastic; color matching cover; field adjustable for close alignment with snap-on cover.

2.5 IMPACT-RESISTANT WALL COVERINGS

A. Semirigid, Impact-Resistant Sheet Wall Covering WP-1: Fabricated from plastic sheet wall covering material.

1. Basis-of-Design Product: Subject to compliance with requirements, provide **IPC Door and Wall Protection Systems; Sanperrel Rigid Vinyl Sheet** or comparable product by one of the following:

a. Balco, Inc.
b. Construction Specialties, Inc.
c. IPC Door and Wall Protection Systems; Division of InPro Corporation.
d. Korogard Wall Protection Systems; a division of RJF International Corporation.
e. Pawling Corporation.

2. Size: 48 by 96 inches (1219 by 2438 mm).
3. Sheet Thickness: 0.060 inch (1.5 mm).
4. Color and Texture: Refer to Room Finish Legend.
5. Height: As indicated.

6. Trim and Joint Moldings: None.
7. Mounting: Adhesive.

2.6 DOOR-PROTECTION SYSTEMS

A. General: Comply with BHMA A156.6.

1. Basis-of-Design Product: Subject to compliance with requirements, provide **IPC Door and Wall Protection Systems; Custom Door Frame Guards** or comparable product by one of the following:

   a. Balco, Inc.
   b. Construction Specialties, Inc.
   c. IPC Door and Wall Protection Systems; Division of InPro Corporation.
   d. Korogard Wall Protection Systems; a division of RJF International Corporation.
   e. Pawling Corporation.

2. Cover: Extruded rigid plastic, minimum 0.080-inch (2.0-mm) wall thickness; in dimensions and profiles indicated.

   a. Height: 48 inches (1219 mm).
   b. Corner Radius: 1-1/4 inches (32 mm).
   c. Color and Texture: Pepperdust or equal.

3. Retainer: Minimum 0.080-inch- (2.0-mm-) thick, 1-piece, extruded aluminum.

2.7 FABRICATION

A. Fabricate impact-resistant wall-protection units to comply with requirements indicated for design, dimensions, and member sizes, including thicknesses of components.

B. Assemble components in factory to greatest extent possible to minimize field assembly. Disassemble only as necessary for shipping and handling.

C. Fabricate components with tight seams and joints with exposed edges rolled. Provide surfaces free of wrinkles, chips, dents, uneven coloration, and other imperfections. Fabricate members and fittings to produce flush, smooth, and rigid hairline joints.

2.8 METAL FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

1. Remove tool and die marks and stretch lines or blend into finish.
2. Grind and polish surfaces to produce uniform, directionally textured, polished finish indicated, free of cross scratches. Run grain with long dimension of each piece.

B. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

C. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and wall areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.

1. Examine walls to which impact-resistant wall protection will be attached for blocking, grounds, and other solid backing that have been installed in the locations required for secure attachment of support fasteners.
2. For impact-resistant wall-protection units attached with adhesive or foam tape, verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Complete finishing operations, including painting, before installing impact-resistant wall-protection system components.

B. Before installation, clean substrate to remove dust, debris, and loose particles.

3.3 INSTALLATION

A. General: Install impact-resistant wall-protection units level, plumb, and true to line without distortions. Do not use materials with chips, cracks, voids, stains, or other defects that might be visible in the finished Work.

1. Install impact-resistant wall-protection units in locations and at mounting heights indicated on Drawings or, if not indicated, at heights indicated below:

   a. Crash Rail: Match existing installation.
   b. Handrails: Match existing installation.

2. Provide splices, mounting hardware, anchors, and other accessories required for a complete installation.

   a. Provide anchoring devices to withstand imposed loads.
   b. Where splices occur in horizontal runs of more than 20 feet (6.1 m), splice aluminum retainers and plastic covers at different locations along the run, but no closer than 12 inches (305 mm).
   c. Adjust end and top caps as required to ensure tight seams.

B. Impact-Resistant Wall Covering: Install with butt joints without joint, corner, or top trim. Caulk with color match sealant

3.4 CLEANING

A. Immediately after completion of installation, clean plastic covers and accessories using a standard, ammonia-based, household cleaning agent.

B. Remove excess adhesive using methods and materials recommended in writing by manufacturer.

END OF SECTION 102600

SECTION 102800 - TOILET AND BATH ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Public-use washroom accessories.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include the following:

1. Construction details and dimensions.
2. Anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
3. Material and finish descriptions.
4. Features that will be included for Project.
5. Manufacturer's warranty.

B. Samples: Full size, for each accessory item to verify design, operation, and finish requirements.

1. Approved full-size Samples will be returned and may be used in the Work.

C. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.

1. Identify locations using room designations indicated on Drawings.
2. Identify products using designations indicated on Drawings.

D. Maintenance Data: For toilet and bath accessories to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Source Limitations: For products listed together in the same articles in Part 2, provide products of same manufacturer unless otherwise approved by Architect.

1.5 COORDINATION

A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.

B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Stainless Steel: ASTM A 666, Type 304, 0.0312-inch (0.8-mm) minimum nominal thickness, unless otherwise indicated.

B. Brass: ASTM B 19 flat products; ASTM B 16 (ASTM B 16M), rods, shapes, forgings, and flat products with finished edges; or ASTM B 30, castings.

C. Steel Sheet: ASTM A 1008/A 1008M, Designation CS (cold rolled, commercial steel), 0.0359-inch (0.9-mm) minimum nominal thickness.

D. Galvanized Steel Sheet: ASTM A 653/A 653M, with G60 (Z180) hot-dip zinc coating.

E. Galvanized Steel Mounting Devices: ASTM A 153/A 153M, hot-dip galvanized after fabrication.

F. Fasteners: Screws, bolts, and other devices of same material as accessory unit and tamper-and-theft resistant where exposed, and of galvanized steel where concealed.

G. Chrome Plating: ASTM B 456, Service Condition Number SC 2 (moderate service).

H. Mirrors: ASTM C 1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.

2.2 PUBLIC-USE WASHROOM ACCESSORIES

A. Basis-of-Design Product: The design for accessories is based on products indicated. Subject to compliance with requirements, provide the named product or a comparable product by one of the following:

1. A & J Washroom Accessories, Inc.
2. American Specialties, Inc.
3. Bobrick Washroom Equipment, Inc.
4. Bradley Corporation.

B. Recessed Toilet Tissue (Roll) Dispenser TPD:

1. Basis-of-Design Product: Bobrick #B-3888.
2. Description: Roll-in-reserve dispenser with radiused corners and hinged front secured with tumbler lockset.
3. Mounting: Recessed.
4. Operation: Noncontrol delivery with theft-resistant spindle.
5. Capacity: Designed for 5-inch- (127-mm-) diameter tissue rolls.
6. Material and Finish: Stainless steel, No. 4 finish (satin).
7. Location: Adjacent to all water closets except where conditions require surface or toilet partition-mounted dispensers as specified below.

C. Grab Bars:

1. Basis-of-Design Product: Bobrick B-#5806.
2. Mounting: Flanges with concealed fasteners.
3. Material: Stainless steel, 0.05 inch (1.3 mm) thick.

    a. Finish: Smooth, No. 4, satin finish.

4. Outside Diameter: 1-1/4 inches (32 mm).
5. Configuration and Length: As indicated on Drawings.

D. Mirror Unit:

1. Basis-of-Design Product: Bobrick B-#165.
2. Frame: Stainless-steel channel.

    a. Corners: Mitered and mechanically interlocked.

3. Hangers: Produce rigid, tamper- and theft-resistant installation, using method indicated below.

    a. One-piece, galvanized steel, wall-hanger device with spring-action locking mechanism to hold mirror unit in position with no exposed screws or bolts.

4. Size: As indicated on Drawings.

E. Oval Mirror: Custom, frameless mirror that complies the following.

1. Tempered Clear Mirror Glass: Meeting ASTM C 1503. Mirror Glazing Quality, for blemish requirements; and comply with ASTM C 1048 for Kind FT, Condition A, tempered float glass before silver coating is applied.

    a. Nominal Thickness: 6.0 mm.

2. Frameless with 1-inch wide perimeter bevel.

3. Hangers: Produce rigid, tamper- and theft-resistant installation, using method indicated below.

a. One-piece, galvanized steel, wall-hanger device with spring-action locking mechanism to hold mirror unit in position with no exposed screws or bolts.

4. Size: As indicated on Drawings.

2.3 FABRICATION

A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.

B. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.

B. Grab Bars: Install to withstand a downward load of at least 250 lbf (1112 N), when tested according to method in ASTM F 446.

3.2 ADJUSTING AND CLEANING

A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.

B. Remove temporary labels and protective coatings.

C. Clean and polish exposed surfaces according to manufacturer's written recommendations.

END OF SECTION 102800

SECTION 104414 - FIRE-PROTECTION SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Portable fire extinguishers.
2. Fire-protection cabinets for the following:

a. Portable fire extinguishers.

1.3 SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for fire-protection cabinets.

1. Fire Extinguishers: Include rating and classification.
2. Fire-Protection Cabinets: Include roughing-in dimensions, details showing mounting methods, relationships of box and trim to surrounding construction, door hardware, cabinet type, trim style, and panel style.

B. Maintenance Data: For fire extinguishers and fire-protection cabinets to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain fire extinguishers and fire-protection cabinets through one source from a single manufacturer.

B. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."

C. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.

1. Provide fire extinguishers approved, listed, and labeled by FMG.

1.5 COORDINATION

A. Coordinate size of fire-protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

2.2 MATERIALS

A. Aluminum: Alloy and temper recommended by aluminum producer and manufacturer for type of use and finish indicated, and as follows:

1. Sheet: ASTM B 209 (ASTM B 209M).
2. Extruded Shapes: ASTM B 221 (ASTM B 221M).

2.3 PORTABLE FIRE EXTINGUISHERS

A. Available Manufacturers:

1. JL Industries, Inc.
2. Larsen's Manufacturing Company.
3. Potter Roemer; Div. of Smith Industries, Inc.

B. General: Provide fire extinguishers of type, size, and capacity for each fire-protection cabinet indicated.

C. Multipurpose Dry-Chemical Type in Steel Container UL-rated 4-A:60-B:C, 10-lb (4.5-kg) nominal capacity, with monoammonium phosphate-based dry chemical in enameled-steel container.

2.4 FIRE-PROTECTION CABINET

A. Available Manufacturers:

1. JL Industries, Inc.
2. Larsen's Manufacturing Company.
3. Potter Roemer; Div. of Smith Industries, Inc.

B. Cabinet Type: Suitable for fire extinguisher.

C. Cabinet Construction: Nonrated.

D. Cabinet Material: Aluminum sheet.

1. Shelf: Same metal and finish as cabinet.

E. Recessed Cabinet: Cabinet box recessed in walls of sufficient depth to suit style of trim indicated.

1. Exposed Flat Trim: One-piece combination 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 (6 to 8 mm).

F. Cabinet Trim Material: Aluminum sheet.

G. Door Material: Aluminum sheet.

H. Door Style: Flush opaque panel, frameless, with no exposed hinges.

I. 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 concealed hinge permitting door to open 180 degrees.

J. Accessories:

1. Mounting Bracket: Manufacturer's standard steel, designed to secure fire extinguisher to fire-protection cabinet, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.
2. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated by Architect.

a. Identify fire extinguisher in fire-protection cabinet with the words "FIRE EXTINGUISHER."

1) Location: Applied to cabinet door.
2) Application Process: Pressure-sensitive vinyl letters.
3) Lettering Color: Red.
4) Orientation: Vertical.

K. Finishes:

1. Aluminum: Clear anodic.

2.5 FABRICATION

A. Fire-Protection Cabinets: Provide manufacturer's standard box (tub), with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.

1. 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 (13 mm) thick.
2. Miter and weld perimeter door frames.

C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

2.6 FINISHES, GENERAL

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. Finish fire-protection cabinets after assembly.

D. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.7 ALUMINUM FINISHES

A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

B. 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 walls and partitions for suitable framing depth and blocking where recessed cabinets will be installed.

B. Examine fire extinguishers for proper charging and tagging.

1. Remove and replace damaged, defective, or undercharged units.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare recesses for recessed fire-protection cabinets as required by type and size of cabinet and trim style.

3.3 INSTALLATION

A. General: Install fire-protection specialties in locations and at mounting heights indicated or, if not indicated, at heights indicated below:

1. Fire-Protection Cabinets: 54 inches (1372 mm) above finished floor to top of cabinet.

B. 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 semirecessed fire-protection cabinets.
2. Fasten mounting brackets to inside surface of fire-protection cabinets, square and plumb.

C. Identification: Apply vinyl lettering at locations indicated.

3.4 ADJUSTING AND CLEANING

A. Remove temporary protective coverings and strippable films, if any, as fire-protection specialties are installed, unless otherwise indicated in manufacturer's written installation instructions.

B. Adjust fire-protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.

C. On completion of fire-protection cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.

D. Touch up marred finishes, or replace fire-protection cabinets that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by fire-protection cabinet manufacturer.

E. Replace fire-protection cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 104414

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SECTION 105113 - METAL LOCKERS

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. This Section includes the following:

1. Standard metal lockers (Match existing in size), New lockers to be sloped top.

1.3 DEFINITIONS

A. Uncoated Steel Sheet Thicknesses: Indicated as the minimum thicknesses.

1.4 SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of metal locker.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Show base, sloping tops, filler panels, recess trim and other accessories.
2. Include locker identification system.

C. Samples for Initial Selection: For units with factory-applied color finishes.

D. Maintenance Data: For adjusting, repairing, and replacing locker doors and latching mechanisms to include in maintenance manuals.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An authorized representative of metal locker manufacturer for installation and maintenance of units required for this Project.

B. Source Limitations: Obtain metal lockers and accessories through one source from a single manufacturer.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver metal lockers until spaces to receive them are clean, dry, and ready for metal locker installation.

1.7 PROJECT CONDITIONS

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

1. Concealed framing, blocking, and reinforcements that support metal lockers before they are enclosed.
2. Recessed openings.
3. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish recessed opening dimensions and proceed with fabricating metal lockers without field measurements. Coordinate wall and floor construction to ensure that actual recessed opening dimensions correspond to established dimensions.

1.8 COORDINATION

A. Coordinate size and location of architectural casework bases for metal lockers.

B. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that metal lockers can be supported and installed as indicated.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008, Commercial Steel (CS) Type B, suitable for exposed applications.

B. Fasteners: Zinc- or nickel-plated steel, slotless-type exposed bolt heads, and self-locking nuts or lock washers for nuts on moving parts.

C. Anchors: Select material, type, size, and finish required for secure anchorage to each substrate.

1. Provide nonferrous-metal or hot-dip galvanized anchors and inserts at pool areas for corrosion resistance.
2. Provide toothed-steel or lead expansion sleeves for drilled-in-place anchors.

2.2 STANDARD METAL LOCKERS

A. Manufacturers:

1. MF lockers by Lyon Workspace Products; Standard Lockers.

B. Locker Arrangement: Box.

C. Body: Assembled by riveting or bolting body components together. Fabricate from unperforated, cold-rolled steel sheet with thicknesses as follows:

D. Frames: Channel formed; cold-rolled steel sheet; lapped and factory welded at corners; with top and bottom main frames factory welded into vertical main frames. Form continuous, integral door strike full height on vertical main frames.

E. Doors: One-piece; cold-rolled steel sheet; formed into channel shape with double bend at vertical edges, and with right-angle single bend at horizontal edges.

F. Hinges: Self-closing; welded to door and attached to door frame with not less than 2 factory-installed rivets per hinge that are completely concealed and tamper resistant when door is closed; fabricated to swing 180 degrees.

1. Hinges: Manufacturer's standard, steel continuous or knuckle type.

G. Door Handle and Latch for Box Lockers: Stainless-steel strike plate with integral pull; with steel padlock loop that projects through metal locker door.

1. Equipment: Equip each metal locker with identification plate.

H. Accessories:

1. Continuous Sloping Tops: Fabricated from cold-rolled steel sheet, standard thickness, but not less than 0.0329 inch (0.85 mm) thick.

a. Closures: Hipped-end type.
b. Sloped top corner fillers, mitered.

2. Finished End Panels: Fabricated from 0.0209-inch- (0.55-mm-) thick, cold-rolled steel sheet.

I. Finish: Baked enamel or powder coat.

1. Color(s): Match existing.

2.3 FABRICATION

A. General: Fabricate metal lockers square, rigid, and without warp; with metal faces flat and free of dents or distortion. Make exposed metal edges free of sharp edges and burrs, and safe to touch.

1. Form body panels, doors, shelves, and accessories from one-piece steel sheet, unless otherwise indicated.
2. Provide fasteners, filler plates, supports, clips, and closures as required for a complete installation.

B. Unit Principle: Fabricate each metal locker with an individual door and frame; individual top, bottom, and back; and common intermediate uprights separating compartments.

C. Knocked-Down Construction: Fabricate metal lockers for nominal assembly at Project site using nuts, bolts, screws, or rivets. Factory weld frame members together to form a rigid, one-piece assembly.

D. Hooks: Manufacturer's standard ball-pointed type, aluminum or steel; zinc plated.

E. Identification Plates: Manufacturer's standard etched, embossed, or stamped aluminum plates; with numbers and letters at least 3/8 inch (9 mm) high.

F. Continuous Sloping Tops: Fabricated in lengths as long as practicable, without visible fasteners at splice locations; finished to match lockers.

2.4 STEEL SHEET FINISHES

A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Factory finish steel surfaces and accessories except stainless-steel and chrome-plated surfaces.

C. Surface Preparation: Clean surfaces of dirt, oil, grease, mill scale, rust, and other contaminants that could impair paint bond. Use manufacturer's standard methods.

D. Baked-Enamel Finish: Immediately after cleaning, pretreating, and phosphatizing, apply manufacturer's standard thermosetting baked-enamel finish. Comply with paint manufacturer's written instructions for application, baking, and minimum dry film thickness (or powder coat – see next paragraph).

E. Powder-Coat Finish: Immediately after cleaning and pretreating, electrostatically apply manufacturer's standard baked-polymer thermosetting powder finish. Comply with resin manufacturer's written instructions for application, baking, and minimum dry film thickness.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine walls, floors, and support bases, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install level, plumb, and true; shim as required, using concealed shims.

1. Anchor locker runs at ends and at intervals recommended by manufacturer, but not more than 36 inches (910 mm) o.c. Install anchors through backup reinforcing plates, channels, or blocking as required to prevent metal distortion, using concealed fasteners.
2. Anchor single rows of metal lockers to walls near top and bottom of lockers.
3. Anchor back-to-back metal lockers to floor.

B. Knocked-Down Metal Lockers: Assemble knocked-down metal lockers with standard fasteners, with no exposed fasteners on door faces or face frames.

C. Equipment and Accessories: Fit exposed connections of trim, fillers, and closures accurately together to form tight, hairline joints, with concealed fasteners and splice plates.

1. Attach hooks with at least two fasteners.
2. Attach door locks on doors using security-type fasteners.
3. Identification Plates: Identify metal lockers with identification indicated on Drawings.

a. Attach plates to each locker door, near top, centered, with at least two aluminum rivets.
b. Attach plates to upper shelf of each open-front metal locker, centered, with a least two aluminum rivets.

4. Attach filler panels with concealed fasteners. Locate fillers panels where indicated on Drawings.
5. Attach sloping top units to metal lockers, with closures at exposed ends.

3.3 ADJUSTING, CLEANING, AND PROTECTION

A. Clean, lubricate, and adjust hardware. Adjust doors and latches to operate easily without binding.

B. Protect metal lockers from damage, abuse, dust, dirt, stain, or paint. Do not permit metal locker use during construction.

C. Touch up marred finishes, or replace metal lockers that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by metal locker manufacturer.

END OF SECTION 105113

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SECTION 122413 - ROLLER WINDOW SHADES

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. Manually operated roller shades with single rollers.
2. Motor-operated roller shades with single rollers.

B. Related Requirements:

1. Section 012100 “Alternates” for work of this Section affected by Alternates.
2. Section 061053 "Miscellaneous Rough Carpentry" for wood blocking and grounds for mounting roller shades and accessories.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include styles, material descriptions, construction details, dimensions of individual components and profiles, features, finishes, and operating instructions for roller shades.

B. Shop Drawings: Show fabrication and installation details for roller shades, including shadeband materials, their orientation to rollers, and their seam and batten locations.

1. Motor-Operated Shades: Include details of installation and diagrams for power, signal, and control wiring.

C. Samples: For each exposed product and for each color and texture specified, 10 inches (250 mm) long.

D. Roller-Shade Schedule: Use same designations indicated on Drawings.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Certificates: For each type of shadeband material, signed by product manufacturer.

C. Product Test Reports: For each type of shadeband material, for tests performed by manufacturer and witnessed by a qualified testing agency.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For roller shades to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Fabricator of products.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver roller shades in factory packages, marked with manufacturer, product name, and location of installation using same designations indicated on Drawings.

1.8 FIELD CONDITIONS

A. Environmental Limitations: Do not install roller shades until construction and finish work in spaces, including painting, is complete and dry and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

B. Field Measurements: Where roller shades are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Allow clearances for operating hardware of operable glazed units through entire operating range. Notify Architect of installation conditions that vary from Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design: Subject to compliance with requirements, provide products by **MechoShade Systems, Inc.** or comparable products by one of the following manufacturers:

1. Draper, Inc.
2. Lutron Electronics Co., Inc.
3. Skyco Shading Systems, Inc.

B. Basis-of-Design Product for Motor Operated Roller Shades: Subject to compliance with requirements, provide **MechoShade Systems, Inc.; Electroshade Electro/1** or comparable product by another manufacturer listed above.

C. Source Limitations: Obtain roller shades from single source from single manufacturer.

2.2 MANUALLY OPERATED SHADES WITH SINGLE ROLLERS

A. Chain-and-Clutch Operating Mechanisms: With continuous-loop bead chain and clutch that stops shade movement when bead chain is released; permanently adjusted and lubricated.

1. Bead Chains: Manufacturer's standard nickel-plated metal or stainless steel.

a. Loop Length: Full length of roller shade.
b. Limit Stops: Provide upper and lower ball stops.
c. Chain-Retainer Type: Clip, jamb mount.

2. Spring Lift-Assist Mechanisms: Manufacturer's standard for balancing roller-shade weight and lifting heavy roller shades.

a. Provide for shadebands that weigh more than 10 lb (4.5 kg) or for shades as recommended by manufacturer, whichever criteria are more stringent.

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: Left side of inside face of shade.
2. Direction of Shadeband Roll: Regular, from back 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. Shadebands:

1. Shadeband Material: Light-filtering fabric.
2. Shadeband Bottom (Hem) Bar: Steel or extruded aluminum.

a. Type: Enclosed in sealed pocket of shadeband material.

E. Installation Accessories:

1. Exposed Headbox: Rectangular, extruded-aluminum enclosure including front fascia, top and back covers, endcaps, and removable bottom closure.

a. Height: Manufacturer's standard height required to enclose roller and shadeband when shade is fully open, but not less than 3 inches (76 mm).

2. Endcap Covers: To cover exposed endcaps.

3. Closure Panel and Wall Clip: Removable aluminum panel designed for installation at bottom of site-constructed ceiling recess or pocket and for snap-in attachment to wall clip without fasteners.
4. Installation Accessories Color and Finish: As selected from manufacturer's full range.

2.3 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, 110 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. Limit Switches: Adjustable switches interlocked with motor controls and set to stop shades automatically at fully raised and fully lowered positions.
5. Operating Features:

    a. Group switching with integrated switch control; single faceplate for multiple switch cutouts.

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.

C. Mounting Hardware: Brackets or endcaps, corrosion resistant and compatible with roller assembly, operating mechanism, installation accessories, and mounting location and conditions indicated.

D. Shadebands:

1. Shadeband Material: Light-filtering fabric.
2. Shadeband Bottom (Hem) Bar: Steel or extruded aluminum.

    a. Type: Enclosed in sealed pocket of shadeband material.

E. Installation Accessories:

1. Closure Panel and Wall Clip: Removable aluminum panel designed for installation at bottom of site-constructed ceiling recess or pocket and for snap-in attachment to wall clip without fasteners.
2. Installation Accessories Color and Finish: As selected from manufacturer's full range.

2.4 SHADEBAND MATERIALS

A. Shadeband Material Flame-Resistance Rating: Comply with NFPA 701. Testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

B. Light-Filtering Fabric: Woven fabric, stain and fade resistant.

1. Source: Roller-shade manufacturer.
2. Product: As indicated in the Room Finish Legend located on the Drawings.
3. Orientation on Shadeband: Manufacturer's standard orientation.
4. Openness Factor: 3 percent.
5. Color: As indicated on Drawings.

2.5 ROLLER-SHADE FABRICATION

A. Product Safety Standard: Fabricate roller shades to comply with WCMA A 100.1, including requirements for flexible, chain-loop devices; lead content of components; and warning labels.

B. Unit Sizes: Fabricate units in sizes to fill window and other openings as follows, measured at 74 deg F (23 deg C):
1. Outside of Jamb Installation: Width and length as indicated, with terminations between shades of end-to-end installations at centerlines of mullion or other defined vertical separations between openings.

C. Shadeband Fabrication: Fabricate shadebands without battens or seams to extent possible except as follows:

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, operational clearances, accurate locations of connections to building electrical system, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 ROLLER-SHADE INSTALLATION

A. Install roller shades level, plumb, and aligned with adjacent units according to manufacturer's written instructions.

1. Shadebands: Located so shadeband is not closer than 2 inches (51 mm) to interior face of glass. Allow clearances for window operation hardware.

B. Electrical Connections: Connect motor-operated roller shades to building electrical system.

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 CLEANING AND PROTECTION

A. Clean roller-shade surfaces after installation, according to manufacturer's written instructions.

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that roller shades are without damage or deterioration at time of Substantial Completion.

C. Replace damaged roller shades that cannot be repaired, in a manner approved by Architect, before time of Substantial Completion.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain motor-operated roller shades.

END OF SECTION 122413

SECTION 123623.13 - PLASTIC-LAMINATE-CLAD COUNTERTOPS

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 plastic-laminate countertops.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product, including panel products, high-pressure decorative laminate and adhesive for bonding plastic laminate.

B. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.

1. Show locations and sizes of cutouts and holes for plumbing fixtures, faucets and other items installed in plastic-laminate countertops.
2. Apply AWI Certified Compliance Program label to Shop Drawings.

C. Samples for Verification:

1. Plastic laminates, 8 by 10 inches (200 by 250 mm), for each type, color, pattern, and surface finish, with one sample applied to core material and specified edge material applied to one edge.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and fabricator.

B. Woodwork Quality Standard Compliance Certificates: AWI Quality Certification Program certificates.

1.5 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance. Shop is a certified participant in AWI's Quality Certification Program.

B. Installer Qualifications: Fabricator of products or other certified participant in AWI's Quality Certification Program.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver countertops until painting and similar operations that could damage countertops have been completed in installation areas. If countertops must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

1.7 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install countertops until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

B. Field Measurements: Where countertops are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

C. Established Dimensions: Where countertops are indicated to fit to other construction, establish dimensions for areas where countertops are to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

PART 2 - PRODUCTS

2.1 PLASTIC-LAMINATE COUNTERTOPS

A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades indicated for construction, installation, and other requirements.

1. Provide labels and/or certificates from AWI certification program indicating that countertops, including installation, comply with requirements of grades specified.
2. The Contract Documents contain selections chosen from options in the quality standard and additional requirements beyond those of the quality standard. Comply with those selections and requirements in addition to the quality standard.

B. Grade: Premium.

C. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or, if not indicated, as required by woodwork quality standard.
1. Manufacturer: Subject to compliance with requirements, provide high-pressure decorative laminates as indicated in the Room Finish Legend located on the Drawings.

D. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:

1. As indicated by manufacturer's designations.

E. Edge Treatment: Subject to compliance with requirements, provide **T-Mold** as manufactured by **Charter Industries**, style and color as indicated on drawings.

F. Core Material: Particleboard.

G. Core Material at Sinks: Exterior-grade plywood.

H. Core Thickness: 3/4 inch (19 mm).

1. Build up countertop thickness to 1-1/2 inches (38 mm) at front, back, and ends with additional layers of core material laminated to top.

I. Backer Sheet: Provide plastic-laminate backer sheet, NEMA LD 3, Grade BKL, on underside of countertop substrate.

2.2 WOOD MATERIALS

A. Wood Products: Provide materials that comply with requirements of referenced quality standard unless otherwise indicated.

1. Wood Moisture Content: 5 to 10 percent.

B. Composite Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of woodwork and quality grade specified unless otherwise indicated.

1. Particleboard: ANSI A208.1, Grade M-2, made with binder containing no urea formaldehyde.

2. Softwood Plywood: DOC PS 1.

2.3 ACCESSORIES

A. Countertop Support Brackets: L-shaped countertop support brackets manufactured from 6063-T6 extruded aluminum with mitered and welded corner for surface mounting. Provide clear anodized finish. Install over studs or concealed blocking at 48 inches on center maximum.

1. Product: Subject to compliance with requirements, provide "EH-1818" support brackets by Rakks; Rangine Corporation at 24-inch deep counters.

B. Edge Angles: Metal angles of material and finish indicated on Drawings for protection of casework edges.

C. Grommets for Cable Passage through Countertops: 2-inch (51-mm) OD, black, molded-plastic grommets and matching plastic caps with slot for wire passage.

1. Product: Subject to compliance with requirements, provide "SG series" by Doug Mockett & Company, Inc.

2.4 MISCELLANEOUS MATERIALS

A. Adhesives: Do not use adhesives that contain urea formaldehyde.

B. Adhesive for Bonding Plastic Laminate: Contact cement.

1. Adhesive for Bonding Edges: Hot-melt adhesive or adhesive specified above for faces.

C. VOC Limits for Installation Adhesives and Sealants: Use products that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

1. Wood Glues: 30 g/L.
2. Multipurpose Construction Adhesives: 70 g/L.
3. Structural Wood Member Adhesive: 140 g/L.
4. Architectural Sealants: 250 g/L.

2.5 FABRICATION

A. Fabricate countertops to dimensions, profiles, and details indicated. Provide front and end overhang of 1 inch (25 mm) over base cabinets. Ease edges to radius indicated for the following:

B. Complete fabrication, including assembly, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
1. 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 before disassembling for shipment.

C. Shop cut openings to maximum extent possible to receive 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.

1. Seal edges of openings in countertops with a coat of varnish.

PART 3 - EXECUTION

3.1 PREPARATION

A. Before installation, condition countertops to average prevailing humidity conditions in installation areas.

B. Before installing countertops, examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming.

3.2 INSTALLATION

A. Grade: Install countertops to comply with same grade as item to be installed.

B. Assemble countertops and complete fabrication at Project site to the extent that it was not completed in the shop.

1. Provide cutouts for appliances, plumbing fixtures, electrical work, and similar items.
2. Seal edges of cutouts by saturating with varnish.

C. Field Jointing: Where possible, make in the same manner as shop jointing, using dowels, splines, adhesives, and fasteners recommended by manufacturer. Prepare edges to be joined in shop so Project-site processing of top and edge surfaces is not required. Locate field joints where shown on Shop Drawings.

1. Secure field joints in plastic-laminate countertops with concealed clamping devices located within 6 inches (150 mm) of front and back edges and at intervals not exceeding 24 inches (600 mm). Tighten according to manufacturer's written instructions to exert a constant, heavy-clamping pressure at joints.

D. Install countertops level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches (3 mm in 2400 mm).

E. Scribe and cut countertops to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.

F. Countertops: Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop.

1. Install countertops with no more than 1/8 inch in 96-inch (3 mm in 2400-mm) sag, bow, or other variation from a straight line.
2. Secure backsplashes to walls with adhesive.
3. Seal junctures of tops, splashes, and walls with mildew-resistant silicone sealant or another permanently elastic sealing compound recommended by countertop material manufacturer.

3.3 ADJUSTING AND CLEANING

A. Repair damaged and defective countertops, where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.

B. Clean countertops on exposed and semiexposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

END OF SECTION 123623.13

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SECTION 123661 - SIMULATED STONE COUNTERTOPS

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. Solid-surface-material countertops and backsplashes.

1.3 ACTION SUBMITTALS

A. Product Data: For countertop materials and sinks.

B. Shop Drawings: For countertops. Show materials, finishes, edge and backsplash profiles, methods of joining, and cutouts for plumbing fixtures.

C. Samples for Verification: For the following products:

1. Countertop material, 6 inches (150 mm) square.

1.4 PROJECT CONDITIONS

A. Field Measurements: Verify dimensions of countertops by field measurements after base cabinets are installed but before countertop fabrication is complete.

1.5 COORDINATION

A. Coordinate locations of utilities that will penetrate countertops or backsplashes.

PART 2 - PRODUCTS

2.1 SOLID-SURFACE-MATERIAL COUNTERTOPS

A. Configuration: Provide countertops with front and backsplash style as indicated on drawings.

1. Endsplash: Matching backsplash.

B. Countertops: 1/2-inch- (12.7-mm-) thick, solid surface material. Build up front edge with same material and shape to profile indicated.

C. Backsplashes: 1/2-inch- (12.7-mm-) thick, solid surface material.

D. Fabrication: Fabricate tops in one piece with shop-applied edges unless otherwise indicated. Comply with solid-surface-material manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.

1. Fabricate with loose backsplashes for field assembly.
2. Install integral sink bowls in countertops in the shop.

2.2 COUNTERTOP MATERIALS

A. Adhesives: Adhesives shall not contain urea formaldehyde.

B. Solid Surface Material: Homogeneous solid sheets of filled plastic resin complying with ANSI SS1.

1. Manufacturers: Subject to compliance with requirements, provide products indicated on drawings.
2. Integral Sink Bowls: Comply with ISSFA-2 and ANSI Z124.3, Type 5 or Type 6, without a precoated finish.
3. Colors and Patterns: As indicated by manufacturer's designations on drawings.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install countertops level to a tolerance of 1/8 inch in 8 feet (3 mm in 2.4 m).

B. Fasten countertops by screwing through corner blocks of base units into underside of countertop. Pre-drill holes for screws as recommended by manufacturer. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.

1. Install backsplashes and endsplashes to comply with manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.
2. Calk space between backsplash and wall with sealant specified in Section 079200 "Joint Sealants."

END OF SECTION 123661

TABLE OF CONTENTS

DIVISION 20 - MECHANICAL

20 00 00 BASIC MECHANICAL CONDITIONS

20 00 01 GENERAL

This Section includes general contractual, administrative and procedural requirements for the Work of Divisions 20 – 29 to supplement the requirements specified in Division 1.

The organization of the Specifications into Divisions, Sections and Subsections, and the arrangement of the Plans shall not in and of itself divide the Work among the Contractors and Subcontractors nor establish the Work to be performed by any trade.

The "Scope of Work" and "Work Included" under each respective sectional heading, nevertheless, attempts to segregate the Work by known contracting activities. In the final analysis, the General Contractor shall be responsible for scoping the work for each trade based on local practice to include all the Work of a given type in the related proposal, regardless of where and how identified in the Bid Documents.

20 00 02 SCOPE OF WORK

A. This project is for a new and partially renovated Endoscopy suite at St. Joseph Memorial Hospital located at 2 Hospital Dr. Murphysboro, IL 62966. The design, defined by the Project Documents, provides for patient prep, recovery, and endoscopy procedures.

The Mechanical Work for this project shall include all material, labor and services necessary for and incidental to providing the following systems (respective Sections of the Specifications are noted in the right hand column):

Basic Mechanical Materials and Methods 20
Insulation Work 20
Fire protection system 21
Plumbing Work 22
HVAC Piping and Equipment 23
Air Distribution 23
Temperature Control Systems 25

20 00 03 REFERENCES

A. The Plans, the general provisions of the of the Contract, including the General, Supplementary and/or Special Conditions and specification sections of Division 1 shall apply to Work of Divisions 20 - 29 of the Specifications.

B. All provisions and conditions cited in this Section shall apply to Work for all other sections of Divisions 20 – 29 of these Specifications.

20 00 04 REFERENCES, REGULATORY REQUIREMENTS

A. All material and equipment shall be listed, labeled or certified by Underwriters Laboratories, Inc., where relevant standards have been established (see also Paragraph 20 00 60). Material and equipment, which are not covered by UL Standards, will be acceptable provided they meet safety requirements of a nationally recognized testing laboratory. Products which no nationally recognized testing laboratory accepts, lists, labels, certifies or determines to be safe will be considered if inspected or tested in accordance with national industrial standards such as NEMA or ANSI. Evidence of compliance shall include test reports and definitive submittals.

B. Pressure vessels and pressure retaining safety devices shall be certified in accordance with applicable requirements of the ASME Boiler Code.

C. Definitions:

"Listed": A product is "listed" if of a kind mentioned in a list which: Is published by a nationally recognized laboratory which makes periodic inspections of such production. States that such product meets nationally recognized standards or has been tested and found safe for use in a specified manner.

"Labeled": The product is "labeled" if: It embodies a valid label or other identifying mark of a nationally recognized testing laboratory such as UL, Inc. Production is inspected periodically by a nationally recognized testing laboratory. The labeling indicates compliance with nationally recognized standards or tests to determine safe use in a specified manner.

"Certified": The product is "certified" if: The product has been tested and found by a nationally recognized testing laboratory to meet nationally recognized standards or to be safe for use in specific manner. Production is inspected periodically by a nationally recognized testing laboratory. The product bears a label, tag or other record of certification.

"Nationally recognized testing laboratory:"

20 00 05 DEFINITIONS

A. The term **"Work"** used in this Division shall be the furnishing of material, labor and/or services necessary for and reasonably incidental to providing specific component(s), consideration(s) and/or system(s) of the design for the mechanical facilities for this Project as hereinafter defined by the Project Documents.

B. The term **"Project Documents"** used in this Division shall be the compilation of the Specifications, the Plans and any Attachment and Addendum which collectively define the design and the intent of the Work to construct the Project.

C. The terms **"Architect"** and **"Engineer"** as used in this Division of the Specifications shall be the professional individual and/or company developing the respective portion(s) of the Project Documents and administering the responsibility for the adherence to the intent of these documents. The "Architect/Engineer" is the agent of the "Owner", and shall represent and discharge authority on all matters unless the matter is referred to the Owner or the Owner elects to perform in their own behalf.

D. The term **"General Contractor, Construction Manager, or Prime Contractor"** as used in Division 20 shall mean the Contractor who has the prime contract with the Owner and who is responsible for general conditions of the project and is responsible for seeking experienced and qualified Trade Subcontractors to perform the Work.

E. The terms **"Contractor"** and **"Subcontractor"** where used in this Division shall mean any Company, regularly in business, to perform the type of work for which the Contract was sought, who has contracted with the Owner or General Contractor to perform the work included in and defined by this section and any other section or sections of this Division.

F. The term **"submittal"** as used in this Section of the Specifications shall be construed to be information in various forms compiled by the Contractor to transmit to the Architect/Engineer for review, comment and/or approval and return same to the Contractor with notice to react. The information shall support and/or substantiate that the given product complies with the intent of the Project Documents, should be incorporated in the Work and therefore, warrants approval to permit proceeding with that Work. The information may be any form or accepted practice of shop drawings, data, published catalogs, etc. that sufficiently provide the Architect/Engineer with basis of making a determination.

G. The term **"unfinished space"** as used in Division 20 - 25 of the Specifications shall be a mechanical or electrical equipment room. These are rooms that are generally unpainted and accessible only to building maintenance personnel.

H. The term **"finished space"** as used in Division 20 - 25 of the Specifications shall mean any space not defined as "unfinished space" (i.e. occupied rooms, corridors, stairways, closets, etc.).

I. The term **"exterior"** or **"outdoors"** as used in Division 20 - 25 of the Specifications shall mean exposed to atmospheric weather conditions.

J. The term **"interior"** or **"indoors"** as used in Division 20 - 25 of the Specifications shall mean not exposed to atmospheric weather conditions.

K. The term **"concealed"** as used in Division 20 - 25 of the Specifications shall mean anything that is not visible in a "finished space".

L. The term **"inaccessible"** as used in Division 20 - 25 of the Specifications shall mean located within walls or above non-lay-in ceiling (i.e., drywall, plaster).

M. The term **"packaged"** as used in Division 20 - 25 of the Specifications shall be construed to be a factory manufactured piece of equipment for which all components are totally assembled, prepiped and prewired within its own structure and ready to operate when connected to proper external mechanical and electrical services.

N. The term **"cold piping system"** as used in Division 20 - 25 of the Specifications shall be a piping system containing media at or below 79 degrees F temperature.

O. The term **"ambient piping system"** as used in Division 20 - 25 of the Specifications shall be a piping system containing media which is neither heated or chilled and remains at a temperature range between 80 and 109 degrees F temperature.

P. The term **"hot piping system"** as used in Division 20 - 25 of the Specifications shall be a piping system containing media at or above 110 degrees temperature.

Q. The term **"medical gas"** as used in Division 20 - 25 of the Specifications shall include gaseous oxygen, nitrous oxide and medical (clinical) air, all installed per NFPA 99.

R. The term **"medical vacuum"** as used in Division 20 - 25 of the Specifications shall include vacuum, installed in accordance with NFPA 99.

20 00 06 CODES, STANDARDS, ETC.

A. The material, workmanship and systems for Work of this Division shall comply with all applicable codes, standards, regulations and laws of the legal governmental jurisdiction at the project site.

Should the Contractor perform any work that does not comply with the requirements of the applicable codes, standards, regulations, statutes, laws, acts, or which does not receive the approval of the responsible inspection authority, Contractor shall bear all costs arising in correcting the deficiencies.

Applicable requirements of the current and accepted edition of the following codes shall apply to the Work for Divisions 20 – 29: **<Edit list to meet project requirements>:**

International Building Code, 2003
International Mechanical Code, 2003
Illinois State Plumbing Code, Latest Edition
Code of Federal Regulations (CFR)
City of Herrin adopting Ordinances, Laws and Statutes
Life Safety Code, NFPA 101, 2000
National Electrical Code, 2005
Air Conditioning and Ventilation Systems, NFPA 90A, 2002
NFPA 99: Standard for Healthcare Facilities, 1999

Applicable requirements of the current and accepted edition of the following industry standards, codes and specifications shall apply to the Work for Divisions 20 - 29:

<Edit list to suit project by Section, those without section numbers should stay>

AGA	American Gas Association	**20**
AMCA	Air Moving and Conditioning Association	**23 30 00**
ANSI	American National Standards Institute	**20 10 00**
API	American Petroleum Institute	**23 00 00**
ASHRAE	American Society of Heating, Refrigerating and Air Conditioning Engineers	
ASME	American Society of Mechanical Engineers	**20 10 00**
ASSE	American Society of Sanitary Engineers	**22 00 00**
ASTM	American Society of Testing and Materials	**20 10 00**
AWS	American Welding Society	**23 00 00**
AWWA	American Water Works Association	**22 00 00**
CISPI	Cast Iron Soil Pipe Institution	**22 00 00**
IEEE	Institute of Electrical & Electronic Engineers	
IPCEA	Insulated Power Cable Engineers Association	
MSS	Manufacturers Standardization Society of Valve and Fitting Industry	**20 10 00**
NIST	Institute of Science and Technology	**20 10 00**
NEC	National Electric Code, including amendments by local authority having jurisdiction	
NEMA	National Electrical Manufacturers Association	

NFPA	National Fire Protection Association	**21 00 00**
NSF	National Sanitation Foundation	**22 00 00**
NIOSH	National Institute of Occupational Safety and Health	
OSHA	Occupational Safety and Health Act	
SMACNA	Sheet Metal and Air Conditioning Contractors National Association	**23 30 00**
UL	Underwriters Laboratory, Inc.	

Guidelines for Construction and Equipment of Hospital and Medical Facilities

Applicable requirements of all the relevant Federal laws including current and accepted edition of the Americans with Disabilities Act (ADA).

20 00 10 CONDITIONS, BID

20 00 11 REQUEST FOR PROPOSAL

A. The terms for Contractor's proposal shall be as described in the General Conditions, Supplementary and/or Special Conditions and Specification Sections of Division 1.

20 00 12 TAXES

A. The Owner is tax exempt, see General Conditions, Supplementary and/or Special Conditions and Specifications Sections of Division 1.]

20 00 13 FREIGHT

A. The respective Contractor or Subcontractor shall pay all shipping and/or freight charges coincidental with the purchase of material and equipment for the fulfillment of their respective Work.

20 00 14 PERMITS AND FEES

A. The respective Contractor or Subcontractor shall apply for, obtain and pay for all charges for permits and fees required to install the respective Work. The Contractor shall arrange for and pay all required charges and/or fees to inspect and accept the Work by the appropriate authority.

Any deficiency arising from the improper administering or complying with requirements for permits, fees, or inspections shall be corrected by the Contractor without additional compensation.

20 00 20 CONDITIONS, JOBSITE

20 00 21 TEMPORARY FACILITIES

A. General

In general, the Construction Manager or the Owner to the extent as described in Division 1 of the Specifications will provide temporary facilities. However, if that is not the case, the specific conditions of this project are identified as follows:

CONSTRUCTION ELECTRIC POWER and LIGHTING:

The Construction Manager shall provide 120 volt, 60 Hz, single phase electric service to a single distribution panel at the job site and shall provide minimal temporary lighting throughout the Project.

TEMPORARY CONDITIONING OF AIR (HEATING/COOLING):

The permanent heating, ventilating and air conditioning systems and machinery shall not be used for temporary heating or cooling during construction. Any devices required for temporary conditioning of the spaces would be the responsibility of the Construction Manager.

If the Contractor should request through a separate agreement with the Owner to utilize the permanent systems or equipment for temporary space conditioning, the following minimum conditions will be apart of that agreement:

a. The return air system shall not be used. This shall include the return air ductwork, return air inlets at air devices and return air connections at air handling equipment. Air shall be returned directly through the filter section at the air handling equipment and the return air system shall be isolated and sealed tightly.
b. All safety devices shall be installed and operative.
c. Temporary filters shall be installed in the filter section(s). These filters shall be removed and discarded at the end of the temporary period.
d. At the end of the temporary period and before acceptance, all coils shall be chemically cleaned, and all supply air system(s) including ductwork, plenums, and air devices shall be cleaned and return air system(s) activated all to the satisfaction of the Architect/Engineer.

TEMPORARY TOILETS and WATER:

1. The Construction Manager shall be responsible for providing temporary toilets and water for contractor's use during construction.

   Any connections to the domestic water which could cause contamination shall be connected via a backflow prevention device.

JOB SITE SECURITY:

1. The Contractor shall cooperate with the Owner in the procedures and requirements for entering and exiting the building.
2. The Contractors work hours shall conform to the building's normal operating hours unless special arrangements are made with the Owner.
3. Each trade shall be responsible for securing its trailers, lockboxes, materials, supplies, tools, etc. and Owner will not be responsible for damage, theft, or loss.

JOB SITE PARKING:

Contractor shall park in only the designated areas assigned to them for use by the Owner and shall not park in No Parking Areas, on lawns, or unpaved areas and shall not block access to loading docks, fire hydrants, etc. See Division 1 for additional requirements or restrictions.

CONTRACTOR ID BADGES:

Contractors shall obtain ID badges from the hospital

20 00 22 REQUIREMENTS TO PURSUE THE WORK

A. Work space: The respective Contractors and Subcontractors shall be assigned areas at the job site for construction trailers, lay-down, storage and work spaces as arranged with the Owner. All spaces shall be accessible to the Architect/Engineer. All material and equipment shall be protected during the course of construction against weather, dirt, comprehensive damage and theft. All items subject to water damage shall be adequately protected. Damage occurring or defects detected before acceptance shall be repaired or replaced at no additional compensation.

Tools: The Contractors and Subcontractors shall provide their own tools and services to perform their respective Work. Rented or leased services shall have proper and adequate insurance in accordance with requirements of Division 1.

Temporary storage: The Contractors and Subcontractors shall be responsible for any requirements to temporarily store material and equipment until it is incorporated into the Project.

SIH Infection/Safety Class: All contractors (workers on site) shall attend and obtain SIH Infection/Safety training offered by the Hospital.

20 00 30 PROJECT DOCUMENTS

20 00 31 GENERAL

A. The Plans and the Specifications are intended to define complete and satisfactorily functioning systems. The Contractor shall be responsible for providing all necessary material, labor and services to provide the completed, operating systems at no additional compensation even though each and every element thereof is not specifically identified.

The Plans are diagrammatic and indicate general arrangements, approximate sizes and relative locations of principal equipment and materials to provide for the design and intent of the Mechanical Work, and shall be followed as closely as actual building and site conditions and other work permit. Because of the scale of the drawings, the Plans do not represent every offset, fitting, accessory, etc. that may be required for the piping, ductwork or other appurtenances, nor is it implied that all conflicts between elements of the Work or building components have been resolved. The Contractor shall prepare details and/or coordination drawings where it may be required and submit to the Architect/Engineer for approval before proceeding with the Work (see Subsection 20 10 53, Coordination).

To the extent contained in the Project Documents, elevations, sections, isometrics, typical details, and schematic diagrams are included for instructions to the craftsperson. If any additional isometrics or diagrams are desired and/or required for further instruction to the craftsperson, for permit applications, or for any other reason, the Contractor shall develop the drawings.

Significant discrepancies and/or changes required to accomplish the intent of the Project Documents, in the opinion of the Contractor, shall be identified and submitted to the Architect/Engineer for approval before proceeding with the Work in question. Changes originated by the Architect/Engineer shall be processed under the subsection heading "Changes in the Work".

The Plans and the Specifications are mutually complementary. Work required by one, but not the other, shall be performed as if required by both.

In the event of conflict between the Plans and the Specifications, the Contractor shall notify the Engineer for clarification. The Contractor shall assume that the stricter requirements apply when there is not sufficient time for the clarification request, or when there is not sufficient time for it to be answered.

20 00 32 PLANS

A. The Plans for the Work for Divisions 20 – 29 are as follows:

Sheet No./ Revision No.	Description	Date
M - 1.0	**Title, symbols**	
M - 2.0A	**FIRST FLOOR PLUMBING FOUNDATION PLAN – BASE BID – PHASE 1**	
M - 2.0B	**FIRST FLOOR PLUMBING FOUNDATION PLAN – BASE BID – PHASE 2B**	
M - 2.1A	**FIRST FLOOR PLUMBING – BASE BID – PHASE 1**	
M - 2.1B	**FIRST FLOOR PLUMBING – BASE BID – PHASE 2B**	
M - 2.2	**ROOF PLAN PLUMBING**	
M - 2.3A	**FIRST FLOOR PLUMBING FOUNDATION PLAN – ALT – PHASE 1**	
M - 2.3B	**FIRST FLOOR PLUMBING FOUNDATION PLAN – ALT – PHASE 2B**	
M - 2.4A	**FIRST FLOOR PLUMBING FOUNDATION PLAN – ALT – PHASE 1**	
M - 2.4B	**FIRST FLOOR PLUMBING FOUNDATION PLAN – ALT – PHASE 2B**	
M - 2.5	**FIRST FLOOR MEDICAL GAS PLAN**	
M - 2.5A	**FIRST FLOOR MEDICAL GAS PLAN – PHASE 1**	
M - 2.5B	**FIRST FLOOR MEDICAL GAS PLAN - PHASE 2A**	
M - 2.5C	**FIRST FLOOR MEDICAL GAS PLAN ALT – PHASE 2B**	
M – 3.1A	**FIRST FLOOR HVAC DUCTWORK PLAN – PHASE 1**	
M – 3.1B	**FIRST FLOOR HVAC DUCTWORK PLAN – PHASE 2A**	
M – 3.1C	**FIRST FLOOR HVAC DUCTWORK PLAN – PHASE 2B**	
M – 3.2	**FIRST FLOOR HVAC PIPING**	
M – 3.2A	**FIRST FLOOR HVAC PIPING PLAN – PHASE 1**	
M – 3.2B	**FIRST FLOOR HVAC PIPING PLAN – PHASE 2B**	

M – 3.3	**FIRST FLOOR HVAC DUCTWORK PLAN – ALTERNATE**
M – 3.3A	**FIRST FLOOR HVAC DUCTWORK PLAN – ALTERNATE - PHASE 1**
M – 3.3B	**FIRST FLOOR HVAC DUCTWORK PLAN – ALTERNATE - PHASE 2A**
M – 3.3C	**FIRST FLOOR HVAC DUCTWORK PLAN – ALTERNATE – PHASE 2B**
M – 3.4	**FIRST FLOOR HVAC PIPING PLAN – ALTERNATE**
M – 3.4A	**FIRST FLOOR HVAC PIPING PLAN – ALTERNATE - PHASE 1**
M – 3.4B	**FIRST FLOOR HVAC PIPING PLAN – ALTERNATE - PHASE 2A AND 2B**
M – 3.5	**HVAC PARTIAL ROOF PLAN – PHASE 1**
M – 5.1	**CHILLED WATER AND HEATING WATER SYSTEM FLOW DIAGRAMS**
M – 5.2	**AHU-12 AIR FLOW DIAGRAM**
M – 6.1	**SCHEDULES**
M – 6.2	**BUILDING SECTIONS**
M – 6.3	**DETAILS**
M – 8.1	**FIRST FLOOR FIRE PROTECTION PLAN**
MD – 2.1	**FIRST FLOOR PLUMBING DEMOLITION PLAN**
MD – 2.5	**FIRST FLOOR PLUMBING DEMOLITION PLAN – PHASE 2A**
MD – 3.1	**FIRST FLOOR HVAC DUCTWORK DEMOLITION PLAN – PHASE 2A**
MD – 3.2	**FIRST FLOOR HVAC PIPING DEMOLITION PLAN – PHASE 2A**

20 00 33 SPECIFICATIONS

A. The specification for Divisions 20 – 29 includes the following sections:

20	Basic Mechanical Conditions
20	Basic Mechanical Materials and Methods
20	Insulation Work
21	Fire Protection System
22	Plumbing Systems
23	HVAC Piping and Equipment
23	Air Distribution System
25	Temperature Control System

Referenced sections of other Divisions whether attached or in separate volumes or binders shall be a part of the Contract Documents.

20 00 34 ADDENDUM

A. The Architect/Engineer may issue revisions, modifications, attachments or other documentation in the form of an "addendum" to the Project (Bid) Documents during the bidding phase only to change, detail or clarify the scope of the Work.

B. The “addendum” shall become a part of the Contract Documents. Contractor shall indicate on his Bid the addenda received and therefore included in the Bid.

20 00 35 INTERPRETATIONS

A. The Architect/Engineer shall be the sole source of interpretation of the design and intent of the Project Documents.

20 00 36 CONSTRUCTION SCHEDULE

A. The Contractor shall furnish sufficient manpower as the schedule dictates and is required to maintain the overall project schedule. Manpower or overtime to meet the project schedule including, but not limited to, premium time, inefficiencies associated with longer days/hours, inefficiencies associated with additional manpower, or other labor burdens shall be included in the Contract Sum.

B. The Work shall be scheduled in accordance with the General, Supplementary and/or Special Conditions and specification sections of Division 1. The respective contractor shall coordinate with this schedule in preparation of his schedule for his portion of the Work.

The respective Contractor shall cooperate with the Construction Manager and other trades to develop an overall project schedule.

20 00 37 RECORD DRAWINGS

A. The respective Contractor shall maintain a separate set of plans at the jobsite, and mark thereon as a “record” any changes in the Work as the construction proceeds. These record drawings shall include exact locations and relevant details (i.e. inverts, elevations, sizes, dimensions related to building lines, etc.) of all underground work, all concealed work, all considerations requiring periodic attention and access thereto (i.e. valves, air vents, dampers, drives, control devices, terminal units, filters, steam traps, strainers, etc.).

20 00 38 AS-BUILT DRAWINGS

A.. At the completion of the project, the Architect/Engineer will provide Contractor updated drawings and CADD files posted with addenda and alterations made through supplementary drawings issued with RFIs, ASI’s or Proposal Requests for the Contractors use to transfer all of the information on the “record” drawings. The Contractor shall transfer any additional information, including mark-ups, changes or field conditions from the on-site working as-built drawings. These marked-up drawings shall then be returned to the Engineer who will then incorporate into the CADD as-built drawing. The Contractor for their representation and accuracy of the final installation conditions shall certify these “as-built” drawings. Drawings shall be submitted in both CADD and PDF format.

B. In addition to the information on the “record” drawings the “as-built” drawings will contain the following information: Updated Equipment Schedules with shop drawing data and valve tag numbers placed on the flow diagrams.

C. Contractor shall maintain one copy of the specification, including addenda as Record Specifications. Mark to show variations in Work performed in comparison with the text of the specifications. Such variations shall only be permitted where agreed to by the Architect/Engineer in writing.

20 00 40 DUTIES OF CONTRACTOR

20 00 41 GENERAL (PURSUIT OF WORK)

A. The Contractor shall thoroughly examine all Bid Documents before submitting a bid/proposal for the Work. If in the opinion of the Contractor there are any deficiencies in the Documents that might impact on the intent or the scope of the work, the Contractor shall bring the matter to the attention of the Architect/ Engineer for clarification. If in the judgment of the Architect/Engineer such clarification is warranted, an addendum to the Documents will be issued. If the Contractor fails to request clarification or otherwise submits a bid without qualifications; the Contractor thereby agrees to install a complete and functional system with no change in the contract price.

The Contractor shall be responsible for changes required for compliance with codes, standards, regulations, ordinances, etc. and implementing any such change at no change in contract price. In the event of conflict with the Project Documents or other requirements, the more stringent shall apply. The Contractor shall promptly notify the Architect/Engineer of any discrepancy.

The Contractor shall perform the Work to comply with all terms, conditions and intentions, whether explicit or implicit, of this Section and applicable requirements of other Sections of Divisions 20 - 29, the Plans and any other documentation so identified. Should the Contractor perform any Work, which does not comply with the Project Documents or is not in accordance with common trade practices, the Contractor shall bear all costs, at no change in contract price, arising in correcting the Work.

The Contractor shall be responsible for all aspects of the Work for their respective contractual agreement. The Work of the respective suppliers and subcontractors shall be administered properly to assure that all elements thereof have been provided for complete and functioning system(s).

20 00 42 COMMENCEMENT OF CONTRACT

A. The commencement of the Contract work shall be the receipt by the Contractor of a written "Notice to Proceed" via certified United States Postal Service (USPS) mail.

Any further notices to stop and/or restart the Work shall also be transmitted via certified USPS mail. All other correspondence shall be at the discretion of the sender.

20 00 43 SUBMITTALS FOR APPROVAL

A. The Contractor shall submit a list of proposed subcontractors and equipment suppliers within two (2) weeks of a Notice to Proceed. The list shall identify the Work to be subcontracted and the name of the proposed subcontractor; the equipment to be provided including the make, model number and vendor's name and reference to the specific subsection(s) of the Specifications. Approval of this list does not obligate the Architect/Engineer to approve the subsequent detailed submittal if it is not acceptable.

All shop drawings (except temperature control and sprinkler drawings) must be submitted prior to the receipt of second partial payment request. After the first payment has been made, no further payment will be made until the shop drawings have been submitted and approved. Temperature control and sprinkler shop drawings must be submitted prior to the receipt of the fourth partial payment request. After the third payment has been made, no further payment will be made until these shop drawings have been submitted and approved.

The Contractor shall forward the quantity required for distribution within a reasonable time following the award of the contract. In addition to the quantity the Contractor requires the Engineer will retain one (1) copy and four (4) sets should be reserved for closeout documentation (see Section 20 00 47 Catalog Data). Prior to submitting shop drawings, Contractor shall verify equipment delivery for compliance with the overall project schedule. Any delays due to delivery or due to submittals being late, inadequate, or incorrect and therefore rejected by the Architect/Engineer shall be the responsibility of the Contractor making said submittal. The Contractor shall bear all cost for expediting charges or obtaining materials from another vendor to meet the overall project schedule.

The Engineer may take up to three (3) weeks to review a submittal from the time it arrives at the Engineer's office until the time it is returned to the Architect. Resubmittals will be reviewed within two (2) weeks from the time they arrive at the Engineer's office until the time they are returned to the Architect.

The submittals shall include shop drawings, engineering data and support information to sufficiently substantiate compliance with the Project Documents, and shall have been processed in accordance with Subsection 20 00 43. All submittals must include the following information in order to be considered for review. Submittals found to be lacking will be processed without review.

1. Shop drawing shall be manufacturers original documents; no reproductions or telefaxes will be accepted.

   Stamped date of receipt by the Contractor.

   Identification of the project name.

   Indication that the Contractor has reviewed the submittal.

   Identification of the Specification section or subsection that specifies the submitted item.

Identification of the submitted item by the same description that is used in the Project Documents.

Quantity to be provided. The Contractor shall make an independent count and not rely on the Project Documents.

The approval of the submittal shall not relieve the Contractor from complying with all of the terms and conditions of the Project Documents. The Contractor shall be responsible for all physical and performance requirements of equipment provided, including any differences in the cost of installation for variations from these requirements.

Include one (1) copy of the manufacturer's installation instructions and maintenance manual with the equipment submittal for approval for inclusion in the Operations and Maintenance Manuals as specified in Subsection 20 00 46.

Items requiring submittals are listed in each section where the equipment or materials are specified. In general, all items purchased by Contractor for installation where a make and model is specified shall require submittals. Items required for the Work such as sand paper, bolts, gaskets, welding rods, etc. which are not specified are not required to be submitted unless specifically requested.

The following shall be submitted under this section of the specifications:

1. List of subcontractors and equipment supplier.

Payment breakdown.

Construction Schedule.

Detailed submittals.

Catalog Data

Operating and maintenance manuals.

As-built drawings.

Contractor developed details and coordination drawings (when applicable).

Proposed substitution (when applicable).

20 00 44 CHANGES IN WORK

A. The only condition under which a change in the contract price will be considered is if there is to be a change in the scope of intent of the project requirements. Such changes would be limited to revisions in the project initiated by the Owner. The Architect/Engineer will issue a proposal for the new scope of work for the Contractor to prepare a price. When the price and time are agreed upon, the Architect/Engineer will prepare change order or change orders to adjust the contract sum and/or the contract time as necessary to carry out the changes.

No claim for an addition to the Contract Sum will be valid unless authorized as aforesaid in writing by the Owner. Any work completed by the Contractor outside the original project scope without written approval from the Owner will be deemed as a waiver by the Contractor for additional compensation for said work.

No requests for change orders will be reviewed or considered for approval that are not submitted with all of the following information. No cost associated with labor burden or manpower inefficiencies will be approved for a change order without documentation of the present labor burden, manpower requirements, and the critical path nature of the scope change.

1. A complete and detailed line item takeoff of materials and equipment.

   A unit cost identified for each line item with material cost, labor hours, and labor rate identified separately for each line item.

   All fringes and mark-ups identified separately.

Where major subcontracts are involved, the respective subcontractor's calculation, including all of the above data, shall be included with the Contractor's request.

Where there are net differences, the above data shall be included for all items added and for all items deducted with the net calculation clearly identified. Mark-ups shall be applied only after net differences are calculated.

The overhead charged by the Contractor shall be considered to include, but not limited to, performance bond, insurance, job site office expense, normal hand tools, man-lifts, incidental job supervision, field supervision, safety training, general office overhead, and cost associated with the preparation of design documents, layout drawings, shop drawings, or as-built drawings.

In evaluating the value of the contractor's request, for comparison purposes, the Architect/Engineer may use cost and unit data from the current edition of the R. S. Means Company's Cost Data, or information from appropriate suppliers or vendors of the respective materials or equipment.

Any requests submitted without the above details will be returned without review for resubmittal in the proper form.

20 00 45 COMPLETION AND ACCEPTANCE

A. If, at the Owner's option, a portion of the building is to be occupied or a portion of the mechanical work is utilized for beneficial use by the Owner prior to completion and acceptance of the Project, the start of the guarantee shall begin with the "beneficial use" of the related Work.

The Engineer shall inspect the portion of the system for approval prior to acceptance of the system or subsystem.

The Contractor shall prepare a certificate of acceptance for approval by the Owner for that portion of the Work and submit a copy to the Architect/Engineer for record purposes.

20 00 46 OPERATIONS AND MAINTENANCE MANUALS

A. As a part of the contractual agreement, the Contractor shall submit and receive approval for the following to receive payment beyond 75% of the contract amount. This information shall be submitted as soon as practical and while the Contractor is on site.

Provide four (4) sets of manufacturers printed information in three (3) ring binders containing information on installation operation and maintenance for each piece of equipment supplied. Manufacturer's information shall be original copies, no reproduction or telefaxes will be accepted.

The information shall list any maintenance requirements and schedule for required maintenance.

The information shall show all parts and part numbers of available replacement parts available for each piece of equipment.

A cross-index of material and equipment furnished containing:

An alphabetical listing of material and equipment.

An alphabetical listing by manufacturer's name, address and contact person of the local sales representative.

An alphabetical listing of all subcontractors including name, address, contact person, and specific work performed.

All data shall be supplied electronically in PDF format as well.

20 00 47 CATALOG DATA

A. As a part of the contractual agreement, the Contractor shall submit and receive approval for the following to receive payment beyond 75% of the contract amount. This information shall be submitted as soon as all shop drawings have been approved and while the Contractor is on site.

Provide four (4) sets of only those shop drawings that were approved and incorporated into the project.

A cross-index of material and equipment furnished containing:

An alphabetical listing of material and equipment.

An alphabetical listing by manufacturer's name, address and contact person of the local sales representative.

An alphabetical listing of all subcontractors including name, address, contact person, and specific work performed.

All data shall be supplied electronically in PDF format as well.

20 00 48 CLOSE-OUT REQUIREMENTS

A. As a part of the contractual agreement, the Contractor shall submit and receive approval for the following before final payment will be released. This information shall be submitted as soon as practical after project completion:

Testing and Balancing Reports (both hard copy and electronic).

Temperature controls as-built wiring diagrams, sequences of operation with daily, holiday and special operating schedules, and final calibrations of all instruments.

As-built drawing mark-ups.

At the completion of the project, all contractors/subcontractors shall submit a letter stating all materials are asbestos free, and meet the specified ASTM E-84 flame/smoke rating of 25/50, and that all piping and duct penetrations are smoke or fire stopped as required by the Code.

All data shall be supplied electronically in PDF format as well.

20 00 49 GUARANTEE

A. The Contractor shall guarantee all material, equipment and workmanship provided for this project to be free from defects for a period of one (1) year after final acceptance. The guarantee shall include replacement of the defective part(s) and related labor. Manufacturer's written guarantees shall be provided where it is published.

Any obvious defects shall be corrected before final acceptance. For additional defects after final acceptance, the Owner shall advise the Contractor in writing, unless the situation is urgent, to address the deficiency or malfunction. The Contractor shall respond promptly and with no additional compensation for a valid guarantee claim.

Longer guarantee periods of time or special conditions may be specified. See particular specifications for these requirements.

If a written guarantee is offered for conditions or period exceeding specified requirements; this guarantee shall be included in the “Close-out” specifications of Subsection 20 00 48.

The Contractor shall not qualify the guarantee with requirements placed upon the Owner. If the Contractor has concerns with maintenance of a piece of equipment then Contractor shall allow for making periodic inspections, adjustments, etc. during the warranty period.

20 00 50 PAYMENTS

A. The Contractor shall submit for approval by the Architect/Engineer, at least four (4) weeks prior to the first request for payment, a format utilizing AIA form G702 of an itemized cost breakdown of all systems (material and labor), subsystems (material and labor), and major equipment groups to be invoiced for progress payments.

The Contractors of Divisions 20 - 29 will also be subjected to the following requirements for payments in addition to the requirements specified in the General Conditions or Division 1:

1. The Contractor shall submit all shop drawings [except temperature control and sprinkler drawings] prior to receiving the second partial payment, see Section 20 00 43. Temperature control and sprinkler shop drawings must be submitted prior to the receiving the fourth partial payment.

Payments will be for the total of the approved payment request, less a retainage of 10%.

The Contractor shall submit Operations and Maintenance Manuals and Catalog Data prior to receiving payment beyond 75% of the contract amount, see sections 20 00 46 and 20 00 47, respectively.

The Contractor shall submit Closeout Documents prior to receiving final payment, see section 20 00 48.

20 00 50 MATERIAL AND EQUIPMENT

A. General

All equipment and materials furnished and installed by Contractor shall be new. The equipment to be furnished and installed shall be standard cataloged products of manufacturers regularly engaged in the production of this type of equipment and shall be of the latest design. Equipment of the same general type shall be of the same make throughout the Project.

Manufacturers shall have been in business for two (2) consecutive years operating under the same name

Products shall be in production at time of the bid date. A scheduled release of a new product during construction is not acceptable. Prototype, alpha or beta products shall not be used.

Products for which fewer than 100 units have been produced and which have been in service for less than one year shall be submitted for approval, in writing, to the Engineer in writing prior to bid date.

The Contractor shall be responsible for the physical fit and configuration of the equipment to suit the space available and the intent of the Work. Due consideration shall be included for external connections and service maintenance access to the equipment.

The Contractor shall verify in the course of preparing the submittal that the respective material and equipment comply with the following criteria of the Project Documents:

The performance ratings meet the specified requirements.

The mechanical and electrical physical characteristics meet the specified requirements.

The identification of the material or equipment to catalog data is correct and proper.

Confirm (or establish) the quantity required.

The application of the material or equipment is acceptable to the manufacturer and to the intent of the scope of Work.

Any inability of material and/or equipment to comply with the aforementioned criteria shall be promptly brought to the attention of Architect/Engineer.

20 00 51 EQUIPMENT MANUFACTURERS

A. The equipment manufacturer may be specified in any one of the following manners. "Equivalent" shall mean, equivalent in the opinion of the Engineer. Where equipment is scheduled on the drawings, the scheduled manufacturer is what the design is based upon:

Single manufacturer named, "No substitution allowed":
The intent is to use the particular make and model only, no other shall be considered.

Single manufacturer named:
Single manufacturer named followed by "or approved equivalent":
The design has been based on this particular make and model for acceptable physical characteristics, performance and quality. Any other comparable and equivalent product may be substituted in accordance with procedures for submittals and approvals (Subsection 20 00 43) and conditions of Subsection 20 00 52, Equipment substitution.

Limited multiple manufacturers named:
The design has been based on the first named manufacturer for acceptable physical characteristics, performance and quality. Any one of the other limited named manufacturers is equally acceptable in quality and may be substituted in accordance with procedures for submittals and approvals (Subsection 20 00 43) and conditions of Subsection 20 00 52, Equipment substitution.

Limited multiple manufacturers named followed by "or approved equivalent": The design is based on the first named manufacturer for acceptable physical characteristics, performance and quality. Any one of the other limited named manufacturers is equally acceptable in quality and along with other comparable and equivalent product may be substituted in accordance with procedures for submittals and approvals (Subsection 20 00 43) and conditions of Subsection 20 00 52, Equipment substitution.

List of "Acceptable Manufacturers":
Where a specific product from a manufacturer is listed along with the words "Acceptable Manufacturers" and a list of manufacturers this equal product(s) of any of the limited list may be submitted without concern from Subsection 20 00 52.

B. The Contractor shall follow the option specified from above as applied to each respective material and equipment specification subsection. The Contractor shall indicate within the options allowed the respective supply source(s) for the listing requested in Subsection 20 00 43. The Contractor shall assume all responsibilities and liabilities of "or equivalent" substitutions (see Subsection 20 00 52).

C. The Contractor shall prepare and transmit submittals for approval, even for the option of Subsection 20 00 51.

20 00 52 EQUIPMENT SUBSTITUTION

A. General: As previously stated, the design has been based on a single manufacturer and model. Substitution, where permitted (as described above), may cause consequential effects that may impact on the Project. These effects may take various forms and may require changes in the design. These changes and any additional costs associated therewith are the responsibility of the Contractor proposing the substitution; no additional compensation shall be provided to the Contractor.

B. A possible change in design may result from the proposed substitution from one or more of, but not limited to, the following conditions:

1. Architectural: different physical configuration, size or fit, aesthetics effected.

2. Structural: different bearing or heavier loading.

3. Capacity: different performance, lesser output is unacceptable.

4. Mechanical: change in flow rates (air, water, etc.), different configuration and size of external piping or ductwork connections.

5. Electrical: different horsepower requirements, effect on distribution.

6. Controls: interconnections with control devices and equipment, additional requirements.

7. Impact on environmental or energy efficiency issues.

8. Departure from intent of original design or Project Documents.

C. Changes in loading, sizing and/or performance of the proposed substitution shall consider the total requirements served or needed by the particular equipment. A revised design to accommodate the substitution shall be extended to the point where the change has no effect on the parameters used in the original design.

D. An equipment substitution requiring a change in the design shall be processed as follows:

1. The Contractor shall prepare and submit to the Architect/Engineer for review, a proposal to provide a substitution that shall require a change in the design. Substantiate that the substitution complies with the intent of the Project Documents and include sufficient information of the changes required so that a judgment may be rendered.

2. Proposal shall include an original drawing originated by the Contractor, and shall not be a catalog cut, assembly manual, or other generic documented printed by the manufacturer or their representative. The design shall show the intended installation to the same level of detail as that of the original design.

3. Prior to submitting the proposal, the Contractor shall notify all other contractors whose work may be affected and request details and pricing for their respective changes. This information along with the Contractor's details shall be transmitted to the Architect/Engineer for approval.

4. The Contractor in preparing the proposal recognizes that he shall compensate other trades that are affected by said proposal.

5. If the proposal and the substitution are acceptable, the Architect/Engineer will approve the submittal and initiate a change order, at no additional compensation, and a notice to proceed.

E. Equipment that was listed as a multiple manufacturer with a model number shall be submitted as a shop drawing. Contractor shall be responsible for all other provisions of Section 20 00 52. If, and only if, the material or equipment substitution requires no design change, the Work shall proceed in accordance with the Product Documents.

F. Equipment that is being proposed as 'or equivalent' or was listed as a multiple manufacturer without a model number shall be in the form of a written proposal before the shop drawing phase. 'Or equivalent' shall mean or equivalent in the opinion of the Architect/Engineer and he shall have sole discretion to determine whether or not a proposed substitute manufacturer and/or model is to be considered as acceptably equivalent and may be submitted in the form of shop drawings. If, and only if, the material or equipment substitution requires no design change, the Work shall proceed in accordance with the Project Documents.

G. If changes are in fact required or a delay in work occurs because of the material or equipment substitution which were not properly processed, the Contractor initiating the substitution shall be liable for all consequential effects and expenses to accommodate the change or delay.

END OF SECTION

20 10 00 BASIC MECHANICAL MATERIALS AND METHODS

20 10 01 GENERAL

A. This Section describes and specifies basic mechanical materials and methods to be utilized in the Work included in other sections of Divisions 20 - 25.

The Plans, the general provisions of the Contract including the General, Supplementary and/or Special Conditions and specification sections of Division 1 shall apply to Work of Divisions 20 - 25 of the Specifications.

C. Provisions and conditions cited in this Section shall apply, where and when relevant, to Work of other sections of Divisions 20 - 25 of these Specifications.

20 10 02 REGULATORY REQUIREMENTS

A. Work for this section of the Specifications shall be performed in accordance with the Codes, Standards, etc. as identified in Division 20.

20 10 03 RELATED SECTIONS OF THE SPECIFICATIONS

A. Requirements of the following Section(s) of the Specifications apply to Work of this Section:

B. Division 20 - Basic Mechanical Conditions.

C. Requirements of this Section of the Specifications shall apply to Work of the following sections of Divisions 20 - 29:

1. Division 20 - Insulation Work
2. Division 21 - Fire Protection System
3. Division 22 - Plumbing Work
4. Division 23 - HVAC Piping and Equipment
5. Division 23 - Air Distribution System
6. Division 25 - Temperature Control System

20 10 04 WORK INCLUDED

A. Furnish material, labor and services necessary for and incidental to the installation of the following work where shown on the Plans and as hereinafter specified. Include all necessary work in related sections of the Specifications (sub-section 20 10 03) to perform the Work completely.

B. Identification of piping and equipment for the work of Divisions 20 - 25.

C. Cleaning of piping and equipment for the work of Divisions 20 - 25.

D. Excavation, trenching and backfilling for the work of Divisions 20 - 25.

E. Painting of piping and equipment for the work of Divisions 20 - 25.

F. Demolition for the work of Divisions 20 - 25.

G. Concrete for the work of Divisions 20 - 25.

20 10 05 WORK NOT INCLUDED

A. Materials and methods are specified in this section for the work of Divisions 20 - 25. The Work, itself, is specified in the respective sections of Divisions 20 - 25 of the Specifications.

20 10 06 SUBMITTALS

A. The Contractor shall submit materials for the Work of Divisions 20 - 25 for approval in accordance with Section 20 00 43. The requirements are enumerated in the respective sections of Divisions 20 - 25 of the Specifications.

B. Single and multiple manufacturers are cited in this Sub-section as acceptable sources of piping material. While “or equivalent” is not included, the intent of this Section is to permit substitution as defined in Sub-section 20 00 51, EQUIPMENT MANUFACTURERS, unless “no substitution allowed “ is noted.

C. The following shall be submitted under this section of the specification:

1. Coordination drawings, see Section 20 10 53 for specific requirements.
2. Identification, see Section 20 10 90 for specific requirements.

20 10 07 SPECIAL REQUIREMENTS

A. Special requirements for work shall be specified in the respective sections of Divisions 20 - 25 of the Specifications.

20 10 10 BASIC PIPING MATERIALS

A. General:

1. The intent of sub-sections 20 10 11, 20 10 12, and 20 10 14 is to identify materials that may be utilized for Divisions 20 - 25 Work as specified for each specific piping system. Piping, hangers, valves, fittings and joining materials for Division 21 Fire Protection shall be Factory Mutual and U.L. listed as specified in Division 21 and may not

necessarily be as specified in this section; however all methods and procedures which are not in conflict with those permitted by NFPA shall govern.

2. Respective piping materials shall be manufactured, fabricated and/or provided in accordance with the ANSI, ASTM, ASME or other accepted industry standard as specified herein.

20 10 11 PIPE AND TUBE

A. General:

1. All pipe and tube material shall be uncoated, unless specified otherwise.
2. Manufacturer's mill reports and applicable documents to certify the validity of procured piping materials shall be on file at the Contractor's office.

B. Steel pipe**:** Used for heating/cooling, condenser water, steam and condensate

1. Steel pipe shall be specified by finish, size by nominal diameter, ASTM specification number, manufacturing process, wall thickness (by schedule number or decimal dimension) and end preparation as follows:

ASTM finish	mfr. spec#	wall method	size thickness	end range	prep
black	A-53	CW/ERW	Sch 40, 80	2” and smaller	T&C
black	A-53	SMLS	Std, Sch 40,80	all	PE/T&C
black	A-106	SMLS Grade A	Std, Sch 40,80	all	PE/T&C
galv	A-53	SMLS Grade A	Std, Sch 40,80	all	PE/T&C

(1) Per ANSI B36.10, schedule 40 is standard weight pipe for 10” pipe size and smaller.

(2) Schedule 80 in this pipe size range is extra strong pipe.

(3) Standard weight pipe for all sizes 12” and larger is 0.375” wall thickness and are generally not referred to by schedule number.

(4) Outside diameters of pipe sizes 14” and larger are even whole numbers (e.g. - 18” O.D., 20” O.D., etc.)

CW = continuous weld
ERW = electric resistance weld
SMLS = seamless
PE = plain end
T&C = threaded and coupled

2. All steel pipe shall be mill coated and rust free.

C. Copper tube: Used for heating/cooling, condenser water, domestic water, refrigeration, medical gases

1. Type K and L copper tube shall be in accordance with ASTM B88. Tubing is available in various finished products and wall thickness, which must be called out as well as sizes being either “nominal” or “outside diameter” (O.D.) since there are overlaps in smaller sizes.

2.

type	size range	annealed hard	annealed soft	application
K	¼”-2”		x	heaviest wall, underground water (ASTM B-88)
L	¼”-8”	x		general use, HVAC, refrig., plumbing (ASTM B-88)
DWV	1-1/4”-6”	x		plumbing drains and vents (ASTM B-306)
Refr./ACR	1/8”-4-1/8”	x		O.D. tube, refrigeration (ASTM B-280)
Oxygen Service Type L	¼”-8”	x		Medical Gases above ground, 200 psig and less, (ASTM B-819)
Oxygen Service Type K	¼”-8”	x		Underground medical gases and medical gas greater than 200 psig pressure (ASTM B-819)

D. Cast iron pipe**:** Used for sanitary and storm

1. Hub and spigot soil pipe shall be accordance with ASTM A-74. Available in service weight and extra heavy, both with coal tar coating, 5 foot and 10 foot lengths, single and double hub ends, range 2” - 15” diameter.

2. No-hub soil pipe shall be in accordance with ASTM A-888, CISPI 301. Available with coal tar coating, 5 foot and 10 foot lengths, range 1-1/2” - 10” diameter.

E. Plastic pipe: Used for sanitary and storm

1. PVC pressure rated schedule 40 (white) and schedule 80 (gray) pipe shall be in conformance with ASTM D-1785.

2. CPVC pressure rated Schedule 40 and Schedule 80 pipe shall be in conformance with ASTM F-441.

3. PVC DWV pipe for non-pressure applications shall be schedule 40 pipe in conformance with ASTM D-1785.

4. SDR PVC sewer pipe outside of building shall be in conformance with ASTM D-3034 and ASTM F-477.

20 10 12 FITTINGS

A. Cast iron: Used for 2-1/2" and smaller heating/cooling, steam and condensate

1. Screwed fittings and flange unions: 125# standard and 250# extra heavy threaded in accordance with ANSI B16.4 (except plugs and bushings which are ANSI B16.14). Available in black or galvanized, range ¼" - 8".

2. Flanged fittings and flanges: 125# standard, flat faced in accordance with ANSI B16.1. 250# extra heavy, raised face in accordance with ANSI B16.2. Flange facing and drilling shall be in accordance with ANSI B16.5. Available black and limited galvanized, range 1-1/2" - 12".

3. Flanged elbows shall be long radius (1.5 x diameter), short radius elbow are not permitted, unless specifically noted.

Used for sanitary and storm

4. Drainage fittings: recessed pitched threads for non-pressurized applications. Available in standard black uncoated, coated or galvanized, range 1-1/4" - 8".

5. Soil pipe hub and spigot and no-hub fittings shall be accordance with ASTM A-74, ANSI A-112.5.1, CISPI std #301 and HS-82. Hub and spigot fittings available in service weight and extra heavy, coal tar coating, range 2" - 15" diameter. No-hub fittings with coal tar coating, range 1-1/2" - 10".

B. Forged steel: Used for heating/cooling, steam and condensate

1. Fittings: 2000#, 3000# and 6000# threaded in accordance with MSS SP49 - SP50. 3000# and 6000# socket weld in accordance with ANSI B16.11/MSS SP79. Available black and electro zinc plated; socket weld for schedule 80 bore. Range 1/8" - 4".

2. Unions: 3000# threaded and socket weld, steel to steel and brass to steel; 6000# threaded and socket weld, steel to steel only all in accordance with MSS SP83. Available 3000# black and electro zinc plated, 6000# black only, range 1/8" - 4".

3. "Weldolets, Threadolets, Sockolets and Elbolets": In accordance with ANSI B36.10/ASTM A216, except Elbolets which are ANSI B16.11. Weldolets available

standard and extra strong, black only, range 1/8" - 24". Others available 3000# and 6000#, black only, range 1/8" - 4" (limited). Source: Bonney Forge.

D. Butt weld: Used for 3" and larger heating/cooling, steam and condensate

1. Butt welding fittings shall be in accordance with ASTM A-234 and ANSI B16.9. End preparation of butt welding fittings shall be in accordance with ANSI B16.25.

2. Elbows shall be long radius (1.5 x diameter), short radius elbows, and 180-degree returns are not permitted, unless specifically noted.

E. Forged steel flanges: Used for 3" and larger heating/cooling, steam and condensate

1. 150# and 300# forged steel flanges shall be manufactured to the requirements of ASTM A-181 with dimension in accordance to ANSI B16.5. Flange faces shall be flat or raised face as required.

2. Forged steel flanges shall be furnished as weld neck pattern. Slip-on, lightweight slip-on (drilled to 125# ANSI standards) and orifice flanges shall be provided only where specified and/or noted.

F. Copper (alloy and bronze) shall be in conformance with the following ANSI specifications:

1. Cast bronze threaded fittings: ANSI B16.15

2. Cast copper alloy solder fittings: ANSI B16.18

3. Wrought copper pressure solder fittings: ANSI B16.22

4. Cast copper DWV solder fittings: ANSI B16.23

5. Cast bronze flanged fittings: ANSI B16.24

6. Cast copper alloy for flared tubing: ANSI B16.26

7. Wrought copper DWV solder fittings: ANSI B16.29

8. Short radius 90 degrees elbows and 180 degree returns are not permitted, unless specified and/or specifically noted.

G. Grooved**:** **Vibration isolation**

1. All grooved components shall be of one manufacturer made in accordance with ANSI B-31.1, B-31.9. Fittings shall be ANSI 150#, 300# cast of ductile iron in accordance with ASTM A-536, Grade 65-45-12. Fittings shall have an enamel finish. Segmentally welded fittings are not acceptable.

2. Only the following fittings will be accepted: Long radius (1.5 x diameter) 90° and 45° elbows, tee, reducing tee, concentric/eccentric reducers, and flange adapter nipples. Flange rings and reducing couplings are not acceptable.

H. Plastic:

1. PVC DWV fittings for non-pressure applications shall be in accordance with ASTM D-2665 and NSF Standard 14.

2. SDR PVC sewer fittings shall be in conformance with ASTM D-3034 and ASTM F-477.

J. Miscellaneous:

1. Dielectric flanges and unions:

.2 Dielectric unions and flange unions shall be required in piping systems where an electrically insulated connection is needed to separate dissimilar metals from producing galvanic or electrolytic action. Unions shall be rated for 250#; flange unions for 175#. Range: unions ½" - 2"; flange unions 1-1/2" - 12".

3. Steel threaded nipples:

4. General use: Made from ASTM A-120 pipe in standard (schedule 40) and extra strong (schedule 80). Available black and galvanized, range 1/8" - 6" pipe diameters.

5. High-pressure application: Made from ASTM A-53 seamless pipe and ASTM A106 seamless pressure tube in standard (schedule 40) and extra strong (schedule 80). Available black only, range 2" - 6" pipe diameters.

6. Close nipples are not permitted.

20 10 13 VALVES

A. General:

1. When two or more valves of the same type are to be used in the same service, all valves of this type shall be of the same manufacturer.

2. Only general valve series are specified. Valves shall have all options, trim, seat material, and accessories as specified whether or not listed as a prefix, suffix or valve number.

3. All valve manufacturers and models listed shall be considered as "acceptable manufacturers" and may be submitted without concern from subsection 20 00 62
4. All valves for use in "cold" piping shall have stem or neck extensions allowing proper insulation and a continuous vapor barrier.

5. No asbestos packing allowed.

B. Ball Valve: Used for heating/cooling, domestic water, medical gas service valves

1. 2" and smaller: Bronze 2-piece body, 600 psi WOG, quarter turn lever handle, blow-out proof stem, stem extension (for "cold" applications), full port, virgin TFE seats, all stainless steel trim, threaded or soldered ends. Nibco S-585-70-66, Apollo 77-240, Watts Series B-6081, Hammond 8311 or approved equivalent.

2. 2-1/2" - 3": Bronze 2-piece body, 600 psi WOG, quarter turn lever handle, blow-out proof stem, stem extension (for "cold" applications), standard port, virgin TFE seats, all stainless steel trim, threaded or soldered ends. Nibco S-585, Apollo 70-200, Watts Series B-6001, Hammond 8511 or approved equivalent.

3. 2-1/2" and smaller: Bronze 3 piece body, 600 psi WOG, quarter-turn lever handle, blow-out proof stem, stem extensions (for "cold" applications), full port, TFE seats, bronze trim, threaded or soldered ends. NIBCO Figure 595-Y-66, Appollo 82-200, Milwaukee BA-360, Hammond 8613, Watts B-6800, or approved equivalent.

4. Medical Gas and Medical Vacuum 4" and smaller: Bronze 3 piece body, 400 psi WOG, vacuum service to 29" Hg, quarter turn lever handle, blow-out proof stem, full port, virgin TFE seats, bronze trim, Type K tubing extensions with soldered ends, 1/8" NPTF port on tube extension, cleaned and packaged for oxygen service per NFPA 99, valve handle shall indicate service, and pad-lockable handle for valves in concealed spaces. Medeas 6802, Allied Healthcare Products 77-03 or approved equivalent.

5. Gauge cocks where not specified or specifically identified shall be ¼" bronze 2 piece body ball valves with lever handle and threaded ends.

C. Butterfly: [Used for heating/cooling, domestic water service valves]

1. 2" - 24": Class 125 ASTM A126 Class B cast iron body, 1/4 turn, extended neck, geometric drive, EPDM molded-in seat liner, threaded lug type, aluminum bronze disc, 416 SS stem, lubersized bronze or Teflon bushings. Optional manual lever handle or

gear operator, and electric or pneumatic actuator. NIBCO figure LD 2000, Centerline Series 200, Watts DBF-03, Grinnell LC 8000, Milwaukee M Series, Hammond 6200, Mueller Steam Series 52A, Keystone 222, ABZ 102 or approved equivalent. Dead end service at 200 psi with no downstream flange required.

2. Service valves 6" and less shall have a 10-position lever handle; balance valves shall have infinitely adjustable lever handle with memory stop locking option. Control valves shall have actuators as specified in Division 25.

D. Balancing Valves:

1. General: Balance valves shall provide positive shut-off for service and shall have adjustable memory stops to allow returning to original balanced position after servicing.

2. 3" and smaller: Valves shall indicate method for position of the throttling mechanism. Valves shall have integral pressure tap ports provided with "drip caps". Balance valves shall be Nibco F1710/F737, Tour and Anderson 786/787, Bell and Gossett Circuit Setter Plus, Armstrong CBV, Taco, or Watts CSM/CSM-8IT or approved equivalent.

3. 4" – 6": Valves shall indicate method for position of the throttling mechanism. Valves shall have integral pressure tap ports provided with "drip caps". Balance valves shall be Nibco F737, Tour & Anderson 788, Bell and Gossett CB Circuit Setter, , or approved equivalent.

E. Check:

1. 2" and smaller: Class 125 (125 psi at 400°F, 200 psi at 150°F), bronze, horizontal swing, vertical up-flow, Y pattern, teflon renewable seat and disc in conformance with MSS SP80. Nibco 413, Grinnell 3300, Watts 5000, Crane 1707, Hammond IB904, Stockham B320, or approved equivalent.

2. 2" - 6": Class 125 (125 psi at 400°F, 200 psi at 150°F), iron body, flanged, horizontal swing, vertical up-flow, bolted bonnet, renewable seat and disc in conformance with MSS SP71, type 1. Nibco 918, Grinnell 6300A, Watts 511, Crane 373, Hammond IR1124, Jenkins 624C, Stockham G931, or approved equivalent.

F. Gate:

1. 2" and smaller: Class 125 (125 psi at 400°F, 200 psi at 150°F), ASTM B-62 bronze, screw-in bonnet, rising stem, solid wedge in conformance with MSS SP80. Nibco 111, Grinnell 3010, Milwaukee 148, Hammond IB640, Watts 3100, Stockham B100, or approved equivalent.

2. 2-1/2" - 6": Class 125 (125 psi at 400°F, 200 psi at 150°F), ASTM A-125 Class B cast iron body, brass mounted, flanged, bolted bonnet, OS & Y, solid wedge, in conformance

with MSS SP70. Nibco F-617, Grinnell 6020, Milwaukee F-2885, Hammond IR1140, Watts F503, Stockham 6623, or approved equivalent.

G. Globe: Used for steam throttling valves

1. 2" and smaller: Class 125 (125 psi at 400°F, 200 psi at 150°F), bronze, straightway pattern, screw-in bonnet, renewable seat and disc, in conformance with MSS SP80. Nibco 211, Grinnell 3210, Milwaukee 502, Hammond IB440, Watts 4000, Stockham B13, or approved equivalent.

2. 2-1/2" - 10": Class 125 (125 psi at 400°F, 200 psi at 150°F), iron body, brass mounted, flanged, straight way pattern, bolted bonnet, renewable seat and disc. Nibco F-718, Grinnell 6200, Milwaukee F-2981, Hammond IR116, or approved equivalent.

20 10 14 STRAINERS

A. General:

1. When two or more strainers of the same type are to be used in the same service, all strainers of this type shall be of the same manufacturer.

2. Only general strainer series are specified. Strainers shall have all options, trim, and accessories as specified whether or not listed as a prefix, suffix or the model number.

3. All manufacturers and models listed shall be considered as "acceptable manufacturers" and may be submitted without concern from subsection 150620.

B. "Y" Strainers:

1. 2" and smaller: ANSI 125 lb. (125 psi at 353°F, 200 psi at 150°F), ASTM B62 bronze body and straight thread cap, ASTM A240 304 stainless steel perforated sheetmetal with .033" openings for steam and 1/8" diameter for water service. Mueller 351M, Keckley F-150, Armstrong F4SC, Spirax/Sarco BT, Watts 777/777S, or approved equivalent.

2. 2-1/2" through 6": ANSI 125 lb. (125 psi at 353°F, 200 psi at 150°F), ASTM A126-B cast iron body and cover, ASTM A240 304 stainless steel perforated sheetmetal with .045" openings for steam and ¼" diameter for water service. Mueller 751, Keckley A, Armstrong A-FL-125, Spirax/Sarco F-125, Watts 77F-D, or approved equivalent.

20 10 20 MISCELLANEOUS MATERIALS

20 10 21 SLEEVES (NON-WATER PROOF, NON-FIRE RATED)

A. Piping passing through non-fire rated interior walls or floors shall be neatly field cut round holes with hole saws or core drill as appropriate. “Beating” an opening in a gypsum or masonry wall shall not be accepted.

B. In field formed walls or floors the contractor shall install appropriate blocking or material or pipe sleeves.

20 10 22 WATER SEALS

A. Sleeves for underground or interior to exterior applications shall be hot-dipped galvanized pipe fabrication with continuously welded water stop plate. Thunderline Corp. “Century-Line” CS model (plastic), WS model (steel) or SS model “Sleev-Sec” (modular sections) sleeves may be used at the Contractor's option.

B. In existing structures, holes shall be core drilled to the manufacturer’s recommended size for the type and size of pipe to be sealed.

C. The annular space between pipes and interior to exterior sleeves and sleeve penetrations shall be sealed with Thunderline Corp. “Link Seal” Model C closure seals in accordance with manufacturer's data and application.

D. The Contractor shall submit a schedule of sleeves and seals to the Architect/Engineer for approval indicating the following: carrier pipe size, location, type of sleeve - fabricated with dimensional details or purchased with manufacturer's support information, seal requirements - none, fire rated, non-fire rate or “Link Seal” with respective support data.

20 10 23 FIRESTOPS AND SMOKESTOPS, FIRE RATED/SMOKE PARTITIONS.

A. All penetrations through rated assemblies, walls, shafts, floors, roofs, etc., shall be firestopped in accordance with Local Building Codes, NFPA, U.L. Fire Resistant Directory, and manufacturer’s instructions.

B. Provide a FIRESTOP PRODUCT SCHEDULE consisting of the following minimum information:

Type – indicate the type of materials, or system.
Manufacturer – manufacturer’s name, product name and product number.
Mechanical System – indicate which Divisions 20 - 25 items the product is utilized for.
Rating – indicate the fire rating and UL detail numbers.

C. Submit the following with the above FIRESTOP PRODUCT SCHEDULE:

- Manufacturer's specifications and technical data including installation instructions.

- Details of each proposed assembly.

- Manufacturer's representative who shall provide qualified engineering judgments and drawings for non-standard applications.

- Contractor's qualifications and related experience.

D. Materials shall be stored per the manufacturer's recommendations and as specified for General Project storage in Division 20.

E. All firestop materials shall be ST1 Products, no substitutions.

20 10 24 SEALS, NON-FIRE RATED

A. All penetrations through non-rated walls, floors, etc., shall be sealed for draft stopping with caulk, putty, etc., designed for this use.

20 10 25 ESCUTCHEONS

A. Wall, floor, and ceiling plates shall be spun brass, plain pattern, chrome plated, spring type or setscrew fastening. Provide escutcheons for all exposed piping in finished spaces.

20 10 26 FLASHINGS, CURBS, AND EQUIPMENT SUPPORTS

A. Piping and other roof penetrations shall be flashed and/or pitch pocketed by the Contractor in a manner approved by the roofing contractor and specified herein.

B. Single pipe and other round penetrations less than 12 inch OD diameter shall be flashed with Pate Pipe Seal or equal product, which consists of a spun aluminum base, a stepped rubber boot, and stainless steel adjustable clamps.

C. Multiple pipe and other round penetrations less than 12 inch OD diameter shall be flashed with Pate Pipe Curb or equal product, which consists of a galvanized roof curb, thermoplastic cover, rubber boots, and stainless steel adjustable clamps.

D. When an irregular shaped member extends above the roof, a pitch pocket fabricated of galvanized or copper sheet metal material shall be provided. The vertical box portion shall extend a minimum of 4" beyond the contained pipe or member, have a solid bottom cut for the penetration and extend at least 6" above the finished roof. The collar portion shall extend

a minimum of 9” beyond the vertical box and be fastened to the roof deck. The open space on the inside of the pitch pocket shall be filled with oakum and topped with a minimum thickness of 2” of pitch or roofing cement.

E. Supports for roof mounted equipment piping, and ductwork shall also meet the requirements listed above. All roof supports shall be anchored to the structure in a manner that will transmit all loads including seismic and wind loads from the equipment supports through the roofing to the building structure. Equipment supports shall be equal to Pate model ES-1. Pipe/duct supports shall be equal to Pate model PRS-1. Curbs not specified with the equipment shall be equal to Pate Curbs.

20 10 27 ROOF PENETRATIONS

A. All roof penetrations shall be made in a manner that is consistent with the roofing installation and shall maintain the existing roof warranty. Coordinate with the roof warranty supplier as required.

B. Supports for roof mounted equipment shall also meet the requirements listed in paragraph .1 above. All roof supports shall be anchored to the existing structure in a manner that will transmit all loads including seismic and wind loads from the equipment supports through the roofing to the building structure.

20 10 28 ACCESS DOORS

A. Access to mechanical equipment and ductwork of Divisions 20 - 29 required for testing, adjusting, inspection, maintenance or servicing shall be the responsibility of the Contractor. Doors for manufactured equipment shall be an integral feature included with the respective equipment. Access openings in ductwork shall be included with the fabrication in accordance with SMACNA practices.

B. Openings in building components for access to concealed mechanical work shall be furnished by the Contractor and installed with the building construction work. Access doors shall be located as indicated on the Plans or as strategically required for inspection, maintenance, and service. The model and style shall fit the building construction, fire rating requirements and provide adequate size and function.

C. Access doors shall be sized as shown on the drawings or shall be a minimum size of 18” x 18” and otherwise shall be large enough for purpose intended and shall be fabricated of heavy gauge steel frames and door panels with double action concealed spring hinges, 1/4 turn flush screwdriver operated cam locks and prime coat paint finish. Access doors for various applications shall be as follows:

building construction:	Milcor access door:
flush door in dry wall construction (walls and ceilings)	style DW
flush door in masonry or tile walls with exposed frame flange	style M (steel), Style MS (stainless)
flush door in plaster construction (walls and ceilings)	style K
recessed door in acoustical plaster ceiling	style AP

recessed door in suspended drywall ceiling	style CT (aluminum - wet locations)
flush door in suspended drywall ceiling	style CF (aluminum - wet locations)
door in suspended drywall ceiling	style ATR (fire resistive door)

fire rated separation (walls and ceilings) - fire rated door

D. Access doors are not required for Work above lay-in panel ceilings.

E. Submittals shall indicate schedule of locations, sizes, types, adjacent building construction, finish, fire rating including thickness and type of insulation, conformance to UL requirements and associated labeling, metal and gauge of fabrication. Access door shall be as manufactured by Karp Associates, Milcor, or Higgins MfCO.

20 10 29 RESTRICTIONS, GENERAL FOR ALL PIPING SYSTEMS

A. Do not use gaskets or packing containing asbestos.

B. Selections of material and equipment and options for substitution shall conform to the requirements of Sub-section 20 00 60, MATERIAL and EQUIPMENT.

C. “Bull head” tee connections are not permitted, unless approved by the Engineer.

D. Close nipples and bushing reducers are not permitted.

E. Slip joints are permitted in sanitary drainage systems only, on the fixture side of traps.

F. Mitered elbows are not permitted in welded pipe construction.

G. Solder for use in joints of copper piping for [domestic] (sanitary) cold water, hot water, hot water recirculating and softened water shall not contain lead.

H. Unprotected, non-smoke rated plastic piping material is not permitted in above-the-ceiling spaces used as return air plenums, or exposed in any occupied space.

I. Black and galvanized pipe, fittings, nipples and specialties are not permitted in water piping systems where copper and/or brass are the basic materials.

J. Cast iron fittings are not permitted for gaseous distribution applications.

K. Cast brass/copper fittings are not permitted for gaseous applications including refrigerant lines.

L. Short radius 90-degree elbows and 180-degree returns are not permitted, unless specified and/or specifically noted.

M. The use of pipe hooks, chain and perforated band iron are not permitted for hanging or supporting piping.

N. Power driven inserts and attachments are not permitted unless approved by the Architect/Engineer on express request by the Contractor.

O. Welded attachments to the structural steel of the building are not permitted unless otherwise noted or approved by the Architect/Engineer on specific request of the Contractor.

P. Plastic pipe, fittings, valves and specialties are not permitted for gaseous distribution applications.

Q. Plastic and fiberglass piping systems shall not be tested pneumatically.

20 10 30 JOINTS AND CONNECTION METHODS

20 10 31 THREADED USED WITH STEEL PIPE 2-1/2" AND SMALLER FOR HEATING/COOLING, , STEAM AND CONDENSATE

A. Threads for all screwed pipe systems shall be American National Standard taper threads in accordance with ANSI B-1.201.

B. Threads shall be full, sharp, clean and free of fins and burrs. Pipe ends shall be reamed to remove internal burrs.

C. Threaded connections shall be joined using teflon sealing tape applied to the male threads only.

D. This sub-section does not apply to threads for compression, flare and sanitary drainage slip type drainage fittings.

20 10 32 WELDED USED FOR STEEL PIPE 3" AND LARGER FOR HEATING/COOLING, STEAM AND CONDENSATE

A. Welded joints shall be "V" type butt welds in accordance with ANSI B31.1.

B. The Contractor shall only use welders regularly engaged in the piping trades and certified by the National Certified Welding Bureau, using procedures set forth in ASME Boiler Construction Code, Section IX, "Welding Qualifications".

C. Contractor shall keep a copy of welder's certification on file at Contractor's office. Upon request the Architect/Engineer may request Contractor to produce certifications. Any pipe installed by a non-certified welder shall be removed if requested by Architect/Engineer.

D. All steel piping shall be cleaned of mill scale and rust before assembly. Welds shall be chipped and hammered after each pass and joints shall be built up to at least the same thickness as that of the pipe wall. All welding shall be done in accordance with the welding procedures of the National Certified Pipe Welding Bureau conforming to the requirements of the ASA Code for Pressure Piping.

E. Architect/Engineer shall have the authority to accept or reject the welds and require random samples of installed welds to be removed, tested and inspected.

20 10 33 GROOVED USED FOR STEEL PIPE FOR VIBRATION ISOLATION AND MOTION CONTROL

A. Grooved joints for grooved couplings and fittings shall be in accordance with accepted manufacturer's specifications and practices.

B. Grooves may be cut or rolled in accordance with manufacturer's recommendations for type of pipe, sizes and thicknesses specified for respective systems.

C. Gaskets shall be suitable for the temperature, pressure and compatibility with the fluid contained therein. Unless specifically specified otherwise or incompatibility with the system, gaskets shall be EPDM grade E.

D. Grooved couplings shall be ASTM-A47 grooved malleable iron clamp type couplings as manufactured by Victaulic or equivalent.

E. Grooved couplings for vibration isolation or as unions at equipment connections shall be similar to Victaulic Style 77; all others shall be similar to Victaulic Style 07.

20 10 34 SOLDERED AND BRAZED USED FOR COPPER PIPE 3" AND SMALLER FOR HEATING/COOLING, REFRIGERANT, MEDICAL GAS, AND LONG RUNS OF STEAM CONDENSATE WITHOUT CONNECTION TO EQUIPMENT

A. Soldered and brazed connections shall be made in accordance with recommendations of the current edition of the Copper Tube Handbook of the Copper Development Association or as hereinafter specified.

B. General criteria for soldered and brazed joints shall be as follows:

1. Copper tubing shall be square-end cut by varied methods at the Contractor's option. The ends of the tubing shall be reamed to remove both internal and external burrs.

2. Joints for copper piping for medical vacuum, hydronic systems, domestic water, temperature controls, DWV systems and other applications of fluids below 250 degrees F. shall be soldered with 95-5 Tin Antimony. 50-50 Tin Lead solder shall not be used.

3. Joints in copper piping for gases, medical gases, medical vacuum, refrigerant lines and other applications operating above 250 degrees F., or where otherwise specified shall be brazed with Copper Phosphorus (BCuP Series), Silver solder (BAg Series), or other approved high temperature brazing alloy.

4. Cleaning of tubing and fittings, application of flux and heat, purging and cooling shall be in accordance with recommendations of solder and brazing alloy manufacturers for the joint type and material specified in the respective "PIPING MATERIAL SCHEDULE" in Section 155000.

C. Copper connections for medical gas, medical vacuum, refrigerant systems shall be made per the following criteria:

1. Work shall be performed in accordance with NFPA and CGA Medical Gas Piping Standards and Practices. At the end of each installation workday, medical gas piping shall be capped and tagged; piping shall not be left open.

2. Fittings and valves shall be purchased for "oxygen" service. Material shall be factory washed, degreased and packaged separately. When material is contaminated, tubing, fittings and valves shall be washed in a hot solution of one pound of trisodium phosphate to three gallons of water and rinsed thereafter with clean hot water. Do not use hydrocarbon-based solvents. Temporarily cap to prevent recontamination before use.

3. Brazed joints in medical gas systems using copper tubing shall be made with a nitrogen purge to prevent formation of copper oxide on the inside of the pipe. Do not use any flux or thread compound containing oil or an oil derivative.

4. Screwed joints shall be made with teflon tape applied to the male threads.

20 10 35 FLANGED USED FOR STEEL PIPE 3" AND LARGER FOR MATING WITH VALVES AND EQUIPMENT

A. Flanges shall be flat faced or raised faced as required for mating flanges of valves, specialties, equipment connections, etc.

B. Carbon steel hex head machine bolts, ASTM A307, grade 2, with heavy hex nuts shall be used for joining 125 and 150# flanged joints, unless otherwise specified.

C. Alloy steel machine bolts, studs and heavy hex nuts shall be used for joining of 250 and 300# flanged joints, unless otherwise specified.

D. Lubricate the threads of bolts and studs with an acceptable commercial product. Include data with submittal for approval for piping material.

E. Gaskets shall be 1/16" thick non-metallic type conforming to ANSI B16.21 and shall be suitable for the pressure and temperature of the fluid contained therein, shall be provided at all flange joints. Full-faced gaskets shall be used for flat face flanges; ring gaskets shall be used for raised face flanges.

20 10 36 CAST IRON PIPE AND FITTINGS USED FOR SANITARY AND STORM

A. Joints for hub and spigot and no-hub cast iron soil pipe and fittings shall be installed in accordance with recommendations of the CISPI, unless noted otherwise.

B. Do not use joint material which has deteriorated or which does not spread easily or smoothly.

C. Heavy duty no-hub couplings shall conform to the requirements of CISPI 310, ASTM C1540, IAPMO 35-89 and gaskets shall comply with ASTM C564.

1. Band, screw housing, screw, and shield shall all be stainless steel.

2. 1-1/2" through 4" couplings shall have a minimum of four clamps. 5" through 10" couplings shall have a minimum of six clamps. 12" through 15" coupling shall have a minimum of six clamps.

3. Couplings shall be by Charlotte Pipe, Anaco/Husky, Tyler Pipe or approved equivalent.

20 10 38 PLASTIC USED FOR PVC SANITARY, STORM, SEWER AND WATER

A. Solvent cement: Joints in PVC piping shall be made in accordance with manufacturer's guidelines and instructions for CPVC handling, joint preparation, type of primer and solvent/cement, curing time, temperature and testing.

1. PVC pressure piping and DWV - solvent cement shall conform to ASTM D-2564 and primer shall conform to ASTM F-656.

2. CPVC pressure piping - solvent cement shall conform to ASTM F-493.

3. SDR sewer pipe - ASTM D-2855.

20 10 40 HANGERS, SHIELDS, SUPPORTS AND ANCHORS

A. General:

1. All hanger devices (e.g. - concrete inserts, expansion anchors, clamps, pipe hangers, strut, etc.) shall be UL approved for the intended service. Material shall be applied within the load limitations prescribed by the respective manufacturer. Loads transmitted to the building shall be within the limitations of the structure.

2. Acceptable manufacturers of hanger material are Anvil International, B-Line Systems, Inc., Tolco, PHD Manufacturing, ERICO/Michigan Hanger Co., National Pipe Hanger Corp.

3. This section shall not apply to Division 21 Fire Protection.

20 10 41 HANGERS

A. Piping shall be supported from the building structure, walls, and floors. Piping shall not be supported from other piping, ductwork, conduits, etc. Loads shall be within the allowable

load of building component that is connected to. Piping loads shall include, but not limited to, the weight of the piping, valves, specialties, insulation, pipe covering, pipe content, pressure test media content, wind, snow, seismic, etc.

B. Where piping is indicated on common trapeze hangers, racks, stanchions or brackets, the various trade contractors involved shall agree to a mutually acceptable arrangement among themselves, but each shall be responsible for the correctness and compliance of their work.

C. Pipe hangers, supports, etc. for "cold" piping systems shall have hangers sized for the outside diameter of the insulation in order to maintain a continuous vapor barrier.

D. Hangers, and other supports, anchors, guides, etc. in direct contact with copper piping material shall be copper plated. All others shall be electro-plated for indoor use and hot-dipped galvanized for use in mechanical rooms. Hangers for outdoor use to be stainless steel.

E. The use of pipe hooks, chain, perforated band iron, wire, or cable are not permitted for hanging or supporting piping.

F. Singular, horizontal, suspended piping above grade shall be hung with pipe hangers per the following schedule, unless noted otherwise:

pipe sizes	piping application	Anvil International type and figure number
3" and smaller	not subject to expansion/contraction	adjustable ring, #69
4" and larger	not subject to expansion/contraction	adjustable clevis, #260
2-1/2" and larger	systems with pipe guides and anchors	adjustable steel yoke, #181 (2)
4" and smaller	copper pipe/tubing	adjustable ring, #CT-99
5" and larger	copper pipe	adjustable clevis, #260 (1)
all	vertical risers steel copper	riser clamps #261 #CT-121

(1) hanger to be sized for outside diameter of insulation and to be used with insulation protection shield, figure 167.
(2) hanger to be sized for outside diameter of insulation and to be used with insulation protection saddle, figure #160 through figure #165.

G. Hangers, supports, etc. shall position the piping properly in the work, and provide for expansion and contraction.

H. Vertical piping shall be supported at each floor level with riser clamps bearing on the building structure or pipe sleeve.

I. Pipe stands shall be field fabricated to meet the anticipated loads. The base plate shall be spaced 1" minimum above the finished floor with concrete or grout.

J. Wall brackets shall be field fabricated to meet the anticipated loads. The minimum brace angle shall be 45° from the horizontal.

20 10 42 HANGER RODS AND HANGER SPACING

A. Where "All-thread" rod is used it shall be galvanized, cadmium or zinc electro-plated. Where plain rod is used the threads shall be a minimum of 2" in length on each end.

B. Hangers and hanger rod spacing for metallic piping shall be provided and installed in accordance with the Building Codes or the following schedule, whichever is more stringent:

pipe size	rod diameter	max. hanger spacing
1-1/4" & smaller	3/8" diameter	8' on centers
1-1/2" & 2"	3/8" "	10' oc
2-1/2" & 3"	½" "	10' oc
4" & 5"	5/8" "	12' oc*
6" & 8"	¾" "	12' oc*
10" and 12"	7/8" "	12' oc*
14",16" & 18"	1" "	12' oc*

* cast iron pipe shall have a maximum spacing of 10' oc center with the hangers located near the joint.

C. Hangers for non-metallic piping shall be spaced in accordance with the Building Codes or the following schedule, whichever is more stringent:

pipe size	rod diameter	max. hanger spacing
1" & smaller	3/8" diameter	4' oc
1-1/4" - 2"	3/8" "	5' oc
3"	½" "	6' oc
4"	5/8" "	7' oc
6" & larger	¾" "	8' oc

20 10 43 ANCHORING

A. Anchors for piping, ductwork**,** or equipment in new concrete construction may be suspended at the Contractor's option, or as shown on the plans, from inserts placed in the concrete as it is poured-in-place. Mechanical equipment rooms shall have inserts placed at a maximum of 4 ft. centers.

hanger rod size	Grinnell insert figure number
7/8" or smaller	single - CB universal, figure #282
7/8" or smaller	multiple - 1-5/8" x 1" continuous strut, #PS 449

B. Anchors for piping, ductwork, or equipment in new concrete construction, existing concrete construction or new precast construction] shall be suspended from epoxy resin set anchors, installed per the manufacturer's recommendations set into holes drilled into the concrete. Anchors shall be UL and/or FM approved, and applied within the allowable working load ratings for the respective size. Cataloged load values shall be derated by one third for seismic allowances. Minimum embedment depth shall be 2/3 of concrete thickness. Field pullout test shall be performed when requested by the Engineer. Anchors shall be Hilti type HVA.

C. Anchors for piping, ductwork, or equipment in steel structured buildings shall be attached to the steel by bolting directly through the void in the bar joist chord or by using the appropriate cataloged type C-clamp or beam clamp. The roof deck shall not be used for supporting the piping or ductwork.

D. Welded attachments to the structural steel of the building are not permitted unless otherwise noted on the Construction Documents or where approved by the Architect/Engineer on specific request of the Contractor.

hanger rod size	Grinnell insert figure number
7/8” or smaller	multiple - 1-5/8” x 1” continuous galvanized strut, #PS 400S

F. Power driven inserts and attachments are not permitted unless approved by the Architect/Engineer on express request by the Contractor.

G. In all cases, anchor loading shall be based on hanger spacing, weight of the pipe to be supported when full and insulated, weight of any additional loads imposed upon the anchor, wind loading, seismic loading, quality of the material that the anchor is being installed in, etc. The Contractor shall verify in the field that the anchors used and the materials that they are being installed in are suitable for the load imposed and shall bring any problems to the attention of the Owner's Representative in writing immediately.

H. Where anchors are loaded in shear in existing concrete structure, suitably sized and installed wedge type anchors may be used. Wedge type anchors shall be Hilti Kwik Bolt II.

20 10 44 SEISMIC RESTRAINT

.1 All materials and workmanship shall specifically comply with the above listed Building Code with respect to seismic requirements for the support and anchorage of all mechanical systems and equipment as installed on this project. Lateral forces to be restrained shall be as required by IBC Section 1621 Architectural, Mechanical, and Electrical Component Seismic Design Requirements and ASCE 7-02 Section 9.6 Architectural, Mechanical, and Electrical Components and Systems with the following design parameters:

- Site Class (ASCE 7-02, Table 9.4.1.2 and 9.4.1.2.4a) D

-	Seismic Use Group	III	
-	Seismic Design Category	D	
-	Component Importance Factor (Ip)		
	Fire Protection (Ip)		1.5
	Medical Gases and Vacuum (Ip)	1.5	
	Chilled Water, Heating Water (Ip)		1.5
	Domestic Cold, Hot and Hot Water Return (Ip)		1.5
	Other Piping not listed above (Ip)		1.0
	Ductwork (Ip)		1.5
	All other systems not listed above (Ip)		1.0
-	Spectral Acceleration, Short period (S_{DS})		1.12
-	Component Amplification Factor (Ap)	ASCE 7-02 Table 9.6.3.2	
-	Component Seismic Coefficient (Rp)	ASCE 7-02 Table 9.6.3.2	
-	Operating Component Weight (Wc)		Actual

.11 Seismic restraints shall not be required for the following services (with the exception of sprinkler piping which shall meet the requirements of NFPA-13):

.111 Piping with nominal pipe size 1" and smaller with Ip = 1.5.
.112 Piping with nominal pipe size 3" and smaller with Ip=1.0.
.113 Ductwork suspended from hangers 12" or less from the top of duct to supporting structure with Ip=1.0
.114 Ductwork with cross-section less than 6 ft^2 with Ip=1.0

.12 All piping support and restraint details and practices shall conform to the publication "Seismic Restraint Manual Guidelines for Mechanical Systems" by SMACNA, 1998 Edition, and/or "Seismic Restraints" by B-Line systems, Inc.

.13 Seismic restraint submittals shall be provided for engineer review and include, but not be limited to, detailed drawings showing seismic restraint types, anchor type and attachment details, calculations and spacing requirements of unique equipment, piping and ductwork for this specific project. Submittals shall include floor plan drawings indicating equipment, ductwork and piping to be restrained, restraint locations and restraint component types. All submittals and floor plan drawings shall bear the seal of a licensed engineer of the State of Illinois.

20 10 50 BASIC MECHANICAL METHODS - GENERAL

20 10 51 INTENT OF PROJECT DOCUMENTS

A. Install the Work in accordance with the Project Documentation and considerations enumerated in Subsection 150310, GENERAL (Project Documents).

20 10 52 ARRANGEMENT OF WORK

A. All Work shall be arranged so that hangers and supports for the mechanical equipment and materials shall be within the load limitations of the structure and the respective hanger and/or support.

B. Contractor shall not scale from drawings to determine the exact locations for devices, piping, ductwork, etc., but shall follow the architectural drawings, the structural drawings and the actual building conditions, in establishing dimensions and lines of run. The work shall be adjusted to accommodate interferences anticipated and encountered. The Contractor shall verify the exact material quantities and lengths required.

C. Piping that is required to pitch shall have priority over piping that does not pitch. Work which cannot be changed in elevation shall have priority over that which can be moved. Offsets, transitions and changes in direction shall be made in piping and ductwork to maintain headroom and pitch whether or not indicated on the Plans. The Contractor shall provide air vents, traps, dirt legs, drains, lifts, sanitary vents, mechanical vent lines, etc. as required to install the mechanical systems for proper operation and maintenance.

D. Do not install work in the immediate proximity of electrical components (e.g. - panels, switches, controls, boxes, etc.) in equipment rooms. Drip pans above and/or around electrical equipment are not permitted.

E. Aluminum and copper products shall not be encased in concrete.

F. Work in “finished spaces” shall be concealed within walls, chases or above the ceiling unless specifically indicated otherwise. Install the Work to coordinate with other trades and to conform to the architectural reflected ceiling plan.

G. The work shall be installed parallel with the building lines unless specifically shown or noted otherwise.

20 10 53 COORDINATION

A. Each Contractor shall prepare and submit coordination drawings (at a scale equal to or larger than the project documents) to the Architect/Engineer for review prior to any fabrication or installation.

B. It shall be the Contractor's responsibility to coordinate their work with the work of other trades, and with the architectural and structural drawings. Where physical interferences cannot be resolved between the trades, or when encountered in the field, the Contractor shall prepare composite drawings at a scale of not less than 3/8” = 1'-0” clearly showing the Work of Divisions 20 - 29 in relation to the Work of others to identify the conflict. Submit a proposed resolution to the Architect/Engineer for approval in accordance with Sub-sections 150310, GENERAL (Project Documents) and 150430, SUBMITTALS.

1. Do not proceed with Work in question until the matter is mutually resolved among the involved parties, and adequate information has been submitted to the Architect/Engineer for review. No additional compensation shall be granted for modifications and execution of the resolution(s). Modifications are to be incorporated in the "as-built" drawings.

C. Contractor shall review the Project Documents, site conditions, and the requirements of other disciplines, and shall report any discrepancies between them to the Architect/Engineer and obtain from him written permission for changes necessary in the Mechanical Work. Subsequent clarification(s) by the Architect/Engineer will not be a change in scope of the Work. The Contractor at no addition in the contract price shall perform any such modifications required.

D. The drawings shall not be scaled; obtain detailed information, shop drawings, installation and maintenance bulletins, etc. to determine exact requirements and to satisfactorily achieve the intent of the Project Documents.

E. The Contractor shall furnish and properly install all sleeves, slots, chases, openings, recesses, supports, anchors and anchor bolts required for his Work in coordination with the other trades as the building is erected.

F. The expenses for changes required by neglect in executing, coordinating or scheduling the Work properly or avoiding conflicts shall be borne by the Contractor precipitating the issue requiring the changes.

20 10 54 DELIVERY, STORAGE AND HANDLING

A. Delivery, storage and handling of equipment and material are the Contractor's responsibilities. The Contractor shall perform the Work in accordance with the following criteria:

1. Delivery shall be arranged by the Contractor (including Owner furnished items) for the expeditious and economical pursuit of the Work and to meet the scheduling requirements of the Contract.

2. The Contractor will be assigned a "lay-down" area at the job site and shall confine temporary storage to this area.

3. The Contractor may take delivery of equipment and material at his "shop" or an off-site location as suits the performance and schedule of the Work.

4. Regardless of where and how equipment and material are temporarily stored prior to installation, or if installed at the job site prior to acceptance, the Contractor is responsible for the following:

41. All equipment and material shall be accessible to the Architect/Engineer for inspection.

42. All equipment and material shall be protected adequately and properly from the weather, dirt and water, chemical, mechanical or comprehensive damages.

43. The Contractor shall be liable for the repair and/or replacement (including labor) of any equipment and material lost, damaged or defective prior to acceptance.

5. The Contractor shall arrange all labor, tools, services and scheduling to perform the handling of equipment and material for his Work.

20 10 55 GENERAL CLEANING

A. Each Contractor and Subcontractor shall be responsible for progress and final clean-up of his respective Work in accordance with the Contract Documents, requisite ordinances and regulations. Clean-up and legal disposal of debris from the Work, excess refuse and presence at the job site shall be performed in a timely and satisfactory manner. If not, the Contractor shall be notified of the unsatisfactory condition. If the matter persists, the Contractor will be back charged for the clean-up performed by others.

B. Clean exposed exteriors and limited access interior surfaces of all equipment, piping and ductwork of foreign matter to provide an “as new” condition.

20 10 56 CLEANING OF PIPING SYSTEMS

A. The Contractor shall clean the respective piping system(s) that are included in his scope of work. All systems shall be flushed with water or air (depending on ultimate use) to relieve any congestion and internally cleanse the respective piping system. The Contractor shall provide all flushing media in sufficient quantity, inlet connections, discharge or drainage outlets and any temporary provisions to protect components, or remove it, to facilitate the flushing. Clean and replace all strainer screens and filters. Flush clean and drain all low points in the piping.

B. Owner’s representative shall be present for flushing, cleaning, and rinsing. Water treatment representative must check water after rinsing to insure all chemical cleaner has been removed and the Alkalinity of the rinse water is equal to that of the make-up water.

All pipe systems for hydronic applications shall be flushed continuously with 100% city water make-up until the water runs clean from all drain locations. Each piping system shall be subsequently cleaned with recommended dosage of an approved pre-cleaning chemical designed to remove deposition such as pipe dope, oils, loose rust, mill scale and other extraneous materials for a minimum period of twenty-four (24) hours then drained, refilled, and rinsed clean. Flushing before and rinsing after cleaning shall be supplying constant make-up water while draining at all system low points and drains.

Steam and condensate return piping shall be flushed continuously with 100% city water make-up until the water runs clean from all drain locations. Each piping system shall be subsequently cleaned with recommended dosage of an approved pre-cleaning chemical designed to remove deposition such as pipe dope, oils, loose rust, mill scale and other extraneous materials for a minimum period of twenty-four (24) hours then drained, refilled,

and rinsed clean. Flushing before and rinsing after cleaning shall be by supplying constant make-up water while draining at all system low points and drains.

F. New or repaired potable water systems shall be purged of deleterious matter and disinfected prior to utilization. The method to be followed shall be that prescribed by the health authority having jurisdiction or, in the absence of a prescribed method, the procedure described in either AWWA C651 or AWWA C652, or as described in this section. This requirement shall apply to “on-site” or “in-plant” fabrication of a system or to a modular portion of a system.

1. The pipe system shall be flushed with clean, potable water until dirty water does not appear at the points of outlet.

2. The system or part thereof shall be filled with a water/chlorine solution containing at least 50 parts per million (50 mg/L) of chlorine, and the system or part thereof shall be valved off and allowed to stand for 24 hours; or the system or part thereof shall be filled with a water/chlorine solution containing at least 200 parts per million (200 mg/L) of chlorine and allowed to stand for 3 hours.

3. Following the required standing time, the system shall be flushed with clean potable water until the chlorine is purged from the system.

4. The procedure shall be repeated where shown by a bacteriological examination that contamination remains present in the system.

20 10 57 PRESSURE TESTING

A. The Contractor shall submit a schedule at the beginning of the Work of the piping systems that are to be pressure tested, and indicate whether tests will be for an entire or partial system. Entire piping systems shall be pressure tested at one time unless it is not possible or practical.

B. All piping to be insulated or concealed shall be pressure tested prior to the application of the insulation or concealment.

C. A representative of the Architect/Engineer shall witness all pressure testing. The Contractor shall notify the Architect/Engineer at least three (3) days prior to the test date.

D. Each piping system shall be tested per the method, test pressure, and test duration as specified in the Piping Material Schedules.

E. The Contractor shall provide all test media, measuring devices, inlet connections, test measurement connections, and disposal of test media. The Contractor shall protect, isolate and/or remove piping system components that can not be subjected to test pressures.

Hammer each joint in welded or soldered piping while under test. Leaks shall be repaired and the test(s) repeated until the respective piping system is tight.

20 10 58 LEAK TESTING of REFRIGERANT PIPING

A. After the refrigerant piping connections have all been made, the entire refrigerant system shall be put under pressure and tested for leaks using dry nitrogen to develop the test pressure and the refrigerant charge as the tracer gas for leak testing.

B. A pressure regulator and a relief valve set at the test pressure (see Pipe Material Schedules) shall be used in the nitrogen test hookup.

The nitrogen shall be admitted to the system through the gage port on one of the refrigerant valves. All valves in the system shall be back seated so that holding charge refrigerant gas and nitrogen can diffuse throughout the piping.

If any leaks are discovered, the joint shall be broken and re-soldered. If possible, the section of piping containing the leaking joint should be isolated from the rest of the system. Dry nitrogen shall be passed through the joint being remade to prevent the formation of copper oxide.

1. Occasionally, a joint may be suspected of leaking, but the leak is so small that it is difficult to get a positive indication with the halide detector. When this happens, completely enclose the joint with a small plastic bag. Tape the open ends of the bag securely to the piping to insure a gas tight seal. Leave the bag in place for several hours.

2. To test a leak, make a small hole in the bag at the lowest point and insert the exploring tube of your halide detector. Make another hole at the top of the bag to admit air. If the joint does have a slow leak, enough refrigerant gas will collect in the bag to give a positive indication.

20 10 59 CHARGING REFRIGERATION SYSTEMS

A. Evacuation and Dehydration. The Contractor shall evacuate and dehydrate the refrigerant system to remove any air and moisture from the system. The manufacturer's literature shall be referred to for the evacuation procedure for each system installed.

1. A vacuum pump capable of producing a vacuum of 1-mm Hg absolute is necessary for field evacuating. A single-stage pump having a free air displacement of 100 liters, or about 3 cubic feet/minute, is suitable. An accurate manometer type high vacuum gage, such as a Stokes or a Zimmerli gage, is also necessary.

2. The vacuum pump shall be connected to the gage port of the suction line shutoff valve, so that moisture in the new refrigerant lines will not be drawn through the compressor when the system is evacuated. The vacuum gage shall be connected to the gage port of the liquid line shutoff valve. The pump shall be operated until the gage indicated a vacuum of 2.5 mm Hg or less.

3. When the vacuum is sufficient, the refrigerant valves shall be back seated while the vacuum pump is running. The pump is then stopped. The system shall be allowed to

stand under vacuum for at least 12 hours to allow all moisture to vaporize and to see if there is any in-leakage of air.

4. After 12 hours, the Contractor shall break the vacuum with oil-pumped dry nitrogen or gaseous refrigerant and re-evacuate the system to 2.5 mm HG to further reduce the residual air and moisture to prevent compressor damage.

5. The system can now be charged if the pressure has not risen noticeably.

B. Charging. The Contractor shall determine the weight of a full charge of refrigerant and oil for the equipment plus refrigerant charge based on the length of refrigerant piping and in accordance with the unit manufacturer's literature.

The following charging procedure shall be used:

1. The Contractor shall follow the manufacturer's installation instructions and/or industry standards in charging and start-up of equipment.

20 10 60 BASIC MECHANICAL METHODS - INSTALLATION

20 10 61 GENERAL

A. The Contractor shall install all equipment and material as specified in the Project Documents. The Contractor shall review the installation requirements, and provide all of the appurtenances and accessories required for complete systems and a functioning installation. The Contractor shall be prepared to submit installation details and procedures where specified or requested for approval by the Architect/Engineer.

B. The Contractor shall follow the manufacturer's instructions for the handling, temporary storage, protection and installation of the respective equipment and material. The Contractor shall promptly notify the Architect/Engineer in writing of any discrepancy or conflict between the Project Documents and the manufacturer's instructions, and request clarification. Unless there is a specific change in the scope of work, no additional compensation shall be granted for modification(s) and execution of the clarification.

C. Work performed that does not comply with the manufacturer's instructions, any approval or instructions from the Architect/Engineer, or that causes a significant and/or unapproved deviation from the intent of the Project Documents shall not be grounds for additional compensation for costs to modify the Work in a manner directed by and to the satisfaction of the Architect/Engineer.

D. All Work shall be installed to permit access and/or removal of components e.g. - coils, fan wheels and shafts, filters, guards, bearings, motors, mechanical drives, etc. that require periodic maintenance, servicing, repair and/or replacement. Equipment, piping, ductwork, conduit and raceways shall be arranged to permit access to valves, motors, motor and temperature controls, and to clear the opening of doors and access panels.

E. Welded attachments to the building structure are not permitted.

20 10 62 PIPING

A. All piping shall be properly installed and supported with adequate provisions for clearance from other work, for expansion, contraction, slope, anchorage and prevention of transmission of vibration.

B. Piping shall be generally installed parallel to building lines in the most expeditious and economical manner and to facilitate servicing. Piping shall be positioned and installed to provide noiseless circulation, and pitched to provide drainage and avoid air pockets. Valves and specialties shall be located to provide proper function and be readily accessible for servicing and maintenance.

C. All piping connecting to equipment shall be installed without springing and any strain at final connections. The Contractor may be requested to disconnect piping to demonstrate that the piping has been so installed.

Steel piping connections to equipment with rotating or reciprocating components shall be provided with a minimum of two grooved clamp type couplings per piping connection, which shall be Victaulic Style 77 couplings or equivalent. Copper piping connections to equipment with rotating or reciprocating components shall be provided with Mason Industries SafetyFlex model SFDEJ flexible joint. Air handling units with internal fan isolation are not included in the above.

Changes in direction in the piping shall be made with manufactured fittings only. All elbows shall be long radius (1.5 x diameter) unless specifically noted otherwise. Bending may be permitted on submittal for approval of a satisfactory procedure to the Architect/Engineer for approval. Bending is to be accomplished with hydraulic type equipment producing no mal-formations in the piping.

Full size branch connections and branch connections one size smaller in steel piping shall be made with manufactured fittings only. Branch connections two sizes and smaller than the main run may, in special cases with the Engineer's written permission, be made with manufactured fittings, weld-o-let or thread-o-let type fittings for welded piping construction, saddle type fittings for grooved piping construction or a pipe-to-pipe nozzle weld. Small branch connections for thermometers, pressure gauges, controls, etc. may be made with nozzle welded 3000# forged steel threaded couplings, thread-o-lets or saddle fittings. For insulated piping, provide branch connections with sufficient “neck” length to extend beyond the thickness of the insulation.

Changes in direction in piping systems using hard temper copper tubing shall be made with manufactured and cataloged elbow fittings. Branch connections and reductions in all copper tubing systems shall be made with tee and reducer fittings. At the Contractor's option, utilizing a “Tee Turner” tool and corresponding procedure may provide branch connections. These joints shall be brazed and not soldered.

Minimum slope for piping shall be provided in accordance with the following schedule, unless otherwise specified, noted or shown:

Type of Piping Fluid Conveyed	System Component	Pitch	Direction of Fall

Sewer, sanitary	main/branch	1/8”/Ft.	w/flow
Sewer, storm	main/branch	1”/40 Ft.	w/flow
Steam	main	1/8”/Ft.	w/flow
Steam	branch	1/8”/Ft.	to main or drip
Steam condensate	main/branch	1/8”/Ft.	w/flow
Chilled/heating water	supply/return main	1”/40 Ft.	from vent
Chilled/heating water	runouts to risers	1/8”/Ft.	back to mains
Condensate drain		1”/20Ft.	w/flow
Refrigerant piping		1”/20Ft.	w/flow
Domestic water		1”/40Ft.	to drain

All piping materials shall be physically cleaned internally and externally of mill scale, oxidation, grease, oil, dirt, mud, loose and foreign matter before fabrication and installation.

All open ends of piping and equipment shall be closed during fabrication and installation to keep dirt and foreign matter out of the Work.

20 10 63 VALVES

A. Shut-off valves shall be provided at all inlet and outlet connections to equipment, at major branch connections to mains, where required for normal service, and where shown on the drawings, flow diagrams or details.

B. Valves shall be the same size as the adjacent piping, except for control valves furnished in Division 25.

C. Valves shall be accessible and free from interference when operated. Valves shall be installed with the stem on or above horizontal. Globe valves shall be installed with pressure under the seat. Butterfly valves shall be free to open and close without obstruction.

D. Valves shall be packed and glands adjusted before final acceptance.

20 10 64 EQUIPMENT

A. The Contractor shall furnish and install the necessary frames, stands, brackets, stiff-legs, hangers, etc. to support or suspend the equipment and material that require this installation arrangement. The Contractor shall be responsible for the size, quantity, location and design of the supports and suspensions. The design shall permit no deflection of the support, the suspension arrangement or related building members, nor impart any vibration into the building structure. Loads transmitted to the building shall be within the limitations of and distributed satisfactorily to the structure. Designs for supports and suspensions shall be submitted for approval to the Architect/Engineer. Any attachment to the floor shall be provided with a minimum of 1” thick concrete or grout between the base and the floor. All associated ferrous metal parts shall be painted or galvanized. Painting shall consist of one (1) coat of base primer on properly prepared surfaces and one (1) coat of rust inhibiting enamel, color selected by the Architect/Engineer.

B. Each exposed mechanical drive and rotating shaft shall be provided with a protective guard. The guards may be provided with the respective equipment or may be field fabricated. The guard shall be constructed to comply with the appropriate safety requirements of the National Institute of Safety and Health and OSHA. Provide adequate and proper access for speed measurements for all rotating shafts. Guards shall not interfere with the lubrication of equipment nor restrict the airflow into fan inlets. The design for field fabricated guards shall be submitted for approval to the Architect/Engineer.

C. All equipment except pumps, having rotating or reciprocating components shall be provided with captive spring type vibration isolation mounts for seismic and restrained service. Mounts shall be selected at a maximum transmissibility of 0.03 (isolation efficiency of 97%) at the lowest anticipated operating speed of the equipment.

D. Grease fittings for bearings shall be extended to accessible locations.

Installation Instruction

1. Equipment shall be set level, plumb, properly oriented, aligned and secured in the location shown on the drawings.

2. Shims used for leveling shall be of size sufficient to cover the entire bearing surface except where shims are used to level preparatory to grouting. Shims used in conjunction with grouting shall be located to properly support equipment at load points to prevent any distortion.

3. Assembly and installation of the equipment shall be in strict compliance with the equipment vendor's instructions.

4. Where specified, equipment shall be assembled, installed, inspected and adjusted under the supervision of the Vendor's representative.

5. Lugs, saddles, supports, covers or similar components which have been shipped separately or loose shall be located and attached by the Contractor by means of welds or bolting.

6. Holes in structural steel required for installation of equipment shall be drilled as required.

7. Contractor shall supply and install self-anchoring anchors.

8. The Contractor shall grout under the equipment to effect a firm permanent setting as required.

9. Upon completion of installation the Contractor shall remove all staging, blocking and construction debris from the equipment.

10. The Contractor shall check all packaged or pre-assembled equipment to make sure that all packing shims and blocking is removed before rotating, running or testing the equipment.

Equipment Alignment

1. The Contractor shall do a cold final alignment of all rotating equipment shafts and coupling assemblies even when they were factory aligned. The reverse dial indicator method of alignment is preferred whenever possible. The following requirements apply to alignment:

   Initial Alignment shall be checked with all piping larger than NPS 1" disconnected from the equipment. Maximum misalignment readings shall be 0.05-in. total indicator reading (TIR) on the rim and on the face of the coupling hub for all equipment unless otherwise noted in the Equipment Data Sheet instructions. Equipment shall rotate freely, all bolts shall be tight, all bearings and couplings shall be lubricated, and all safety guards shall be in place.

   Soft Foot. Equipment will be checked for "soft foot". If the dial indicator indicates more than 0.05 in. (TIR) when any equipment to baseplate bolt is loosened, the equipment will be reshimed.

   Final Alignment. The Architect/Engineer will witness the final alignment check on each piece of rotating equipment. Connecting pipe shall fit up to the equipment without the use of mechanical force. Connecting piping greater than NPS 1" will be bolted to the equipment one at a time, with the dial indicator attached. If the alignment changes by more than 0.05 inches (TIR), the piping will be revised until the alignment change is acceptable.

2. Shims used for aligning the equipment shall be stainless steel and shall be stamped with the shim thickness. The shim shall be large enough to cover the complete load bearing area and the total height shall be a maximum of 1/8 inch and shall be installed between the equipment's foot and the equipment's baseplate.

20 10 65 MISCELLANEOUS

A. Sleeves, inserts, etc.

1. The Contractor shall furnish and properly install sleeves, inserts, supports, anchors and anchor bolts required for his Work. The size, quantity and location of chases, openings and recesses in the building structure shall be the responsibility of the Contractor performing the Work that requires these considerations. Patching of oversized openings and finishing thereof shall be the responsibility of the trade or Contractor requiring the opening. Material and labor for openings in [new construction] requiring structural framing including lintels and angles shall be furnished by the trade requiring the opening and installed by the General Contractor. Lintels shall be structural steel angles, channels, or tees of proper size and sections for the load supported.

2. Sleeves shall be provided for all penetrations through the building structure. Sleeves through floors shall extend 1” above the finished floor except where otherwise noted; sleeves through walls, partitions or structural members shall be flush with the exterior surface on both sides. Sleeves shall sized to include the pipe/duct insulation.

3. The space between the sleeve (or opening in the structure) and the pipe/duct or outside of the insulation of penetrations through fire rated components of the building shall be fire stopped, see Section 20 10 20 Miscellaneous Piping Materials. Penetrations through non-rated components of the building shall be draft stopped, see Section 20 10 20 Miscellaneous Piping Materials.

B. Unions and flanges:

1. A ground joint type union shall be provided in threaded joint piping, 2” and smaller pipe or tube size, down-stream of each branch shut-off valve, control valve and specialty item, the inlet and outlet connections of each piece of equipment, and where shown on the drawings.

2. Flanged connections shall be provided in piping 2-1/2” and larger at each manual valve, control valve, specialty item and the inlet and outlet of each piece of equipment.

C. Interconnections between dissimilar piping material systems shall be made with fittings manufactured for the specific application. Rather than dielectric unions between copper and steel piping systems, three piece ball valves shall be utilized to isolate the materials.

20 10 70 BASIC MECHANICAL METHODS - RELATED WORK

20 10 71 DEMOLITION <INCLUDE ONLY ITEMS THAT ARE APPLICABLE>.

A. Work Included: <Options to be selected by the Engineer>

1. The Contractor shall legally dispose of the designated equipment, apparatus and/or piping. Any cost of removal or salvage value shall be credited to the Contractor's account and shall be considered accordingly in the Contractor's bid.

11. Recovery and reclaim of refrigerant shall be performed by the Contractor in accordance with EPA regulations. The Contractor shall submit to the Owner a certificate stating the names and license numbers of the personnel performing the removal of the refrigerant, the machine and serial number of the reclaim equipment used, type and quantity of reclaimed refrigerant, and all other required data.

2. Disconnect only, make inoperable, remove any internal substances and abandon-in-place designated mechanical equipment, apparatus and/or piping for removal by others. Do not include any electrical power and/or control considerations.

3. Remove externally applied insulation only as required to facilitate dismantling and ultimate removal of the designated mechanical equipment and material. Do not include removal of any asbestos-based insulation.

B. Work Not Included:

1. The removal and disposal of asbestos based insulation or other hazardous materials applied to, or contained in, the mechanical equipment, material and piping designated to be demolished shall not be included in the scope of the work regardless if known ahead of time or discovered in the course of performing the Work. In the latter case, the Contractor shall notify the Architect/Engineer and shall not pursue that portion of the Work until others have removed the asbestos-based material. The removal and disposal of asbestos-based material shall be arranged by and to the account of the Owner, and conducted separately from the demolition work.

C. Miscellaneous:

1. Loose ends of mechanical systems shall be capped and/or sealed in a safe and secure manner approved by the Architect/Engineer.

2. Dead legs of branch piping are not permitted unless a cap is specifically shown on the drawings. Where a cap is not shown and the drawings indicate to cap piping, the Contractor shall remove branch piping back to the main and cap at that point.

20 10 72 CUTTING AND PATCHING

A. The basic premise of this Sub-section is that the cutting and patching (where required) are performed in existing building components. In “new” construction, the premise is that the building component is already in place.

B. The Contractor requiring the penetration of or the access way in the building structure to fulfill the intent of the Project Documents for his Work shall be responsible for the cutting and the subsequent patching in accordance with the following criteria:

1. No structural component of the building shall be cut or violated without express approval of the Architect/Engineer.

2. The Contractor shall verify the presence of any concealed utility or service within the structure (walls, roof, floor, etc.) in question, and shall be responsible for maintaining continuity and/or replacing it.

C. Cutting of work-in-place in “new” construction because of error, neglect or damage inflicted shall be the responsibility of the Contractor precipitating the issue.

D. “Patching” shall be construed as the repairing or replacing of the building structure to return it to an original or new condition, in the opinion of the Owner and/or Architect/Engineer, as existed prior to the cutting.

E. Patching and finishing work shall be the responsibility of the Contractor requiring the cutting. The patching shall match all the substantive and visual aspects of the structure and adjacent surfaces. Restoration and finishes shall be as specified and executed in the respective

sections, schedules and/or details of the Project Documents for the general construction work. Completed work and any special requirements shall be subject to approval by and satisfaction of the Architect/Engineer.

20 10 73 EXCAVATION, TRENCHING AND BACKFILLING

A. General:

1. This sub-section shall supplement Section 02200 – Earthwork for excavation, trenching, and backfilling required to install the work of Divisions 20 - 29.

2. In the event of a conflict between this sub-section and Section 02200, the more stringent shall apply.

B. Definitions:

1. Topsoil: shall be friable, free from clay lumps, grass, brush, roots, stumps, toxic substances, litter, gravel, stains greater than 1 ½" diameter, or other foreign material. Topsoil shall not contain plant parts of Nutsedge, Johnson Grass, Nimblewill, Bermuda Grass, Bindweed, or other noxious weeds. Topsoil shall have the following composition by percent volume: sand (9% - 30%), silt (30% - 70%), clay (10% - 27%), organic matter (1.5% minimum) with a P.H. between 5.5 and 7.0.

2. Unsuitable Soil Materials: are defined as those complying with ASTM D2487, soil classification groups GC, SC, ML, MH, CL, CH, O, OH, and PT.

3. Suitable Soil Materials: are defined as those complying with ASTM D2487 soil classification groups GW, GP, GM, SW, SP, and SM; free of rock or gravel larger than 2" diameter, debris, waste, frozen materials, vegetation and other deleterious matter.

4. Subsoil: Earth, clay, loose stone, hard pan, abandoned piping, concrete and masonry rubble, broken paving and other materials capable of being removed with standard power driven excavating equipment.

5. Rock: Solid, natural mineral material with a volume of over 1 cubic foot and other matter (e.g.- abandoned foundations, broken paving and rubble) that cannot be removed with standard 100 HP power driven excavating equipment without drilling.

6. Common Fill: Suitable soil as determined by geotechnical testing and/or as approved by the Architect/Engineer; free from wood, debris, organic matter or other deleterious materials.

7. Granular Fill: Naturally or artificially graded mixture of natural or crushed stone, and natural or crushed sand, ASTM D2940; except with 100 percent passing a 1" sieve and not more than 8 percent passing a No. 200 sieve.

8. Drainage Fill: Washed, narrowly graded mixture of crushed stone, or crushed or uncrushed gravel; ASTM D448; coarse aggregate size 57; with 100 percent passing a 1 ½ sieve and 0 to 5 percent passing a No. 8 sieve.

9. Flowable Fill: Lean concrete mixture with fine aggregate of sand and fly ash.

10. Bedding: Natural or crushed sand.

C. The Contractor shall include the following Work:

.1. Contractor shall become familiar with location of underground utilities and structures which may be encountered or affected by Work.

2. Locations of underground utilities and structures shown on Drawings are based upon available owner's records such underground facilities or by others, and were used by engineer to prepare Contract Documents, but are not guaranteed to be complete or correct, and are given only to assist in making determination of location of underground utilities and structures.

3. Contractor shall contact the state's One Call System for public utilities and the Owner with 72 hours notice for all private underground utility locates.

4. Where there are active utilities within 8 feet of excavation the Contractor shall locate utilities using a hydrovac. Where the excavation is parallel or near parallel with the active utility perform hydrovac location at 100 feet intervals.

5. Excavate or trench "subsoil" material in accordance with the Project Documents to depths required for the installation of underground equipment and/or piping in his respective scope of work.

6. Establish the location, routing, invert elevations, slope percentages, trench contours and perform the necessary surveying work for the excavation and trenching of his respective requirements.

7. Be responsible of protecting excavations and trenching as necessary with shoring, bracing, sheathing, sheet piling, underpinning or other methods required to prevent cave-ins, damage to adjacent improvements and injury to personnel. The requirements of OSHA shall be met.

8. Maintain the excavation and/or trenching during the progress of the Work to keep it free from water and to provide for the uninterrupted flow of surface water adjacent to and around the open ground.

9. Provide "bedding" material for uniform support of the equipment/piping in the bottom of the excavation/trench to an elevation as hereinafter specified.

10. Identification of underground utilities with marker tape, refer to Section 20 10 96

11. Backfill and compact the excavation and trenching with "common fill", "granular fill", and "topsoil" in a manner hereinafter specified or as otherwise noted in the respective section of the Specifications of Divisions 20 - 29.

12. Remove any existing and functioning surface improvements necessary to perform the excavation and/or trenching work, and replace to a condition equal to that prior to the removal, unless noted otherwise.

13. Protect and maintain any existing or uncovered functioning piping and/or utility services in the excavation/trenching. Any damage caused by the activity of this Contractor shall be corrected or repaired at no additional compensation.

14. Remove excess and/or "unsuitable soil materials" and backfill materials determined by the Architect/Engineer, and leave the site in a condition not imposing on subsequent work.

D. Work Not Included:

1. The Contractor shall not be responsible for removal of material defined as "rock". In the event this requirement occurs, a change order shall be issued based on a unit price, if so requested in the proposal, or shall be negotiated. Payments for rock removal shall be limited to 8" below the invert elevation of the pipe and 18" wider than the pipe diameter.

E. Trenching, Bedding and Backfilling:

1. Trenching shall be open cut from the surface. The bottom of the trench shall be not less than 8" or more than 16" wider than the outside diameter of the pipe to be laid therein. The bottom elevation shall be clean of loose matter and shall provide for a bedding 4" deep below the piping (or conduit).

2. The "bedding" material shall extend the full width of the trench and to a height of 4" above the piping. The pipe and/or conduit shall be supported uniformly by the compacted bedding. Place and shape the bedding to support the piping over the entire length and to allow for making-up joints properly. Thoroughly compact (95% modified proctor) the bedding material along the sides of the piping for the full height of the bedding while maintaining the alignment of the pipe.

3. After pressure testing and acceptance of the underground installation by the Architect/Engineer, continue to backfill and compact (95% modified proctor) the trench as follows:

    1. For piping inside the building backfill material shall be "granular fill" in layers of 6" and compact (95% modified proctor) between layers.

    2. For piping under sidewalks, under parking lots, or under roadways backfill material shall be "granular fill" in layers of 6" and compact (95% modified proctor) between layers.

    3. For piping outside the building and not listed above then the backfill material may be "common fill" or "granular fill" placed and compacted (95% modified proctor) from the aforementioned elevation to 12" below finish grade in layers not exceeding 8". The final 12" shall be backfilled with "topsoil".

4. Where the excavation undermines existing utilities or structures, the backfill shall be “flowable fill” if the fill listed above can not be properly compacted.

F. Miscellaneous:

1. Trenching shall not interfere with normal 45 degree bearing splay of foundations.

2. Exterior trenches (to the building) for utility services and pipes containing water shall provide for a depth of burial of not less than (insert local frost depth) from the top of the pipe to finished grade, unless noted otherwise.

3. Provide adequately designed and sized concrete anchor/thrust blocks at all changes in direction and end points.

4. The underground piping shall be identified with marking tape laid in the trench in accordance with Subsection 20 00 19.

G. AS-BUILT Drawings:

1. Before backfilling is commenced, the Contractor shall measure and record vertical elevations and horizontal locations of all underground equipment and piping. This information shall be recorded on “record” drawings and submitted to the Architect/Engineer as part of the “As-Built” drawings for the Project, and shall be a requisite for final payment.

20 10 74 CONCRETE WORK (CAST-IN-PLACE)

A. General:

1. This sub-section shall supplement Section 03300 – Concrete Work for the concrete work required to install the work of Divisions 20 - 25.

2. In the event of a conflict between this sub-section and Section 03300, the more stringent shall apply.

B. The Contractor shall include the following Work:

1. Provide concrete foundations, bases and/or housekeeping pads for mechanical equipment furnished in his respective scope of work where such are not indicated on the architectural or structural drawings. Concrete work shall include requisite excavation, formwork, reinforcing and contained hardware.

2. Submit for approval to the Architect/Engineer detailed and dimensioned drawings of size, location, reinforcing and hardware contained therein of concrete work to be provided.

C. Housekeeping Pads:

1. All equipment setting on concrete or other type of pave flooring shall be set upon a raised “housekeeping” pad, unless noted otherwise.

2. The Contractor shall be responsible for this size, location, and any required anchor bolts. In general, housekeeping pads shall be a minimum of 3 ½” high, a ¾” chamfer on exposed corners and edges, and a minimum of 3” beyond the equipment on all sides or as required for anchor bolt edge distance.

3. Housekeeping pads shall be 3000 psi 28-day compressive strength concrete. Pads shall be reinforced and doweled to the floor slab. Refer to ASHRAE-A Practical Guide to Seismic Restraint 1999, Chapter 6 – Housekeeping Pads for size and spacing of reinforcing and dowels.

4. Specifically designed vibration isolation/inertia concrete bases for equipment will be specified and shown separately.

D. Thrust Blocks:

1. Thrust blocks shall be installed at all changes in direction and end points in unrestrained underground piping systems.

2. Thrust blocks shall only contact the backside of the fittings and shall not cover any joints. All thrust blocks will be inspected by the Owner’s Representative prior to backfilling, provide a minimum of 3 days notice.

20 10 75 PAINTING

A. General:

1. This sub-section shall supplement Section 09900 – Painting for the painting work required for the work installed by Divisions 20 - 25.

2. In the event of a conflict between this sub-section and Section 09900, the more stringent shall apply.

B. Painting of the following shall be included in the scope of work of this sub-section:

1. All mechanical equipment including housings, fans, etc., not factory painted shall have prime coat and finish painting.

2. All plain steel hanger rods, plain steel pipe hangers, field fabricated or prefabricated steel supports and braces, and other ferrous metal. Prime coat only for all interior work, both exposed and concealed. Prime coat and finish painting of all exterior work.

3. Touch-up, as required, of factory finished equipment to original condition.

4. Interior surface of air ducts, cabinets, enclosures, covers and air dampers where visible from a finished space through grilles and louvers with one coat of flat black paint.

C. Painting of the following shall not be included in the scope of work of this Sub-section, unless noted otherwise:

1. Surfaces to receive special finishes specified elsewhere.

2. Building construction surfaces - floors, ceilings, interior and exterior walls, exposed concrete work, special finishes, etc.

3. All stainless steel, brass, copper, aluminum, plastic, electro-plated and galvanized surfaces.

4. Caulking, sealers, fire stops, etc.

5. Valves, controls, specialties.

6. Nameplates of equipment. Replace nameplate if painted.

7. Light fixtures.

8. Equipment (mechanical and electrical) which has been finished in a factory.

9. Black steel surfaces over 250 degrees F. (e.g. - breechings, kitchen hood exhaust ducts, etc.).

D. General Requirements:

1. The Contractor shall provide all labor, coating materials, accessory materials (e.g.- turpentine, painting thinners, etc.), tools and services necessary and reasonably incidental to the scope of work of Sub-section 20 10 75.

2. Coatings shall be factory prepared and mixed; ready for application upon delivery; have good flow and brushing properties and be capable of drying and curing free of streaks or sags.

3. Materials for each application shall be compatible with one another and with other specified materials with which contact may be made.

4. Products shall meet the following UL fire hazard classifications when tested in accordance with ASTM E84: Flame spread, 0; Fuel contributed, 5; Smoke developed, 15.

5. Coatings shall be applied in accordance with the paint manufacturer's recommendations with the surfaces well illuminated. In general, coatings shall not be applied when the relative humidity is above 60% nor the ambient temperature below 45 degrees F.

6. The Architect/Engineer shall make color selections, when required.

E. Acceptable Manufacturers

1. Benjamin Moore & Co.
2. Porter International
3. Pratt & Lambert, Inc.
4. Sherwin Williams Co.
5. Glidden
6. Pittsburgh

F. The Contractor shall submit the following to the Architect/Engineer for review and approval:

1. Statement of qualification that the company specializes in commercial painting and finishing with a minimum of five (5) years experience.

2. Product data describing the following:

21. Instructions for substrate preparation including priming.

22. Instructions for product preparation, application procedures, clean-up and maintenance.

23. Recommended ambient temperature and relative humidity range, substrate temperature, moisture content and alkalinity at the time of application.

24. Manufacturer's list of trademarked products for each coat of each system. For each product, state vehicle type, percent solids by volume, method of application, drying time, recommended rate of coverage and dry film thickness for each coat. Coordinate with the Schedule in Sub-section in 20 10 75.84.

25. Advise any recommendations which differ from the specified or scheduled requirements.

3. Material Safety Data Sheet (MSDS) for each coating and painting product, and maintain a file of it at the job site for reference and emergency use.

4. Certificates and/or test reports demonstrating that the painting products specified meet regulatory requirements.

5. Color charts and available sheens of finish, when required, for selection by the Architect/Engineer.

6. Samples of painting products when requested for inspection by the Architect/Engineer.

G. Painting:

1. The Contractor shall be responsible for delivery, handling and storage of all coating and painting materials for the pursuit of his work.

    11. All painting products shall be delivered in sealed containers.

    12. All painting product containers shall be labeled to show the manufacturer's name, type of coating, brand name, coverage, surface preparation, drying time, clean-up, color designation and instructions for mixing and reducing.

    13. All painting products shall be handled and stored in accordance with the respective manufacturer's recommendations. In the absence of specific instructions, products shall stored in well-ventilated areas at a minimum ambient temperature of 45 degrees F. and a maximum temperature of 90 degrees F.

    14. Precautions shall be exercised to prevent fire hazards and spontaneous combustion. Provide adequate type and quantity of fire extinguisher at the job site.

2. The Contractor shall perform the following in preparation of the painting application:

    21. Verify that surfaces and substrate conditions are ready to receive the application of coatings as specified or in accordance with manufacturer's recommendations. Commencement of application is acceptance of existing conditions.

    22. Provide drop clothes and other protective measures to prevent coatings on other work not included in the scope of work of this sub-section.

    23. Where required by Architect/Engineer, post “WET PAINT” signs.

    24. Solvent or power tool clean surfaces, as required or as deemed appropriate, to remove grease, scale, dirt, rust, mill scale, weld splatter and burrs. Apply primer immediately after cleaning.

3. Application:

    31. Coating products shall be prepared and applied in accordance with the respective manufacturer's instructions and reviewed submittals. Dry mil thickness of each coat shall be as scheduled or as recommended by the manufacturer. Finish coat shall not be less than 5.0 mils in thickness, and sufficient to cover completely substrates and undercoats.

32. Where shop prime coat finishes are specified elsewhere, primer may be omitted, except as otherwise scheduled, specified or recommended by the coating manufacturer. Damaged shop prime coats shall be touched-up, using a primer compatible with or same as original primer.

33. Each coat shall be applied to provide a uniform finish, without sags, laps, brush marks or other defects. Allow applied coat to dry before next coat is applied.

4. Schedule - Latex, General Painting Materials:

41. Steel - unprimed, located indoors or outdoors:

One (1) coat lead and chromate free alkyd primer. Two (2) coats latex, semi-gloss.

42. Steel - shop primed, located indoors or outdoors:

Touch-up with lead and chromate free alkyd primer.
Two (2) coats latex, semi-gloss.

43. Insulation on mechanical equipment, located indoors:

One (l) coat latex primer sealer.
Two (2) coats latex, flat.

5. Schedule – Color coding of pipes exposed in Mechanical Rooms:

Fire Protection	Red
Fuels (Gas and Fuel Oil)	Yellow
Steam and Condensate	Orange
Domestic Water (CW, HW, HWR)	Green
Chilled Water	Blue
Drains and Vents	Black
Heating Water	White
Condenser Water	Tan

20 10 76 LUBRICATION

A. Provide all oil and grease for the operation of all equipment until acceptance. The Mechanical Contractor and Subcontractors shall be held responsible for all damage to bearing while the equipment is being operated by them up to the date of acceptance of the equipment. Protect all bearings during installation and thoroughly grease steel shafts and other unpainted steel surfaces to prevent corrosion. All motors and other equipment shall be provided with covers as required for proper protection during construction. For equipment that is received void (dry) of lubrication the Contractor shall lubricate the equipment before storing to prevent internal damage to the equipment.

B. After the Contractor moves on site, he shall hand rotate all existing rotating equipment at least once every week in order to make sure the equipment remains free and eliminate the risk of including a permanent set in the rotating shaft or bearing. Equipment that requires more frequency or special treatment in rotating procedures shall be handled as specified.

20 10 77 DRAINING, FILLING AND VENTING SYSTEMS

A. The Contractor shall provide all required labor for draining, filling and venting of new or modified systems as many times as required during construction and for all phasing activities.

B. Where draining and filling systems affects other systems or the Owner's normal operations, then they shall be scheduled at least 24 hours in advance with the Owner and shall be carried out to minimize such disruptions.

20 10 80 TESTING, ADJUSTING AND BALANCING

20 10 81 GENERAL

.1 At the completion of the installation work the owner will furnish all testing and balancing work under a separate contract., The Contractor shall assist the owner in scheduling and coordinating the balancing.

20 10 90 BASIC MECHANICAL METHODS - IDENTIFICATION

20 10 91 GENERAL

A This Sub-section specifies basic materials and methods for identification that shall apply to systems specified in other sections of Divisions 20 - 29 of the Specifications.

B. The Contractor shall submit schedules and listings of Work to be identified indicating color code, material, name plate information and method of application for approval prior to performing the Work.

20 10 92 REFERENCES

A. All provisions and conditions cited in this Sub-section shall apply to Work of all other sections of Divisions 20 - 29 of these Specifications, where and when relevant.

B. Applicable requirements of the current and accepted edition of the following codes and standards shall apply to the Work of this Sub-section:

1. ANSI/ASME A 13.1 - "Scheme for the Identification of Piping Systems".

2. NFPA 99 – Health Care Facilities

3. CGA Pamphlet C-9 - "Standard Color-Marking of Compressed Gas Cylinders Intended for Medical Use in the U.S.A".

20 10 93 WORK INCLUDED

A. Each respective Contractor and Subcontractor shall identify the applicable components of his Work in accordance with specifications hereinafter enumerated or where required by other sections of Divisions 20 - 29 of the Specifications.

1. All equipment items (i.e., air handling units, fans, pumps, etc.).

2. All piping systems identifying the system type and direction of flow.

3. All control devices and panels.

20 10 94 SUBMITTALS

A. Contractor shall submit shop drawings for approval in accordance with Section 20 00 43 submittals.

B. Provide an Identification Product Schedule consisting of the following minimum information:

- Material - type of identification product.
- System - indicate which system or equipment materials will be used for.
- Manufacturer - Manufacturer's name, product name and model numbers.
- Accessories - Miscellaneous materials used in affixing identification.

C. Provide manufacturer's technical product sheet and recommended installation instructions.

20 10 95 GENERAL METHODS FOR IDENTIFICATION

A. All surfaces to receive identification nameplates or markers shall be clean, degreased, dry, free of oxidation and prepared per manufacturer's recommendations.

B. Plastic nameplates shall be installed with corrosion-resistant mechanical fasteners. Do not use adhesives.

C. Tags shall be installed with corrosion-resistant chain and end fasteners.

D. Pipe and duct markers shall be installed in accordance with the manufacturer's recommendations.

E. Contractor shall consult with the Owner to identify and label select valves.

F. Acceptable Manufacturers:

Products of the following manufacturers may be considered

1. Seton Nameplate Corp.
2. Brady Signmark Division

3. Craftmark Identification Systems
4. D & G Sign and Label

20 10 96 PIPING IDENTIFICATION

A. All piping, bare pipe or insulated, exposed or concealed, shall be identified by one of the methods specified herein.

B. Markers shall be installed in clear view; aligned with axis of pipe; located at not more than twenty-five foot (25') intervals on straight runs, risers and drops; located adjacent to each valve, control device and tee fitting; and located on each side of penetrations of the building structure and non-accessible enclosures.

C. The following schedule shall govern label types for each application:

Location	Type
Mechanical Rooms	II
Above Lay-in Ceilings	I
Exterior/Outdoors	III

1. Pressure Sensitive Tape (Type I): Vinyl pressure sensitive tape color coded and lettered in accordance with ANSI A13.1 for label of service. Flow direction shall be separately labeled with 2" wide pressure sensitive tape. The flow arrow band shall overlap the service label to secure it in place and shall not be less than two complete wraps around the pipe.

2. Plastic Pipe Markers (Type II): Manufactured in accordance with ANSI A13.1 requirements, semi-rigid plastic, pre-formed to fit curvature of pipe or pipe insulation, color coded and imprinted with media identification and flow direction. Available in varied sizes for pipe diameter, wording and inclusion of arrow.

3. Outdoor Pipe Markers (Type III): Non-vinyl chloride markers specifically design for outdoor use. Color coded and lettered in accordance with ANSI A13.1 for label of service with direction of flow arrows.

4. Stencil Lettering (Type IV):

Outside diameter of bare pipe or insulated pipe	Size of letters	Length of color field
¾"- 1-1/4"	½"	8"
1-1/2" - 2"	¾"	8"
2-1/2" - 6"	1-1/4"	12"
8" - 10"	2-1/2"	24"
-10" and larger	3-1/2"	32"

D. Medical gases shall be identified in addition at least once in each room, at zone station valves and at each story traversed by the piping systems.

E. All underground metallic piping shall be identified with continuous 6" wide x 0.004" polyethylene film, color coded, and imprinted for type of utility buried below located in the same trench as the piping and/or utility and positioned approximately 6" to 12" below finished grade.

F. All underground non-metallic piping shall be identified with continuous 6" wide x 0.035 metallic detection tape, color coded and imprinted for type of utility buried below located in the same trench as the piping and/or utility and positioned approximately 6" to 12" below finished grade.

G. The following legend, color, and lettering shall be used:

Service and Legend	Color of Field	Letters
Materials Inherently Hazardous:		
Acid Waste	Yellow	Black
High Press. Compressed Air (over 90 psig)	Yellow	Black
Hot Water Supply	Yellow	Black
Hot Water Return	Yellow	Black
Low Pressure Steam	Yellow	Black
Low Pressure Steam Condensate	Yellow	Black
Medium Pressure Steam	Yellow	Black
Medium Pressure Steam Condensate	Yellow	Black
Pumped Condensate	Yellow	Black
Refrigerant	Yellow	Black
Domestic Hot Water	Yellow	Black
Domestic Hot Water Return	Yellow	Black
Waste	Yellow	Black
Vent	Yellow	Black
Materials of Inherently Low Hazard:		
Chilled Water Supply	Green	White
Chilled Water Return	Green	White
Cold Water	Green	White
Drain	Green	White
Roof Drain	Green	White
Fire Quenching Materials:		
Sprinkler – Fire	Red	White
Health Care:		
Medical Air	Yellow	Black
Nitrogen	Black	White
Nitrous Oxide	Blue	White
Oxygen	Green	White
Medical Vacuum	White	Black
WAGD (Waste Anesthetic Gas Disposal)	Violet	White
Non-Medical Air	Yellow and White Diagonal Stripe	Black

20 10 97 EQUIPMENT IDENTIFICATION

A. All major equipment items (i.e., chillers, air handling units, fans, terminal units, pumps, boilers, fire dampers, etc.) shall be identified with appropriately sized nameplates permanently attached to the respective equipment.

B. Small equipment items (i.e., in-line pumps, pot feeders, etc.) shall be identified with brass valve tags, see requirements for valve tags and chains.

C. Equipment that is controlled by the Building Automation Control System shall be labeled with a 2" x 5" yellow label with black letters:

"CAUTION – THIS EQUIPMENT IS UNDER COMPUTER CONTROL AND MAY CYCLE AT ANY TIME."

D. Interior equipment nameplates shall be 1/16" thick two-ply acrylic plastic 2-1/2" x 1" size minimum with white letters on a black background. Tag size shall be appropriate for equipment name, letters shall be a minimum of ½" high.

E. Exterior equipment shall be identified with nameplates suitable for exterior use or shall be engraved aluminum plates .020" thick, minimum size shall be 4" x 1-1/2" plates.

F. Nameplates shall be attached with corrosion-resistant No. 3 round head or No. 4 sheetmetal screws.

20 10 99 DUCTWORK IDENTIFICATION

A. Supply, return and exhaust ductwork uninsulated or insulated, exposed or concealed, shall be identified as specified herein, except for exposed ductwork in finished areas.

B. Markers shall be installed in clear view; installed on both sides of the duct; run parallel to the ductwork; located at not more than twenty-five foot (25') intervals on straight runs at all branch locations; and located on each side of penetrations of the building structure and non-accessible enclosures.

C. Markers shall be pressure sensitive vinyl tape labeled for service and direction of airflow. Minimum size shall be 2" high x 8" long.

D. Supply, return, exhaust and outdoor air ductwork labels shall be blue with white letters. Hazardous exhaust air ductwork labels shall be yellow. Outdoor air labels shall have an "air" legend.

20 10 100 CONTROL DEVICES IDENTIFICATION

A. The materials specified herein Section 20 10 90 shall apply to Division 25 Temperature Control Systems. Additional identification work is specified in Division 25.

20 20 10 ELECTRICAL REQUIREMENTS

20 20 11 GENERAL

A. This Subsection specifies the basic requirements for electrical components which are an integral part of “packaged” mechanical equipment. These components include, but are not limited to, factory installed motors, starters, disconnect switches, control panels and related prewiring of power and control wiring for a single external electrical service connection. All material and equipment shall be provided for the application and service intended.

B. Specific electrical requirements (e.g. horsepower, electric characteristics, etc.) for mechanical equipment shall be specified within the respective equipment specifications or shall be scheduled on the Plans.

C. The Contractor shall verify that electrical characteristics of material and equipment furnished for Divisions 20 - 25 equipment are in accordance with the electric service and comply with the specifications and requirements of Division 26 - 29.

D. Unless otherwise specified as an integral part of packaged mechanical equipment, motor control centers, motor starters and disconnect switches and the power wiring from power source to motor starting equipment (including variable frequency drive packages) and wiring from that equipment to the respective motors including final connections shall be performed as Electrical Work of Division 26 - 29.

E. The field installation of electrical components, not included in Division 26 - 29, that are specified to be provided with the mechanical equipment and are shipped separately shall be the responsibility of the Contractor furnishing the base equipment.

F. All electrical components and material shall be UL labeled.

G. Submittals for the applicable electrical equipment shall include the following: identification of the equipment which the electrical material is to serve, application, voltage, phases, full load amperage, wattage and NEMA enclosure. For motors: horsepower, RPM, full load power factor and efficiency, frame size and service factor.

H. Identification of electrical components of mechanical equipment shall be in accordance with Subsection 20 10 90, “Basic Mechanical Methods - Identification”.

20 20 12 REFERENCES

A. Electrical material and equipment provided for Divisions 20 - 29 shall meet the applicable requirements of the latest accepted edition of the following codes and standards:

ANSI	American National Standards Institute
EEI	Edison Electrical Institute
IEEE	Institute of Electrical and Electronic Engineers
NEC	National Electrical Code
NEMA	National Electrical Manufacturers Association
UL	Underwriter's Laboratories, Inc.

A. The following are basic minimum requirements for all motors. Additional motors, more detailed and specific requirements may be specified with the respective equipment.

B. Single-phase motors shall be provided for all motors 1/2 HP or less, except as specified or scheduled otherwise and shall be of the permanent split capacitor (PSC) type.

C. Polyphase motors shall be provided for all motors 3/4 HP or larger, except as specified or scheduled otherwise with a minimum power factor of .85 at 65% of full load or shall be power factor corrected.

D. Multi-speed motors shall have dual windings wound to the speeds scheduled or specified.

E. Torque characteristics shall be sufficient to satisfactorily accelerate the driven load(s) with low in rush current.

F. Motor horsepower sizes shall be large enough so that the driven load shall not require the motor to operate in the service factor range.

G. Temperature rating: Rated for 40 deg. C environment with maximum temperature rise for continuous duty at full load of 40°C for open dripproof motors, 50°C for splash proof motors, and 55°C for totally enclosed motors (Class B insulation). Motors used with variable frequency drives/inverters shall have a Class B temperature rise with Class F insulation design to resist transient spikes, high frequencies, and short rise time pulses produced by inverters.

H. Starting capability: Frequency of starts as specified by the automatic control system. For manually controlled motors, not less than five (5) evenly time spaced starts per hour.

I. Service factor: 1.15 for polyphase motors and 1.35 for single-phase motors.

J. Motor construction:

1. NEMA standard frame sizes, general-purpose open dripproof (unless otherwise specified), continuous duty, Design “B” (unless “C” is required for high starting torque). Motor frame, end bells and conduit box shall be cast iron; stator windings shall be copper. Aluminum is unacceptable for any parts. Provide grounding lug in motor terminal box.

2. Motors located outdoors or otherwise exposed to water, dust, etc where an open motor would not be suited, shall be totally enclosed fan-cooled (TEFC).

3. Bearings: Ball or roller bearings with inner and outer shaft seals. Externally accessible inlet/outlet grease fittings. Where motors are enclosed within equipment, extend grease tubing to exterior of the enclosure. Bearings designed to resist thrust loading for drives producing lateral or axial thrust. Fractional horsepower, light duty motors may have sleeve bearings.

4. Overload protection: Built-in thermal overload protection.

5. Noise rating: Motors shall meet IEEE, Standard 85.

6. Efficiency: Motors shall be NEMA Premium Efficiency per NEMA Standards Publication MG 1-2003, Table 12-12 and 12-13.

7. Nameplate: Indicate full identification of manufacturer's name, model number, serial number, horsepower, speed, voltage, characteristics, construction, special features, etc. Nameplates in harsh environments such as for cooling towers, or in pool equipment rooms, etc. shall be suited to the specific application.

8. Acceptable manufacturers: Baldor, General Electric, Gould, Marathon, Magnetek, Reliance, Siemens, Toshiba, and U.S. motors.

20 20 14 MOTOR CONTROLS

A. Motor Starters: NEMA 1, general-purpose enclosures with padlock ears, unless specified other wise. Type, size and duty shall be as specified or as recommended by the motor manufacturer and the requirements of the driven equipment for applicable protection and start-up conditions.

B. Manual Starters: Pilot light and extra positions for multi-speed motors. Melting alloy type thermal overload relay protection.

C. Magnetic Starters: Hand-off-Auto selector switches, pilot lights, interlock contacts, switches and other devices as required for control requirements. Trip-free thermal overload relays for each phase. Built-in 120 volt control circuit transformer, fused from line side, where power service exceeds 240 volts. Externally operated manual reset; under-voltage release of protection.

D. Acceptable Manufacturers: Allen-Bradley, Cutler-Hammer, General Electric, Square D.

20 20 15 DISCONNECT SWITCHES

A. Fusible: For 3/4 horsepower and larger. Disconnect switch shall be horsepower rated, heavy duty, spring reinforced fuse clips each phase, quick-make/quick-break mechanism with arc quenchers, dead front line side shield, solderless lugs, silver electroplated current carrying parts, lockable hinged door, capacity and electric characteristics as specified.

B. Non-fusible: For 1/2 horsepower motor and smaller. Disconnect switch shall be horsepower rated, toggle switch type, quantity of poles and voltage rating as specified.

20 20 16 MULTI-SPEED MOTORS AND CONTROLS

A. Multi-speed motors, when required, shall be specified under the heading of the respective equipment to be driven.

B. Motor controls for multi-speed applications shall be specified, also, under the heading of the respective equipment, if said equipment is a “packaged” type unit.

C. Otherwise, multi-speed motor controls shall be specified in Division 16.

20 20 17 VARIABLE SPEED DRIVES

A. Motor controls for variable speed drives shall be specified under the heading of the respective equipment, if said equipment is a “packaged” type unit.

B. Otherwise, variable speed drives shall be specified in Division 26.

20 20 18 CONTROL PANELS

A. NEMA 1 general-purpose enclosure for indoor application; NEMA 3R weather resistant enclosure for exterior location.

B. Factory mount panel(s) and internal power and control devices. Pre-wire all devices for the operation of the related equipment so that only one main power connection shall be required in the field.

C. Provide internal protection for each circuit, maximum 120-volt secondary control transformer(s), terminal strips for wiring terminations, identification of components and wiring diagram inside the cover.

20 20 20 DRIVES AND GUARDS

20 20 21 GENERAL

A. This Subsection covers V-belt, sprocket-chain, gear and direct coupled drives.

B. All drives shall be selected for 150% of specified motor nameplate horsepower.

C. All drives shall be installed, balanced and aligned in accordance with the respective manufacturer's instructions and recommendations.

20 20 22 V-BELT DRIVES

A. All motors shall be provided with variable pitch pulleys with design RPM at mid-range of adjustment.

B. V-belts shall be premium quality, endless cord impregnated rubber with trapezoidal cross section, type A, B, C or D, matched set (if more than one), 95% minimum drive efficiency.

C. The driving motor shall be installed on an adjustable bolt device to provide for belt tension adjustment.

D. Acceptable manufacturers:

1. V-belt drives: Browning, Eaton, Gates

20 20 23 DIRECT DRIVES

A. Wherever available, motors and related direct driven equipment shall be mounted on a common base.

20 20 24 GUARDS

A. All belts, chains, pulleys, shafts, sheaves, sprockets, gears, couplings, projecting setscrews, keys and any other rotating parts shall be provided with guards by the Contractor furnishing the base equipment.

B. Guards shall be designed and arranged in accordance with OSHA requirements.

C. Guards shall completely enclose the drive, shall be secured to the respective equipment and shall be removable for servicing. Wherever available from the manufacturer, guards shall be provided with the equipment. If not, these shall be field fabricated.

D. Provide reinforced openings with removable coverplates for access to motor and driven shafts for speed measurement.

E. Extend tubing for grease fittings inside the guard to accessible locations outside the guard.

20 20 25 INSTALLATION AND OPERATION

A. Install, balance and align all drives in accordance with the respective manufacturer's instructions and recommendations.

B. The balancing and alignment of drives including pinning, doweling and grouting shall be the responsibility of the Contractor furnishing the equipment. Any adversities arising from executing the Work shall be resolved/remedied by the Contractor.

C. Verify all electrical characteristics prior to running electric motor driven equipment. Check motor amperage draw and rotation for proper operation.

END OF SECTION

20 25 00 INSULATION

20 25 01 GENERAL

A. This Section specifies mechanical insulation of piping, equipment and ductwork.

B. The Plans, the general provisions of the Contract including the General, Supplementary and/or Special Conditions and specification sections of Division 1 shall apply to Work of Divisions 20 - 29 of the Specifications.

C. Provisions and conditions cited in this Section shall apply to Work for other sections of Divisions 20 - 29 of these Specifications.

20 25 02 REFERENCES, REGULATORY REQUIREMENTS

A. Work for this Section of the Specifications shall be performed in accordance with the Codes, Standards, etc. as identified in Division 20 in addition to the following:

1. State and local Air Pollution Codes and Regulations.

2. NFPA 255/UL 723/ASTM E-84 Surface Burning Characteristics of Building Materials.

3. UL 1479/ASTM E-814 Fire Test of Through-Penetration Firestops.

20 25 03 RELATED SECTIONS OF THE SPECIFICATIONS

Requirements of the following Sections of the Specifications apply to Work for this Section:

1. Division 20 - Basic Mechanical Conditions
2. Division 20 - Basic Mechanical Materials and Methods
3. Division 22 - Plumbing Work
4. Division 23 - HVAC Piping and Equipment
5. Division 23 - Air Distribution

20 25 04 DEFINITIONS

A. The term **"fitting"** where used in this Section of the Specifications shall be construed as an elbow, tee or reducer. Unions, flanges and valves shall not be considered as fittings.

B. The term **"cold"** shall be defined as the temperature of a surface that may result in the formation of condensation.

C. The term **"accessory"** shall include staples, bands, wire, mesh, clips, pins, studs, tape, anchors, corner angles, cements, adhesives, coatings, sealers, mastics, finishes, etc.

D. The term **"ASJ"** where used in this Section of the Specifications shall mean a reinforced vapor retarding All Service Jacket.

E. The term **"SSL"** where used in this Section of the Specifications shall mean Self-sealing Lap Joint closure system for longitudinal jacket joints.

F. The term **"supply air"** where used in this Section of the Specifications shall mean downstream of a coil.

G. The term **"outdoor air"** where used in this Section of the Specifications shall mean ambient air that has not been conditioned.

H. The term **"return air"** where used in this Section of the Specifications shall mean conditioned air that is returned from the space.

I. The term **"mixed air"** where used in this Section of the Specifications shall mean air streams that are a mixture of "outdoor air" and "return air".

J. The term **"relief air"** where used in this Section of the Specifications shall mean excess return air that relieved from the building.

K. The term **"exhaust air"** where used in this Section of the Specifications shall mean air that is removed due to contaminates, odors, or heat.

20 25 05 WORK INCLUDED

A. Furnish material, labor and services necessary for and incidental to the insulation of the following systems where shown on the Plans and as hereinafter specified. Include all necessary considerations in the related sections of the Specifications (Subsection 20 25 03) to perform the Work completely.

1. Chilled water piping.
2. Heating water piping.
3. Chilled/hot (heating) water piping.
4. Refrigerant piping [suction, hot gas/discharge, heat recycling and reheat].
5. Condensate drain piping.
6. Waste piping and floor drains located above grade serving condensate drains.
7. Make-up cold water piping.
8. Low pressure (15# and less) steam supply piping.
9. LP steam condensate return and condensate pump discharge.
10. Medium pressure (16# to 50#) steam supply piping.
11. MP and HP steam condensate return and condensate pump discharge.
12. Reheat coils.
13. Ductwork/sheetmetal systems.
14. Domestic hot, hot recirculating and cold-water piping.
15. Storm water drainage..

16. Miscellaneous: engine exhaust, high temperature hydronic piping, process piping, etc.
17. Chiller water boxes and miscellaneous chiller specialties.

B. Providing appropriate size calcium silicate/cellular glass/pipe shield manufactured inserts to the trade contractor for installation between the pipes and oversized hangers as specified in this section.

C. Fire wrapping piping system located in occupied spaces or plenum spaces that do not meet flame spread 25 and smoke development 50.

20 25 06 SUBMITTALS

A. The Contractor shall submit shop drawings for approval in accordance with Subsection 20 00 43, Duties of Contractor - Submittals.

B. Provide an INSULATION PRODUCT SCHEDULE consisting of the following minimum information:

Material - type of insulation material, jackets, or covers.

Manufacturer - manufacturers name, product name, and K-value where applicable.

Accessories - tapes, staples, coatings, adhesives including manufacturer's name and product name.

Systems - indicate systems where product is used.

C Provide an INSULATION THICKNESS SCHEDULE consisting of the following minimum information:

System - indicate which system insulation is installed.

Location - inside, outside, concealed, exposed, etc.

Size - indicate size range of pipe, insulation type used.

Thickness - indicate insulation thickness in inches.

D. Provide manufacturer's technical product data of each material and accessory item with engineering support information and recommended installation procedure. Indicate product number, “K” value, thickness and required accessories for each application.

E. At the completion of the project, submit a letter stating all materials are asbestos free, and meet the specified ASTM E-84 flame/smoke rating of 25/50, and that all piping and duct penetrations are smoke or fire stopped as required by the Code.

20 25 07 SPECIAL REQUIREMENTS

A. Contractor's Qualifications: Contracting company shall be one specializing in insulation application and have a minimum of three (3) years experience in this work.

20 25 10 INSULATION MATERIALS

20 25 11 GENERAL

A. Materials and accessories furnished for this Section of the Specifications shall be standard cataloged products, new, commercially available and suitable for the service specified.

B. Insulation material and/or accessories containing asbestos are prohibited.

20 25 12 FIRE SAFETY STANDARDS

A. All insulation material shall have composite fire and smoke hazard ratings in accordance with NFPA 255 and UL 723 not exceeding the following values as tested by the latest procedures of ASTM E-84: flame spread of 25; smoke developed of 50.

B. Accessories such as adhesives, mastics, cements, tapes and cloths for seams, joints and fittings shall have the same ratings as hereinbefore listed. All products and their respective shipping cartons shall have indications that flame and smoke ratings meet the aforementioned requirements. Any treatment of jackets or facings to impart acceptable flame and smoke safety values shall be permanent; water-soluble applications are prohibited. The Insulation Contractor shall bear responsibility that all products to be used meet the foregoing criteria.

20 25 13 TYPES OF INSULATION MATERIALS

The following types of insulation material are enumerated in the respective INSULATION MATERIAL SCHEDULE. K values listed are in units of (Btu in/hr ft.2 °F) and are based on specific products and are to be met or exceed. ANSI/ASTM types or class shall not provide relief for any K value specified.

A. Type CS: Hydrous calcium silicate, molded pipe or block form, asbestos free, ANSI/ASTM C533, Type I, “k” value of 0.41 at 200 degrees F for pipe, “k” value of 0.39 at 200 degrees F for block, density of 15#/cubic foot. Owens-Corning Calcium Silicate or equivalent by Knauf, Manville or Pabco.

B. Type GF1: Glass fiber, non-combustible, preformed for pipe and tube application, ANSI/ASTM C547, Class 1, “k” value of 0.23 at 75 degrees F. Owens-Corning type ASJ with SSL-II vapor retarder jacket or equivalent by CertainTeed, Knauf, Manville or Schuller.

C. Type GF2: Glass fiber, non-combustible, rigid board with vapor retarder facing, ANSI/ASTM C612, “k” value of 0.24 at 75 degrees F, density of 3#/cubic foot. Owens-Corning type 703 with ASJ 25 jacket or equivalent by CertainTeed, Knauf, Manville or Schuller.

D. Type GF3: Glass fiber, flexible blanket, laminated to reinforced kraft vapor retarder facing, ANSI/ASTM C553, Type II, "k" value of 0.27 at 75 degrees F, density of 1#/cubic foot. Owens-Corning type 100 All-Service faced duct wrap or equivalent by CertainTeed, Knauf, Manville or Schuller.

E. Type F1: Flexible elastomeric foamplastic with smooth exterior surface, preformed for pipe and tube application, ASTM C534, Type I, "k" value of 0.28 at 75 deg. F. Armstrong AP Armaflex pipe insulation or Rubatex R-180-FS.

F. Type F2: Flexible elastomeric foamplastic with smooth exterior surface, sheet material, ASTM C534, type II, "k" value of 0.28 at 75 degrees F. Armstrong AP Armaflex sheet material or Rubatex R-1800-FS.

G. Type FG: Rigid foamglass preformed for pipe applications ANSI/ASTM C552, K value of 0.33 at 75°F with all-purpose vapor retarder jacket. Pittsburgh Corning Foamglass.

H. Type PI: Polyisocyanurate preformed for pipe applications, aged "k" value of 0.19 at 75 degrees F, density of 2#/cubic foot. Saran 560 vapor barrier.

20 25 14 TYPES OF PIPING JACKET MATERIALS **<EDIT TO SUIT PROJECT REQUIREMENTS>**

A. 0.016" aluminum or 0.010" stainless steel jackets with moisture barrier shall be cut and fitted to size required. Fold a ½" safety edge on exposed side, roll to diameter required and secure with ½" x 0.020" aluminum or ½" x 0.015" stainless steel bands respectively on 9" centers (4 bands per 3 foot section of jacketing). Provide appropriate seals, and shed water toward low end of pitched piping. Install lap on top quadrant (2 or 10 o'clock position) of outside diameter of insulation and line up bands and seals to present neat and workmanlike appearance. Fitting covers shall be consistent with piping insulation jacketing. Secure in place with SS screws or banding. Seal with approved caulking. Sharp edges shall be turned under or otherwise protected.

B. PVC jacketing 0.030" thick for pipe insulation and PVC fitting covers shall be applied over the insulation and vapor barrier system where indicated below for aesthetics or mild abuse areas.

C. Finish piping insulation with factory or field application for respective locations as follows:

1. Dry, low abuse: (indoor)
   Concealed, not exposed to view.
   Mechanical equipment room.
   Exposed, finish space.

   Pipe: ASJ jacket.
   Fittings: Pre-molded PVC covers.

2. High abuse area:
   Exposed vertical risers in all Storage Rooms, Janitor Closets.
   Exposed, unfinished space.

   Pipe: Stainless steel jacket with seam away from abusive force. Apply to height of 8 feet.

Fittings: Formed stainless steel covers.

3. Outdoors: All
   Pipe: Smooth aluminum jacket with seam on topside at 2 or 10 o'clock position of horizontal runs.

   Fittings: Formed aluminum covers.

4. Wet areas: <Describe Areas>
   (indoor)

   Pipe: PVC cover.
   Fittings: Pre-molded PVC covers.

20 25 15 DELIVERY AND STORAGE OF MATERIALS

A. All of the insulation materials and accessories covered by this specification shall be delivered to the job site and stored in a safe, dry place with appropriate labels and/or other product identification.

B. The Contractor shall use whatever means are necessary to protect the insulation materials and accessories before, during, and after installation. No insulation material shall be installed that has become damaged in any way. The Contractor shall also use all means necessary to protect work and materials installed by other trades.

C. If any insulation material has become wet because of transit or job site exposure to moisture or water, the Contractor shall not install such material, and shall remove it from the job site. An exception may be allowed in cases where the Contractor is able to demonstrate that wet insulation when fully dried out (either before installation, or afterward following exposure to system operating temperatures) will provide installed performance that is equivalent in all respects to new, completely dry insulation. In such cases, consult the insulation manufacturer for technical assistance and provide the Architect/Engineer with a copy of manufacturer's recommendation for approval.

20 25 16 ACCEPTABLE MANUFACTURERS

The following are acceptable manufacturers for products specified in this section of the specification.

A. Metal jackets:

1. Childers Products Co., Inc.
2. Insul-Coustics
3. Pabco Surfit Metal Corp.
4. RPR Products, Inc.

B. PVC covers:

1. Proto Corp.
2. Ceelco Corp.
3. Speedline PVC Corp.

C. Adhesives and Coatings

1. Alpha Associates
2. Miracle Adhesives
3. Vimasco Corporation

D. Fasteners

1. ACS Industries
2. GEMCO
3. Midwest Fasteners

E. Fire Stop

1. 3M
2. Metacaulk
3. Specified Technologies, Inc.
4. USG Interior, Inc.

20 25 20 INSULATION MATERIAL SCHEDULES:

20 25 21 INSULATION MATERIAL SCHEDULE I-1

A. Service: Hot and cold piping	thickness	insulation material
1. Chilled water supply and return piping		
2” and smaller	¾”	Type PI, F1
2-1/2” through 5”	1”	Type PI, F1 (Contractor's option)
6” and larger	1-1/2”	Type PI
2. Hot water (heating) supply and return		
all sizes	1-1/2”	Type GF1, F1 (Contractor's option)
3. Low pressure steam condensate return piping including condensate pump discharge		
1-1/4" and smaller	1-1/2”	Type GF1
1-1/2” and larger	2”	
4. Low pressure (15# and less) steam supply		
2” and smaller	1-1/2”	Type GF1
2-1/2” thru 6”	2”	
8” and larger	2-1/2”	
5. Medium pressure (16# to 50#) steam supply		
3/4” and smaller	1-1/2”	Type GF1
1" and 1-1/4"	2-1/2”	
1-1/2” thru 4”	3”	
6” and larger	3-1/2”	

6. Electrically heat traced piping, all sizes.	1-1/2”	Type as specified for the system.

7. Domestic water- hot, hot recirc.			
2" and smaller	1"	Type GF1, F1 (Contractor's option)	
2-1/2" and larger	1-1/2"	Type GF1	
8. Domestic water-cold	½"	Type F1, GF1 (Contractor's option)	
9. Storm water from the roof drain to the first floor level below the roof. Thereafter, all horizontal piping only and related elbows to vertical. Insulate drain body with ½" sheet Armaflex.	1"	Type GF1	
10. Refrigeration Piping:			Type F1
Suction - 2" and smaller	¾"		
2-1/2" and larger	1"		
Hot gas/discharge - All sizes where piping is 8'-0" or less AFF	¾"		
11. Waste Piping and Floor Drains:	1/2"		Type F1
Piping above grade serving floor drains, hub drains, indirect cabinets, etc., that receive condensate from cooling coils. Insulate piping to where it connects to main waste pipe.			
12. Sump Pump Discharge Lines:	½"		Type F1

B. Fittings (hot and cold): Molded/preformed fittings, secured in place with twine or tape, seal all "cold" applications prior to installing jacket material.

C. Unions, flanges: Type F1, same thickness as adjacent piping.

Valves: (cold piping) Form external collar, minimum 1" overlap on adjacent insulation. Use adhesive to secure in place and maintain vapor barrier.

D. Unions, flanges: No insulation.

(hot piping)

E. Valves (hot piping): Insulate valve body only.

F. Joints: Lines subject to condensation: seal longitudinal laps of jacket with adhesive and wrap butt joints between sections with 2” wide tape.

20 25 23 INSULATION MATERIAL SCHEDULE I-2

A.	Service: "Hot" equipment	thickness
B.	Steam condensate receivers	2"
C.	Condensate and flash tanks	2"
D.	Hot water pump impeller housings	2"

E. Insulation Material: Type GF2

Option #1: Owens-Corning type ASJ w/ SSL jacket for round surfaces

Option #2: Owens-Corning Pipe & Tank Insulation for round surfaces

F. Flanges: No insulation.

G. Attachment: Secure rigid board with welded pins on 12" centers.

Secure with ¾" x 0.020" SS bands on 12" centers. Fit ends of tanks and irregular surfaces by segmenting or scoring board and wiring into place.

H. Joints: Point and fill-in all joints and voids with insulating cement or fill-in all joints and voids by stuffing with mineral wool.

I. Finish: 0.016" smooth aluminum jacket with moisture barrier, secured with ½" x 0.015" SS bands on 9" centers and SS sheet metal screws.

20 25 24 INSULATION MATERIAL SCHEDULE I-3

A. Service: Ductwork, 0 to 250 degrees F.

Location	Thickness

B. Unconditioned Spaces and Mechanical Rooms

1.	Supply Air, Heated or Cooled Make-up/Ventilation Air	1-1/2”
2.	Return Air	1-1/2”
3.	Outdoor Air and Mixed Air	1”
4.	Outdoor Air and Mixed Air Plenums, and Filter sections	1”
5.	Relief Air	N/A
6.	Exhaust Air	N/A

<You may want to add Insulation on exhaust air for Heat Recovery Ducts>

C. Conditioned Spaces and Return Air Plenums

1.	Supply Air, Heated or Cooled Make-up/Ventilation Air	1”
2.	Return Air	N/A
3.	Outdoor Air and Mixed Air	1”
4.	Outdoor Air and Mixed Air Plenums, and Filter sections	1”
5.	Relief Air	N/A
6.	Exhaust Air	N/A
7.	Supply air devices not in RA plenums	1” F2

D. Outside of the Building Insulation Envelope

1.	Supply Air, Heated or Cooled Make-up/Ventilation Air	2”
2.	Return Air	2”
3.	Outdoor Air and Mixed Air	N/A
4.	Outdoor Air and Mixed Air Plenums, and Filter sections	N/A

<You may want to insulate OA, MXA, Plenums if condensation could be a problem>

5.	Relief Air	N/A
6.	Exhaust Air	N/A

E. Insulation Material

1.	Rectangular ducts	Type GF3
2.	Round and Oval Ducts	Type GF3

20 25 30 INSULATION APPLICATION

20 25 31 INSULATION APPLICATION - GENERAL

.1 Respective piping system, duct system and/or equipment shall be pressure tested, proved tight and accepted, as specified in section for installation of such, before insulation is applied. Sheet metal ductwork joints shall be sealed prior to insulating. Coordination among the respective contractors is essential.

.2 Insulation materials and accessories shall be applied in accordance with respective manufacturer's recommendations and recognized industry practice for the insulation to

serve its intended purpose. All surfaces to receive insulation shall be clean, dry, free of oxidation and prepared as required.

.3 The insulation work shall be subject to inspection during the various applications and construction phases. Material, accessories, finishes, methods and workmanship that are not in compliance with these Specifications and/or approved submittals may lead to rejection of the Work and replacement at the Contractor's expense.

.4 Tie-ins to existing systems and all new work shall be insulated to provide a complete and functional system. Finishes shall be compatible wherever possible.

.41 When existing insulation thickness is different than the specified thickness herein, the Contractor shall notify the Architect/Engineer. It is the intent that the existing piping would be restored to its original condition (thickness and finish) as if new work had not been performed.

.5 Where heat tracing is utilized for piping and/or equipment shall be installed, tested and accepted before insulation is applied.

20 25 32 INSULATION APPLICATION - PIPING

.1 Insulate each piping section with single thickness full-length units of insulation, with a single cut piece to complete the run where a fitting is encountered. Do not use cut pieces or scraps abutting each other.

.2 Extend piping insulation without interruptions through walls, floors, and similar piping penetrations, except where otherwise specified.

.3 Insulation on unions, flanges, valves, strainers, expansion joints, pump impeller housings and other equipment requiring accessible servicing shall be removable and reusable without damage. Items requiring periodic attention shall have covers and/or casings to contain the insulation.

.4 All “cold” piping systems shall be insulated with type and thickness of material herein specified and shall have a continuous vapor retarder through all fittings, hangers, supports and sleeves.

.5 In cold systems flanges, unions, valves, etc., shall be covered with an oversized pipe insulation section sized to provide the same thickness as on the main piping section. An oversized insulation section shall be used to form a collar between two insulation sections with low-density blanket insulation being used to fill gaps. Jacketing shall match that used on main piping system. Rough cut ends shall be coated with suitable weather and/or vapor resistant mastic as required by the system location and service. All valve stems must be sealed with caulking that allows free movement of the stem but provides a seal against moisture incursion.

.6 In hot system flanges, unions, valves, etc., shall be left exposed; insulation ends shall be tapered and sealed to allow bolts to be removed or other required access.

.7 The installation of cold piping systems shall use oversize (outside the thickness of the insulation) pipe hangers.

.71 Piping systems 3" and smaller, the Insulation Contractor shall replace temporary wood blocking with insulation of thickness as scheduled in this section of the specification. Metal pipe shields shall be placed between the pipe hanger and the insulation.

.72 Piping systems 4" and larger, the Insulation Contractor shall replace the temporary wood blocking with high density pre-formed insulation (i.e. calcium silicate, cellular glass) inserts with suitable characteristics for the weight, temperature and application and insulation protection shields at each hanger. The specified insulation should stop and start at the insert at the hanger locations. The insert shall be wrapped with vapor barrier jacketing. Circumferential joints shall be taped with vapor barrier tape and coated with vapor barrier sealant. B-Line, or equivalent, figure B-3380 through B-3384, 360 deg. calcium silicate insert/shields and figure B-3153 protection shields may be used or equivalent may be field fabricated per details submitted for approval.

.73 If in the event pipe hangers are not oversized, this Contractor shall notify the Engineer and the Contractor(s) who provided and/or installed hangers. Hangers shall be corrected before pipe is insulated.

.74 Where size on size hangers have been approved by the Engineer in writing for use in special situations, the insulator shall insulate the hanger and hanger rod with ½" Type F insulation. Pipe insulation shall terminate at each side of the hanger and have vapor barrier end joint butt strips. Hanger insulation shall overlap pipe insulation a minimum of 4" on each side of the hanger and secured to the pipe insulation with contact adhesive. Hanger rods shall be insulated for a minimum of 12" secured to the rod with contact adhesive and the end sealed with a bead of caulk.

.75 The Contractor shall adjust hangers after the insulation and pipe shields have been installed to provide an evenly supported piping system. No hanger shall bear the entire weight or not carry any weight of piping system.

.8 Special requirements for fiberglass pipe insulation:

.81 Fiberglass pipe insulation, All Service Jacket/Self Sealing Lap (ASJ w/SSL) type, shall be installed with laps positioned to shed water, position at either 10 o'clock or 2 o'clock and shall not be visible to view. End joint butt strips shall be installed on all piping with ½" adhesive to adhesive overlap.

.82 For piping systems using fiberglass insulation, the fittings shall be insulated with: double thickness molded fiberglass fittings, or preformed cellular glass fittings secured with twine or wire; or with flexible elastomeric foamplastic; at the Contractor's option. The pre-molded PVC fitting covers shall be installed over the fiberglass inserts and secured with SS tacks. Victaulic fittings or couplings shall be insulated with sheet elastomeric foam plastic insulation formed to the fitting and formed "collars" over all couplings encountered.

.83 For piping systems using fiberglass insulation, butt joints in hot piping shall be made with 2" wide vapor barrier tape over butt joints. Butt joints in cold piping shall be made with a wet coat of vapor barrier lap cement on butt joints and seal joints with 2" vapor barrier tape. All pipe insulation ends shall be tapered and sealed.

.84 On "cold" applications only, the following additional requirements shall apply: the premolded fittings shall be sealed with an approved vapor barrier retardant prior to installing the jacket materials. Premolded PVC fitting covers shall then be installed over the premolded inserts, all joints shall be sealed with vapor barrier cement and 2" vapor

barrier tape on lap joints. Premolded stainless steel or aluminum fitting covers shall be installed per the manufacturer's instructions and a bead of clear silicon caulk applied to all joints. Straight lengths of insulation abutting all fittings shall have both ends sealed with vapor barrier cement to prevent “wicking” or moisture migration. At a maximum of twenty-one foot (21') intervals, joining ends of the butt joints shall be sealed with vapor barrier cement prior to butting together to prevent “wicking” or moisture migration.

.9 For piping systems using elastomeric foamplastic insulation, joints and seams shall be sealed with manufacturer's recommended contact adhesive. Fittings shall be insulated from segments fabricated from pipe insulation or sheet material, secured and sealed with contact adhesive. Termination points and ends shall be sealed to the pipe to prevent backflow of condensation on the inside of the insulation. Any piping outdoors or otherwise exposed to UV or ozone provide two (2) coats of WB Armaflex or Rubatex 374 finish.

20 25 33 INSULATION APPLICATION - EQUIPMENT

.1 Manufactured equipment (i.e. air handling equipment, terminal units, air device plenums, etc.) requiring insulation shall be specified in the respective equipment specifications to be factory insulated with internally applied liner or double wall casing.

20 25 34 INSULATION APPLICATION - DUCTWORK

.1 Ductwork systems shall be insulated in accordance with the insulation schedules. Insulate each duct section with single thickness full length pieces. Do not use scraps abutting each other.

.2 Extend insulation without interruptions through walls, floors, and similar penetration, except where otherwise specified.

.3 “Cold” duct systems shall have insulation with a continuous vapor retarder through all fittings, hangers, supports, air devices, fire dampers, duct mounted coils, dampers, and other devices in the ductwork system, etc.

.4 VAV box reheat coil headers shall be insulated with the ductwork to maintain a continuous vapor barrier.

.5 In “cold” duct systems, using rigid board or sheet elastomeric foam insulation, support angles, stiffener angles, ductmate flanges, etc. they shall be covered with an oversized insulation strip sized to provide the same insulation thickness as on the duct. Provide a minimum of 2” of overlap on each side of the obstruction.

.6 Board insulation shall be properly cut and dry fitted to the surface to be insulated. Edges shall be neat and clean cut. No intermediate cut pieces shall be allowed on the bottom and sides of the ductwork. Insulation board shall be secured in place using mechanical fasteners such as welded pins or speed clips. Locate not less than 3” from each edge or corner and approximately 12” on centers on all sides. There shall be a minimum of two (2) rows of pins on the bottom of the duct and one (1) on the sides. Additional pins may be needed on the bottom to prevent sagging. All seams, joints, penetrations and breaks in the vapor retarder jacket shall be sealed with pressure sensitive tape matching insulation facing. Edges shall be provided with 28 ga. 1” x 1” aluminum corner beading properly secured and shall have the same facing material as the insulation board.

.7 Flexible duct wrap insulation shall be cut properly and fitted to “stretchout” dimensions and a 2” piece of insulation removed from the facing at the end of the piece to form an overlapping staple and tape flap. Insulation shall be installed with facing outside so tape flap overlaps facing at the other end. Insulation shall be butted tightly. Seams shall be stapled on 6” centers with outward clinching staples. Adjacent sections of duct wrap insulation shall be butted tightly with the 2” tape flap overlapping and stapled. For horizontal oval ducts over 30” wide, duct wrap insulation shall be secured additionally to the bottom of the duct with mechanical fasteners such as pins and speed clip washers spaced on 18” centers to prevent sagging. For rectangular ducts, mechanical fasteners such as welded pins or speed clips shall be located not less than 3” from each edge or corner and approximately 12” on centers on all sides. There shall be a minimum of two (2) rows of pins on the bottom of the duct and one (1) on the sides. Additional pins may be needed on the bottom to prevent sagging. All seams, joints, tears, punctures and other penetrations in the vapor retarder jacket shall be sealed with FRK backing pressure sensitive tape.

.8 Stop and point insulation around access doors and damper operators to allow operation without disturbing insulation.

.9 Where a duct run changes from interior lining to exterior application (or vice versa), there shall be a 6” overlap of insulation.

.10 In "cold" duct system with internal duct insulation, with 1 1/2 " thickness flexible duct wrap, insulate air devices, fire dampers, duct mounted coils, dampers, and other devices in the ductwork system that are not internally insulated.

.11 The back of supply air devices located above ceilings which are not return air plenums are to be insulated with Type F2 insulation in order to prevent sweating.

20 25 35 PVC PIPING INSULATION PLENUM FIRE WRAP

.1 Provide 1/2 inch minimum thickness fire resistant blanket wrap consisting of inorganic blanket encapsulated with a scrim-reinforced aluminum foil and overlap seam to provide a flexible, non-combustible enclosure for cables and PVC non-plenum rated pipe in return air plenums as tested to UL 910.

.2 Plenum Wrap shall be tested in accordance with the following:
ASTM C 411, ASTM C 518, ASTM E 84, ASTM E 136, and UL 910
• Maximum Flame Spread (Ft.) 0.01
• Maximum Smoke (Optical Density) 0.01
• Average Smoke (Optical Density) 0.00
Surface Burning Characteristics (ASTM E 84)

.3 Cut Fire Barrier Plenum Wrap to a length sufficient to wrap completely around the perimeter of the pipe, plus provide a longitudinal overlap of not less than 1 inch and an overlap of 1 inch, minimum, over the adjacent wrap section. Use aluminum foil tape to seal cut edges of the blanket. Temporarily secure Plenum Wrap in place using 3/4 inch wide filament tape. Install minimum 1/2 inch wide by 0.015 inch (28 gauge) thick stainless steel metal banding with stainless steel metal band clamp or 16 gauge galvanneal tie wire around the Plenum Wrap to hold it in place. Place the bands or tie wires 1/4 inch from each edge of the blanket and at the midpoint of the blanket, 11-3/4 in. on center. Tension

the banding or tie wire to hold the Plenum Wrap snugly in place, compressing the foil but not cutting the foil.

.4 PVC Piping Insulation Plenum Fire Wrap shall be 3M Fire Barrier Plenum Wrap 5A or approved equivalent.

END OF SECTION

21 00 00 FIRE PROTECTION SYSTEM

21 00 01 GENERAL

.1 This section specifies a hydraulically calculated fire protection system designed and installed by the Contractor as described on the drawings and hereinafter. Contractor shall modify the existing hydraulic designed sprinkler system as illustrated on the drawings for a new layout within the project area.

.2 It is the intent that the drawings and specifications shall describe and provide for a working installation complete in every detail and all items necessary for such complete installation shall be furnished whether specifically mentioned or not.

.3 The Plans, the general provisions of the Contract including the General, Supplementary and/or Special Conditions and specification sections of Division 1 shall apply to Work of Divisions 20 - 29 of the Specifications.

.4 Provisions and conditions cited in this Section shall apply to Work for other sections of Divisions 20 - 29 of these Specifications.

21 00 02 REFERENCES, REGULATORY REQUIREMENTS

.1 Work for this Section of the Specifications shall be performed in accordance with the Codes, Standards, etc. as identified in Division 20 in addition to the following:

.11 National Fire Protection Association (NFPA) 13, 2007.

.12 The Local Authority having jurisdiction.

21 00 03 REFERENCES, RELATED SECTIONS of the SPECIFICATIONS

Requirements of the following Sections of the Specifications apply to Work for this Section:

.1 Division 20 - Basic Mechanical Conditions.

.2 Division 20 - Basic Mechanical Materials and Methods

21 00 04 DEFINITIONS

.1 The term **"layout"** where used in this Section of the Specifications shall mean drawings prepared by the Contractor showing where all piping and heads are located. These drawings should include pipe elevations, need not include pipe sizes and should not include hydraulic calculations.

.2 The term **"Authority Having Jurisdiction"** or **"AHJ"** where used in this Section of the Specification shall mean the organization, office, or individual responsible for approving equipment, an installation, or a procedure.

.3 The term **"rhythm"** where used in this Section of the Specifications shall mean spaced in a manner which would place the heads at the same location with respect to lights or diffusers (i.e., for a row of lights spaced at 12' centers heads shall also be on 12' centers so that the heads will remain the same number of ceiling tiles or distance away from the

lights; where there is an odd number of tiles between lights or diffusers, it is also preferable to have heads located at the tile centered between them).

.4 The term **"working drawings"** where used in this Section of the Specifications shall mean drawing of the quality and containing all information as which would be required for approval by local official and for field construction.

21 00 05 WORK INCLUDED

.1 Furnish material, labor and services necessary for and incidental to the installation of the following systems where shown on the Plans and as hereinafter specified. Include all necessary work in the related sections of the Specifications (Subsection 21 00 03 to perform the Work completely.

.2 Furnish and install a complete hydraulically engineered extension of the building fire protection system including the relocation of existing heads on existing branch lines.

.3 Verify actual water supply with a test, preferably witnessed or performed by the local fire official.

.4 Contractor shall coordinate his work with the work of other trades, and with the architectural and structural drawings.

21 00 06 SUBMITTALS

.1 The Contractor shall prepare submittals for approval in accordance with Subsection 20 00 43, Duties of Contractor - Submittals.

.2 Submit "Layout drawings" and equipment cut sheets with 30 days from the General Contractor's contract date.

.3 Contractor shall submit "Working drawings" coordinated with the other trades for review prior to any fabrication or installation and prior to the General Contractor's fourth partial pay request.

21 00 07 SPECIAL REQUIREMENTS

.1 The Contractor preparing the drawings and calculations shall be NICET Level 3 certified or a Professional Engineer licensed in the State of Illinois whichever is required by the Authority Having Jurisdiction.

.2 All equipment shall be U.L. Listed or F.M. approved for use in fire protection systems.

21 00 08 CLOSE-OUT REQUIREMENTS

.1 Reference Section 20 00 48.

.2 Where NFPA maintenance information is utilized, it shall be edited to contain only information that is relevant to this project.

21 00 10 DESIGN

21 00 11 WATER SUPPLY

.1 The water supply shall be a connection to the (City, private, storage tank, etc.) water supply.

.2 A new flow test witnessed by the Fire Marshal shall be conducted.

.3 This information is provided for general information only.

.4 Design water pressure requirements shall include a minimum of 10-psi safety factor. Where Authority having jurisdiction requires a higher safety factory it shall be used.

21 00 12 LAYOUT - GENERAL to all SPRINKLER SYSTEMS

.1 The “layout” shall be submitted to the Architect prior to performing hydraulic calculation, sizing pipes or seeking approvals from the authority having jurisdiction.

.2 The Architect/Engineer will review “layout” for aesthetics, and pipe routings for consistency with the construction documents.

.3 Minimum head spacing shall be as per NFPA-13 additional heads may be required by the Architect/Engineer to create spacing that works with the reflected ceiling plans. Contractor shall layout any areas not shown on the plans with symmetry and “rhythm” in mind.

.4 Heads shall be on return bends and centered ± 1” for 2' x 2' ceiling tiles, or on quarter points ± 1” for 4' x 2' ceiling tiles.

.5 Contractor shall not scale the drawing, refer to architectural drawings for dimensions. Where the room dimension is at the maximum size listed for the sprinkler heads, install an additional row of sprinklers.

.6 Contractor shall locate heads in the field from the final wall locations. It shall be brought to the Architect’s/Engineer’s attention where the center of tile location exceeds the maximum distance of the sprinkler. Additional heads shall be added and the layout modified as directed by the Architect/Engineer at no additional cost to the Owner.

.7 All sets and rises shall be located above ceilings of adjacent spaces of rooms without ceilings as opposed to making the sets and risers in the exposed spaces.

.8 Inspector test connections and auxiliary drains shall be piped to spaces not occupied by building occupants, i.e., Mechanical Rooms, Storage Rooms, Janitor's Closets, etc.

21 00 13 APPROVALS

.1 Submittal drawings shall show lights, ducts, and pipes indicating all necessary rises and drops in sprinkler piping required for routing. Drawings shall be of a minimum of the same scale as the contract documents ¼” = 1'-0” scale.. A ¼” scale drawing of the service entrance and an elevation of the service entrance shall be required. A sprinkler riser diagram showing all control valves, test connections, supervisory switches, and drains shall be required.

.20 The “layout” submittals shall contain a CAD drawing and pdf of piping layout. Equipment cut sheets shall also be provided at this time.

.21 Any pipe sizing or hydraulic calculations performed prior to the Contractor receiving the “layout” submittal with the 'approved stamp' of the Engineer shall be at the Contractor's own risk. Any design changes resulting in resizing pipe and/or revising hydraulic calculations will be done at no cost to the Owner.

.30 The “working drawing” submittals shall contain a CAD drawing and pdf of piping layout and at least two (2) copies of hydraulic calculations. Calculations shall include peaking information for each area calculated. The hydraulic calculation used for the system design shall be clearly identified from all other hydraulic calculations and should show the safety factor the designed system has relevant to the available water test pressure.

.31 Hydraulic calculations shall include: actual pipe internal diameters and coefficients of materials approved in the “layout” submittal; design density; remote area size; and area per sprinkler.

.40 The Contractor shall not pursue any approvals or interpretations of the design documents except through the office of the Architect/Engineer.

.50 All work shall meet the requirements of the Owner, authority having jurisdiction, Architect and Engineer. These requirements may be greater than required by NFPA. Work shall not start prior to the Contractor receiving the “working drawing” shop drawings with the 'stamp' of the Engineer and approval from the authority having jurisdiction.

21 00 14 TESTING

.1 Preliminary testing witnessed by the Architect/Engineer shall be conducted to assure proper operation before the final test is scheduled. Prior to this testing, pipes shall be flushed, hydrostatically tested, and all valves and devices shall be operated. All requirements of “System Acceptance” of NFPA 13 shall be met in full.

.2 The sprinkler system shall be final Acceptance tested in the presence of the Owner's Representative and the governing agencies having jurisdiction for approval.

21 00 15 ACCEPTANCE

.1 Acceptance test performed as described above.

.2 Contractor shall fill out completely and sign Contractor's Material and Test Certificate provided in NFPA-13 and submit to Engineer for approval and thus system acceptance.

21 00 16 SPACE CLASSIFICATION

.1 The most stringent of NFPA-13, local practices, or the following criteria shall be used in the sprinkler system design and hydraulic calculations.

1) Light Hazard:

Offices

Toilet Rooms
Lobby/Commons Area
Corridors
Meeting Rooms
Vestibules
Hospitals

2) Ordinary Hazard, Group 1:

Mechanical Rooms
Elevator Equipment Room
Janitor's Closet

3) Ordinary Hazard, Group 2:

Storage

21 00 20 SERVICE ENTRANCE

21 00 21 PIPING MATERIAL and FITTING SCHEDULE

.10 Size: 2-1/2" and larger above grade.

.11 Pipe: Schedule 10 Steel, "listed" lightweight steel, or Schedule 40 steel at the Contractor's option.

.12 Fittings: Butt-welded, groove-end, forged steel flanged.

.13 Joints: Butt welded, groove-end couplings, flanged.

.14 Tests: Hydrostatically at not less than 200 psi for two (2) hours per NFPA 13, Section 8-2.2.

.20 Size: 2" and smaller above grade.

.21 Pipe: Schedule 40.

.22 Fitting: Cast iron.

.23 Joints: Screwed, groove-end.

.24 Tests: Hydrostatically at not less than 200 psi for two (2) hours per NFPA 13, Section 8-2.2.

.30 Size: All below grade.

.31 Pipe: Ductile iron.

.32 Fitting: Ductile iron.

.33 Joints: Mechanical

.34 Tests: Hydrostatically at not less than 200 psi for two (2) hours per NFPA 13, Section 8-2.2.

.35 Provide adequately designed and sized concrete anchor/thrust blocks at all changes in direction and end points.

.36 Provide retainer glands where flanged ductile iron pipe is installed at point of building entry.

.4 The following types of fittings are prohibited: plain end couplings and fittings, saddle tee, Victaulic flange rings, and Victaulic reducing couplings.

.5 Pipe velocities shall not exceed 14 feet per second in any section of the piping system.

21 00 22 FLEXIBLE HOSES

.1 Connections to sprinkler heads shall be made with flexible piping as specified below:

.2 Contractor shall provide flexible piping connections to sprinkler heads installed in ceilings, walls, or ducts. System shall be UL listed and FM approved for the intended use.

.3 Flexible piping connections shall be factory, leak tested, fully welded, stainless steel (1" minimum internal diameter) corrugated pressure hose and braided stainless steel outer jacket. Units with mechanical fittings or o-rings will not be accepted. Maximum length shall be 48".

.4 Contractor may use straight hoses where space allows and shall use 90 degree elbow type where space does not allow straight type.

.5 Contractor shall provide brackets and mounting hardware required for the installation.

.6 Contractor shall use manufacturer's pressure drop data in hydraulic calculations.

.7 System shall be manufactured by Flexhead Industries, no substitutions allowed.

21 00 30 WET PIPE SPRINKLER SYSTEM

21 00 31 SPRINKLER HEADS

.1 All sprinkler heads are to be quick response liquid in glass bulb type, with a minimum of ½ inch orifice, ½ inch NPT, and a K factor of 5.65. Sprinklers have an orifice larger than ½ inch shall be ¾" NPT.

.2 In finished spaces with ceilings, concealed sprinklers with an adjustable white coverplate shall be used. Heads shall be equivalent to the Viking model Horizon Mirage, Star model Stealth S110, Central model Royal Flush Concealed, or Reliable model G4QR.

.3 In unfinished spaces or in concealed locations, upright and pendent sprinkler heads with a natural bronze finish shall be used. Heads shall be equivalent to the Viking Microfast Model M, Reliable model F1FR, or Star model SG.

.4 In finished spaces without ceilings the heads shall be the same as above with the addition of a white factory finish.

.5 Sidewall sprinklers where utilized in Unobstructed Construction shall be horizontal recessed type with a white factory finish. Heads shall be equivalent to Viking Microfast model M, Reliable HSW-1, or Star Galaxy model.

.6 Sprinklers located in other locations where they are likely to be damaged shall be furnished with wire guards.

.7 Temperature range and response time shall be suitable for the location and the expected heat release. Within a space all sprinklers should be the same Temperature Range and Response Time to avoid “skipping”.

21 00 32 AREAS SUBJECT to FREEZING

.1 At locations which are subject to freezing and where permitted by the Authority having jurisdiction provide “anti-freeze” fill loop with all required specialties including, but not limited to, fill cup, test valves, drain valve, and backflow preventer. At locations which the above is not permitted provide a dry pipe system.

21 00 60 SECTION NOT USED

END OF SECTION

22 00 00 PLUMBING WORK

22 00 01 GENERAL

.1 The Plans, the general provisions of the Contract including the General, Supplementary and/or Special Conditions and specification sections of Division 1 shall apply to Work of Divisions 22 of the Specifications.

.2 Provisions and conditions cited in this Section shall apply to Work for other sections of Divisions 22 of these Specifications.

.3 Each plumbing fixture, accessory, equipment item and specialty shall be installed in accordance with the respective manufacturer's recommendations.

.4 Plumbing fixtures, equipment and specialties shall be protected against damage in the period between installation and acceptance. Any item damaged shall be removed, repaired and/or replaced at no additional compensation.

.5 All operable devices and features of plumbing fixtures, accessories, equipment and specialties provided for in the Scope of Work of this Section shall be operated and proved to function satisfactorily for a period of eight (8) hours. Adjust, balance, lubricate as required, and instruct the Owner in the proper operation and maintenance of each device.

22 00 02 REFERENCES, REGULATORY REQUIREMENTS

.1 Work for this Section of the Specifications shall be performed in accordance with the Codes, Standards, etc. as identified in Division 20.

22 00 03 RELATED SECTIONS OF THE SPECIFICATIONS

The following sections of the Specifications apply to Work under this Section:

.1 Division 20 - Basic Mechanical Conditions and Basic Mechanical Material and Methods
.3 Division 25 - Temperature Control (for monitoring domestic water temperature)

22 00 04 DEFINITIONS

(none)

22 00 05 WORK INCLUDED

.1 Furnish material, labor and services necessary for and incidental to providing the following Plumbing Work where shown on the Plans and as hereinafter specified. Include all necessary work in the related sections of the Specifications (Subsection 20 00 43) to perform the Work completely.

.11 Sanitary waste system, including but not limited to, sanitary piping, vent piping, acid waste, acid vent piping, plumbing fixtures, floor drains, and cleanouts.

.12 Storm water drainage system, including but not limited to, storm water piping, roof drains, overflow drains, area drains, deck drains, subsoil drain, sump pump, and cleanouts.

.13 Potable domestic water system, including but not limited to, backflow preventers, pressure regulators, water meter, cold water piping, hot water piping, hot water return piping, and connection to all plumbing fixtures, equipment or specialties.

.14 Valved branches in the potable domestic water system with backflow preventers for extension under other sections of the specification for make-up water usage.

.15 Contractor shall coordinate his work with the work of other trades, and with the architectural and structural drawings.

.16 Draining, filling, and venting of all modified systems as required for the above work. This includes scheduling shutdowns with the Owner. (Refer to Section 20 10 70).

.17 Provide sufficient labor and resources required for the testing and balancing (Refer to Section 20 10 80) and for the commissioning process (Refer to Section 152300).

.18 Smoke stopping of all penetrations of pipes and firestopping of the same through fire rated partitions as shown on the architectural drawings including, but not limited to stairways, shafts, corridors, floors, roofs, and required exits. (Refer to Section 20 10 20).

.19 Cleaning and pressure testing equipment, piping, and accessories installed under this section of the specification. (Refer to Section 20 10 50).

.20 All seismic restraints for the above work. (Refer to Section 20 10 40).

.21 Installing accessories specified under other sections of the specification referenced in subsection 20 00 05.

22 00 06 SUBMITTALS (SEE SUBSECTION 20 00 43)

.1 The Contractor shall submit the following shop drawings for approval in accordance with Subsection 20 00 43 - Submittals.

.11 Piping materials and valves as specified in Piping Material Schedule(s) in subsection 22 20 00.

.12 All specified drains and overflows in subsection 22 30 00.

.13 All specified plumbing fixtures in subsection 22 40 00.

.14 All specified plumbing equipment in subsection 22 60 00.

.15 All specified plumbing specialties in subsection 22 80 00.

.16 All general items specified under Division 20 utilized in the installation of work required by this section of the specification.

.2 Provide manufacturer's technical product data of each material and accessory item with engineering support information and recommended installation procedure. Data shall be specific to product specified and clearly identified on all data sheets, which contains multiple models or sizes.

.3 At the completion of the project, submit a letter stating all materials are asbestos free, and meet the specified ASTM E-84 flame/smoke rating of 25/50, and that all piping and duct penetrations are smoke or fire stopped as required by the Code.

.4 Contractor shall submit coordination drawings to the Engineer for review prior to any fabrication or installation. (Refer to Section 20 10 50).

22 00 07 SPECIAL REQUIREMENTS

.1 Where lines installed under this section of the specification tie-in to existing lines Contractor shall verify all existing lines, their elevations and directions of flow before running any new lines.

.11 Contractor shall notify Architect/Engineer upon discovery if the new line cannot tie-in to the existing line due to location, elevation, or direction of flow.

22 20 00 PLUMBING PIPING SYSTEMS

.1 General

.11 Furnish and install the piping systems shown on the Plans and as hereinafter specified in the respective PIPING MATERIAL SCHEDULE. Include all necessary considerations in the related sections of the Specifications (subsection 22 00 05) to provide for complete systems.

.2 All drainage lines shall be flushed clean at the completion of the Work. Rod out any obstructions encountered.

.3 All domestic water lines shall be flushed clean at the completion of the Work. Refer to Section 20 10 56 – Cleaning of Piping Systems.

.4 Pressure test each respective piping system for tightness to the test pressure indicated without loss. Repair any leaks and retest, as required. If test pressure is not indicated, hydrostatically test to 1.5 times the system operating pressure.

.5 The Plans indicate the approximate location and arrangement of roughing-in for waste, vent and domestic water piping to serve the respective plumbing fixture, equipment and specialties. Final locations and arrangements shall be determined from approved shop drawings of the respective item.

.6 Provide approved backflow preventers in all branch lines in the domestic water system for connections to non-domestic applications.

.7 Main vents shall be the same size as waste lines and shall extend 12" minimum above the roof. Minimum vent thru the roof (VTR) shall be 3" size.

22 20 01 PIPING MATERIAL SCHEDULE P-1

.1 Service: Storm water drainage (ST), below grade.
Sanitary waste (SAN), and Vent (V), below grade.
Deck Drain (DD), below grade.

Piping within the building perimeter to 5' beyond the building limit.

.2 Design: Pressure: gravity vented.
Temperature: 140 degrees F.

.3 Pipe: Schedule 40 PVC solid core.

.4 Fittings: Schedule 40 PVC DWV.

.5 Joints: Solvent.

.6 Test: Pressure test at not less than 15 feet static head of water for two (2) hours minimum.

22 20 02 PIPING MATERIAL SCHEDULE P-2

.1 Service: Storm water drainage (ST), above grade.
Sanitary waste (SAN) and Vent (V), above grade.

Piping within the building perimeter.

.2 Design: Pressure: gravity vented.
Temperature: 140 degrees F.

.3 Pipe: Cast iron soil pipe, no-hub.

.4 Fittings: Cast iron, no-hub.

.5 Joints: Heavy duty, No-hub stainless steel coupling assembly, with neoprene rubber gasket.

.6 Flashing: Provide 6 #/SF sheet lead flashing consistent with the type of roof construction x 12" high for all vents-thru-roof (VTR), except for membrane type roofing only which flashing shall be provided by roofing contractor. Minimum VTR shall be 3" size (see also 20 10 26).

.7 Test: Pressure test at not less than 15 feet static head of water for two (2) hours minimum.

22 20 08 PIPING MATERIAL SCHEDULE P-3

.1 Service: Domestic water, above grade.
Includes cold water (CW), hot water (HW), hot water recirculating (HWR) and softened water (SW).
Sump pump discharge piping.

.2 Design: Pressure: 100 psig.
Temperature: 180 degrees F. max. for hot water only.

.3 Pipe: Copper, hard drawn, seamless, type L.

.41 Fittings: Wrought copper, solder ends.

.42 Dielectric Isolation union/union flanges between Fittings: water piping and non-copper connections and at all equipment connections.

.5 Flanges: Cast bronze, 125 psi.

.6 Joints:

All 95/5 Solder

.7 Valves:

.71 Shut-off/Service:

3" and smaller Ball valve, bronze body, two piece, full port, stainless steel ball and trim.
4" and larger Gate valve, Class 125 cast iron body, bolted bonnet, non-rising stem, resilient wedge.

.72 Balancing/Throttling:

3" and smaller "Circuit Setter"

.73 Check Valve:

3" and smaller Class 125 bronze, horizontal swing, Y-pattern, regrinding type, renewable seat and disc, solder ends.
4" and larger Class 125-iron body, bolted bonnet, horizontal swing, renewable seat and disc, bronze mounted, flanged ends.

.74 Hose End Valve: Interior: 3/4" hose thread outlet x copper sweat inlet with integral vacuum breaker. Nibco figure 63-VB.

.8 Test: Hydrostatically pressure test at 150 psi for four (4) hours minimum.

22 30 00 DRAINS and CLEANOUTS

.1 General

.11 Furnish and install the following drains and cleanouts where shown on the Plans and as hereinafter specified. Drains and cleanouts shall have all options, body material, top size,

top style, top material, and accessories as specified whether or not listed as a prefix, suffix, or catalog number.

.2 Drain and cleanout outlets shall be compatible with respective piping material and size. Outlets below grade shall be push type. Outlets above grade may be no-hub or push type at the Contractor's option. Tops shall be compatible with the flooring system.

.3 Provide deep seal P-traps for all floor drains.

.4 Provide full size cleanouts up to 4" size above the lowest floor line in all drainage risers, and where total of the fittings exceed 120 degrees and at changes in direction greater than 60 degrees in horizontal drainage lines, and at intervals of not greater than fifty (50) feet in straight piping runs 4" diameter and smaller, and one hundred (100) feet for piping over 4" diameter.

.5 Do not install cleanouts in electrical equipment rooms. Extend the cleanout to outside the room limits.

.6 Where cleanout is located in open ground, extend the cleanout to finished grade elevation and install a 16" x 16" x 8" deep concrete pad at grade to secure the cleanout.

.7 All cleanouts that are above ceilings need to be extended to floor above.

.8 Submit with products, a room by room schedule indicating floor drains and cleanouts to be used including top size, shape, floor finish material, and setting height with respect to concrete slabs. Any drain body set prior to approval shall be performed with block-outs to allow correct tops and finished heights to be adjusted.

22 30 01 FLOOR DRAINS

.1 Floor Drain: toilet room (FD-A):
Cast iron body with flashing flange, integral reversible clamping collar, seepage openings, 6" x 6" square adjustable satin nickel bronze, strainer top with 3" outlet.
Wade W-1103-G6, Zurn ZN-415-6S, J.R. Smith 2000-B06NB-U-L, MIFAB F1100C-S6-1, or approved equivalent.

.2 Floor Drain: mechanical equipment room (FD-B):
Cast iron body with flashing flange, integral reversible clamping collar, seepage openings, 7" cast iron loose set tractor strainer and 3" outlet. Wade W-1103-TS7, Zurn Z-415-7N, J.R. Smith 2000-D-CI, MIFAB F1100C-N-1, or approved equivalent.

.3 Floor Drain: interior unfinished floor (FD-C):
Cast iron body with flashing flange, integral reversible clamping collar, seepage openings, 6" round adjustable satin bronze round strainer top.
Wade W-110X-STD6, Zurn ZN-415-6B, J.R. Smith 2000-A06NB-U-L, or approved equivalent.

22 30 02 ROOF DRAINS

.1 Roof Drain: (RD).

Cast iron body with flange, flashing collar and gravel stop, removable cast iron dome and under deck clamp, sump receiver pan, adjustable extension. Provide extension, as required, to suit thickness of roof construction. Wade W-300X-AE-42-52-53, Zurn ZC-100-C-EA-R, J.R. Smith 1015-R-C-C1D, MIFAB R1200-EU-M, or approved equivalent.

.2 Overflow Drain: (OV).
Same specification as subsection 22 30 02, except add 2" high dam. Wade W-300X-AE-D-42-52-53, Zurn ZC-100-C-EA-R-89. J.R. Smith 1015-C-C1D-WD, MIFAB R1200-EU-M-R, or approved equivalent.

22 30 04 FLOOR SINK:

.1 Floor Sink (FS-A):
Cast iron 12" square floor sink with 8" sump, A.R.E. interior aluminum dome strainer, and nickel bronze hinged top. Wade W-9140, Zurn ZN-1901-K, J.R. Smith 3150, MIFAB FS1700-1, or approved equivalent.

22 30 05 CLEANOUTS

.1 Cleanout: interior finished floor (FCO):
Cast iron body, threaded adjustable housing, flanged ferrule with straight tread gasketed plug and square secured satin nickel bronze scoriated top, vandal proof, tops shall be for tile, carpet, ceramic tile, terrazzo tile as required. Wade W-6000-TS-179-118, Zurn Z-1400-T-BP-VP, J.R. Smith 4052-U, MIFAB C1100-S-1-6, or approved equivalent.

.2 Cleanout: interior unfinished floor (FCO):
Cast iron body, threaded adjustable housing, flanged ferrule with straight tread gasketed plug and round secured satin nickel bronze scoriated top, vandal proof. Wade W-6000-1-179-118, Zurn Z-1400-BP-VP, J.R. Smith 4032-U, MIFAB C1100-R-1-6, or approved equivalent.

.3 Cleanout: exterior location (YCO):
Cast iron body, threaded adjustable housing, flanged ferrule with straight tread gasketed plug and round secured satin nickel bronze scoriated top. Wade W-6000-1-118, Zurn Z-1400-BP, J.R. Smith 4032, MIFAB C100-S-1, or approved equivalent.

.4 Cleanout: wall type for concealed riser in finished spaces (WCO):
Provide cleanout fitting with screwed plug opening and countersunk plug. Provide 8" x 8" square access covers with polished nickel bronze beveled edge frame with anchor lugs for over the wall installation, smooth stainless steel cover, and vandalproof screws. Wade 8480ST-179, Zurn ZANB-1462-8-VP, J.R. Smith 4730-U-NB, MIFAB C1460-S-3-6, or approved equivalent.

.5 Cleanout: wall type for concealed riser in unfinished spaces (WCO):
Provide cleanout fitting with screwed plug opening and countersunk plug. Provide round access covers with smooth stainless steel cover, and vandalproof center screw. Wade, Zurn, J.R. Smith, MIFAB, or approved equivalent.

22 40 00 PLUMBING FIXTURES

.1 General

.11 Furnish and install the following plumbing fixtures where shown on the Plans and as hereinafter specified. Plumbing fixtures and accessories shall have all options, body material, water consumption, and accessories as specified where or not listed as a prefix, suffix, or catalog number. Include all necessary work in the related sections of the Specifications (subsection 22 00 03) and accessories to provide for complete installation and operation of the respective fixture.

.12 All plumbing fixtures and non-metal accessories shall be white color, except where shown or specified otherwise.

.13 Vitreous china fixtures, where specified, shall be best quality, non-absorbent. Warped or imperfect fixtures shall not be accepted. Enameled cast iron fixtures, where specified, shall be thoroughly fused and bonded to body without discoloration, chips, flaws or cracks. Finish all exposed surfaces.

.14 Fixture trim shall be cast brass with polished chrome-plated finish on exposed surfaces, except where shown or specified otherwise.

.15 Fixture traps shall be tubular wall type, minimum 17 gauge with integral cleanout plugs, polished chrome plated finish, except where shown or specified otherwise. Size to suit fixture tailpiece. Comply with local plumbing code.

.16 All water closets, urinals, and lavatories shall be from the same manufacturer. All faucets, for lavatories, janitor sinks, sinks shall be from the same manufacturer. All supplies and stops for lavatories and sinks shall be from the same manufacturer.

.17 Furnish accessories for fixtures requiring trim, carriers, brackets, back-up plates, specialties, etc. for respective complete installation.

.18 Install all handicapped fixtures to respective ADA Standards requirements per Federal Register 28 CFR part 36, July 26, 1991.

.19 Provide stops (valves) in all water supplies to all fixtures.

.20 Provide escutcheon plates for all wall penetrations for exposed connections to fixtures.

.21 Division 22 shall provide templates of openings required for countertop mounted fixtures to the General Contractor.

.22 Connections between plumbing fixture outlets and respective waste piping shall be gas and watertight. Use suitable and approved setting compound or gasket; rubber gaskets or putty are not acceptable.

.23 Acceptable manufacturers:

.231 Fixtures - American Standard, Kohler, Eljer, Crane
.232 Carrier - Wade, Zurn, J.R. Smith, Watts
.233 Flush Valve - Sloan, Zurn
.234 Supplies, Strainer, Traps – McGuire, Dearborn, Brass Craft, Engineered Brass, American Standard, Kohler, Eljer.
.235 Faucets: Chicago, no substitutions allowed.

22 40 01 WATER CLOSET: floor mounted handicapped (W-A) (1.6 GPF)

.11 Toilet:
Vitreous china elongated bowl, 1.6 gal/flush, siphon-jet, floor mounted 17" rim height, with 1-1/2" top inlet spud. Conforms to ANSI Standard A112.19.2M, ADA, and ANSI 117-1 fixture dimensions. American Standard "Cadet 17H EL 1.6/FV" model 3043.102, Crane "Hymont JR" model 3-816, Kohler "Highcliff" model K-4368, Eljer "Preserve 17" model 111-4815.

.12 Seat:
Solid plastic, open front less cover for elongated bowl, integral bumpers and external check hinges with stainless steel bolts. American Standard model 5901.100, Bemis model 1655CT, Church model 9500CT, Olsonite model 95CT, or Zurn model Z5957SS-EL.

.13 Carrier:
Adjustable anchor foot type for above-the-floor no-hub piping connection for wall hung toilet. Cast iron factory painted adjustable faceplate with corrosion-resistant adjustable waste coupling with neoprene seal and integral test cap. Zinc plated steel fixture studs with vandal proof chrome plated fixture cap nuts and fiber fixture washers. J.R. Smith Series 0200, MIFAB Series MC-10, Wade series W-300, Watts Series CA-100-M16, or Zurn Series Z-1200-VP.

.14 Flush Valve:
Diaphragm type, 1.6 gallons per flush closet flushometer, ADA compliant, battery powered automatic "no hands" operation, chrome plated infrared sensor housing, angled sensor window, manual override flush button. 1" I.P.S. screwdriver angle stop with vandal resistant stop cap, adjustable tailpiece, vacuum breaker flush connection, spud coupling and spud flange for 1½" top spud. Valve shall be in compliance with the applicable sections of ANSI/ASME A112.19.2. Valve to be actuated by 6VDC solenoid**.** Zurn model ZR6000AV-WS1 [Side Mounted].

22 42 01 LAVATORY: wall-hung (L-B) (Automatic Sensor Faucet):

.21 Lavatory:
Vitreous china wall hung lavatory with front overflow, faucet ledge, concealed carrier arms, self-draining deck area with contoured back and side splash shields. Nominal size: 20-1/2" x 18-1/4" with "D" shaped bowl. Conforms to ANSI Standard A112.19.2 for fixture dimensions. American Standard "LUCERNE" series, Crane "Harwich" 1412 series, or Kohler "Kingston" series.

.22 Faucet:
Single hole, 4-½" spout, single supply for tempered water, vandal proof 0.5 GPM vandalproof aerator, infrared sensor operated, metal jacketed hard wired automatic faucet. Provide 120V transformer. Thermostatic temperature mixing valve with hot and cold water supply check valves**.** Chicago Faucet no. 116.101.21.1, Sloan model ETF-610, or Zurn series Z6913-F-HW6.

.23 Wheelchair Lavatory Strainer:
1-1/4" x 5" offset x 17 gauge cast brass grid strainer, integral spud and tailpiece. McGuire Mfg. catalog no. 155-WC. Dearborn Brass catalog no. 760W.

.24 Supplies:
Loose keyed angle stops with lock shield caps and ½" (nominal) copper solder (5/8" ODS) inlet and 1/2" OD outlet x 12" long flexible risers. Provide cast brass escutcheons. Chicago Faucet no. 1027-CP with no. 1003 escutcheon.

.25 Trap:
1-1/2" x 1-1/4" x 17 gauge tubular P-trap with cleanout, plug and wall escutcheon. McGuire Mfg. catalog no. 8902. Dearborn Brass catalog no. 510.

.26 Carrier:
Adjustable concealed arm lavatory carrier with rectangular steel uprights, block base anchor feet. Wade catalog no. W-520-07-M36 or Zurn Z-1231.

.27 Insulation Kit:
Conforms to 28CFR Part 36, Article 4.19.4 (7/26/91). Truebro model no. 103W. Dearborn Brass model no. 515FST and 515KIT.

22 43 01 SINK: stainless steel, single compartment, countertop with gooseneck spout (S-A):

.11 Sink:
18 gauge, type 302 stainless steel, self-rim single bowl sink. Inside bowl dimensions: 16" x 14" x 8". Faucet deck with single fixture hole. Elkay model #LR-1919, Just SL-2019-A-GR.

.12 Faucet:
Single hole, 5-1/4" gooseneck spout, 2.2 GPM aerator. Chicago Faucet no. 116.123.AB.1, no substitutions.

.13 Strainer:
Stainless steel crumb basket with rubber stop for 3-1/2" drain opening and 1-1/2" OD brass tailpiece. Elkay model No. LK-35, Just J-35.

.14 Supplies:
Loose keyed angle stops with lock shield caps and ½" (nominal) copper solder (5/8" ODS) inlet x 1/2" OD outlet x 12" long flexible risers. Provide cast brass escutcheons. Chicago Faucet no. 1006 with no. 1003 escutcheon.

.15 Trap:
1-1/2" x 17 gauge tubular P-trap with cleanout plug and wall escutcheon. McGuire Mfg. catalog no. 8912.

22 43 02 SINK: wall-hung with gooseneck spout (S-B):

.11 Sink:
Vitreous china with front overflow, faucet ledge, concealed carrier arms, self-draining deck area with contoured back and side splash shields. Nominal size: 20-1/2" x 18-1/4" with "D" shaped bowl. Faucet holes on 8" centers. Conforms to ANSI Standard A112.19.2 for fixture dimensions. American Standard "LUCERNE", model 0356.015. Kohler "Kingston" model K-2006, Crane "Harwich" model 1-412-S, Eljer "Delwyn" model 051-2848.

.12 Faucet:
8" centers, 5-3/8" swing gooseneck spout, vandal proof 0.5 GPM aerator, and vandal proof metal wristblade handles. Complies with ANSI A112.18.1. Chicago Faucet no. 786-E3VPCCP or Zurn series Z831B4-2F.

.13 Strainer:
Stainless steel crumb basket with rubber stop for 3-1/2" drain opening and 1-1/2" OD brass tailpiece. Elkay model No. LK-35, Just J-35.

.14 Supplies:
Loose keyed angle stops with lock shield caps and ½" (nominal) copper solder (5/8" ODS) inlet x 1/2" OD outlet x 12" long flexible risers. Provide cast brass escutcheons. Chicago Faucet no. 1006 with no. 1003 escutcheon.

.15 Trap:
1-1/2" x 17 gauge tubular P-trap with cleanout plug and wall escutcheon. McGuire Mfg. catalog no. 8912.

22 43 03 SINK: stainless steel, single compartment, countertop with gooseneck spout (S-C):

.11 Sink:
18 gauge, type 302 stainless steel, self-rim single bowl sink. Inside bowl dimensions: 16" x 14" x 8". Faucet deck with single fixture hole. Elkay model #LR-1919, Just SL-2019-A-GR.

.12 Faucet:
8" centers, 8" swing gooseneck spout, vandal proof 2.2 GPM aerator, and vandal proof metal wristblade handles. Complies with ANSI A112.18.1. Chicago Faucet no. 786-GN8AE3VPCCP or Zurn series Z831C4-2F.

.13 Strainer:
Stainless steel crumb basket with rubber stop for 3-1/2" drain opening and 1-1/2" OD brass tailpiece. Elkay model No. LK-35, Just J-35.

.14 Supplies:
Loose keyed angle stops with lock shield caps and ½" (nominal) copper solder (5/8" ODS) inlet x 1/2" OD outlet x 12" long flexible risers. Provide cast brass escutcheons. Chicago Faucet no. 1006 with no. 1003 escutcheon.

.15 Trap:
1-1/2" x 17 gauge tubular P-trap with cleanout plug and wall escutcheon. McGuire Mfg. catalog no. 8912.

22 43 04 SINK: stainless steel, single compartment (S-D):

.11 Sink:
Owner furnished.

.12 Faucet:

8" centers, 8" swing gooseneck spout, vandal proof 2.2 GPM aerator, and vandal proof metal wristblade handles. Complies with ANSI A112.18.1. Chicago Faucet no. 786-GN8AE3VPCCP or Zurn series Z831C4-2F.

.13 Strainer:
Stainless steel crumb basket with rubber stop for 3-1/2" drain opening and 1-1/2" OD brass tailpiece. Elkay model No. LK-35, Just J-35.

.14 Supplies:
Loose keyed angle stops with lock shield caps and ½" (nominal) copper solder (5/8" ODS) inlet x 1/2" OD outlet x 12" long flexible risers. Provide cast brass escutcheons. Chicago Faucet no. 1006 with no. 1003 escutcheon.

.15 Trap:
1-1/2" x 17 gauge tubular P-trap with cleanout plug and wall escutcheon. McGuire Mfg. catalog no. 8912.

22 43 05 SINK: stainless steel, dual compartment (S-E):

.11 Sink:
Owner furnished.

.12 Faucet:
8" centers, 8" swing gooseneck spout, vandal proof 2.2 GPM aerator, and vandal proof metal wristblade handles. Complies with ANSI A112.18.1. Chicago Faucet no. 786-GN8AE3VPCCP or Zurn series Z831C4-2F.

.13 Strainer:
Stainless steel crumb basket with rubber stop for 3-1/2" drain opening and 1-1/2" OD brass tailpiece. Elkay model No. LK-35, Just J-35.

.14 Supplies:
Loose keyed angle stops with lock shield caps and ½" (nominal) copper solder (5/8" ODS) inlet x 1/2" OD outlet x 12" long flexible risers. Provide cast brass escutcheons. Chicago Faucet no. 1006 with no. 1003 escutcheon.

.15 Trap:
1-1/2" x 17 gauge tubular P-trap with cleanout plug and wall escutcheon. McGuire Mfg. catalog no. 8912.

22 47 11 EMERGENCY EYE WASH

.11 Eyewash (EW-A): Eye/face wash station shall comply with ANSI Z358.1-2009. (Tepid water supply is required). Unit shall be swing-down and deck or wall mounted and include thermostatic mixing valve. Guardian Equipment model G1849 with TMV G3600 or Bradley equivalent.

22 80 00 PLUMBING SPECIALTIES

.1 General

.11 Furnish and install the following plumbing specialties where shown on the Plans and as hereinafter specified. Include all necessary considerations in the related sections of the specifications (subsection 22 00 02) and accessories to provide for complete installation and operation of the respective item.

22 80 01 WALL HYDRANT: exterior with box (WH-A)

.11 ¾" hose outlet x ¾" (nominal) copper sweat straight inlet, non-freeze, anti-siphon wall hydrant with bronze casing, approved ASSE 1019-2004 integral backflow preventer and polished nickel bronze, stainless steel, or chromeplated box. Wade W-8600L-175, Zurn Z-1300, J.R. Smith 5519, Watts HY-429 with box, MIFAB MHY-26, Woodford B65.

22 80 05 BACKFLOW PREVENTER - Reduced Pressure

.11 Furnish and install reduced pressure backflow preventer at water service entrance and at cross connection locations.

.12 Assembly shall include shut off valves, strainer, test cocks, and pressure relief valve with ASME A112.1.2 air-gap fitting located between two positive seating check valves. Construction shall be all bronze with quarter-turn, full port, resilient seated ball valve shut offs for sizes 2" and smaller. 2-1/2" and larger shall be bronze, cast-iron, steel or stainless steel body and interior coating according to AWWA C550 or FDA approved epoxy coating with OS&Y resilient seated gate valve shut offs.

.13 Discharge from air gap shall be piped to a floor drain.

.14 Backflow preventer shall be Watts 909, or Wilkins 375/375A.

22 80 06 PRESSURE REDUCING VALVE - Automatic (3" and larger)

.11 Automatic, pressure piloted, flanged cast iron body with interior coating according to AWWA C550, bronze trim, pressure gauge connections, position indicator, and means for discharge pressure adjustment. Watts E115 or Wilkins ZW1109.

.20 PRESSURE REDUCING VALVE - (2-1/2" and smaller)

.21 Watts U5B or Wilkens 600.

22 80 08 EXPANSION TANK

.11 Expansion tank shall be a steel hydro-pneumatic diaphragm type tank rated for a working pressure of 125 psig at 200°F. All internal wetted parts shall comply with FDA regulations and approvals. Capacity shall be as scheduled on the plans.

.12 Expansion tank shall be Amtrol Therm-X-Trol Model ST or approved equal.

22 80 14 TEMPERATURE RELIEF VALVES:

.11 Temperature relief valves on domestic hot water system shall be a self-contained, reverse acting, with adjustable setpoint as manufactured by Spence, ¾", 2020 TDGQF or equivalent.

22 80 18 THERMOSTATIC MIXING VALVES

.10 Furnish and install thermostatic tempering valves with integral check valves, removable cartridge strainers, stainless steel pistons, and thermal bellows – rough bronze finish.

.11 Mixing valves serving tempered water, individual fixtures or small groups of fixtures shall be Armstrong RADA or approved equivalent.

END OF SECTION

23 00 00 MECHANICAL PIPING SYSTEMS

23 00 01 GENERAL

.1 The Plans, the general provisions of the Contract including the General, Supplementary and/or Special Conditions and specification sections of Division 1 shall apply to Work of Division 20 of the Specifications.

.2 Provisions and conditions cited in this Section shall apply to Work for other sections of Division 20 of these Specifications.

23 00 02 REFERENCES, REGULATORY REQUIREMENTS

.1 Work for this Section of the Specifications shall be performed in accordance with the Codes, Standards, etc., as identified in Division 20.

23 00 03 REFERENCES, RELATED SECTIONS of the SPECIFICATIONS

Requirements of the following Sections of the Specifications apply to Work for this Section:

.1 Division 20 - Basic Mechanical Conditions and Basic Mechanical Materials and Methods
.3 Division 25 - Temperature Controls

23 00 04 DEFINITIONS

(none)

23 00 05 WORK INCLUDED

.1 Furnish material, labor and services necessary for, and incidental to, installing the following systems where shown on the Plans and as hereinafter specified. Include all necessary work in the related sections of the Specifications (Sub-section 23 00 03 to provide for complete systems.

.01 Cooling system including, but not limited to piping, piping specialties, and pumps.

.02 Heating system including, but not limited to piping, piping specialties, pumps, condensate pumps, unit heaters, convectors, fin tube, terminal heating coils, relief valves.

.03 Air handling equipment including, but not limited to, central station air handling units, terminal units, return fans, exhaust fans, coils, condensing units and humidifiers

.04 Condensing units/remote air-cooled condenser systems including, but not limited to, refrigerant piping, filter-drier, sight glasses, service valves, test-charge ports and accessories.

.05 Draining, filling, and venting of all modified systems as required for the above work. This includes scheduling shutdowns with the Owner (Refer to Section 20 10 70).

.06 All seismic restraints for the above work (Refer to Section 20 10 40).

.07 Smoke stopping of all penetrations of pipes and ductwork, and firestopping of the same through fire rated partitions as shown on the Architectural drawings including, but not limited to stairways, shafts, corridors, floors, roofs, and required exits (Refer to Section 20 10 20).

.08 Cleaning and pressure testing equipment, piping, and accessories installed under this section of the specification. (Refer to Section 20 10 50).

.09 Leak testing and charging of field piped refrigerant systems (Refer to Section 20 10 50).

.10 Provide sufficient labor and resources required for the testing and balancing (Refer to Section 20 10 80) and for the commissioning process (Refer to Section 152300).]

.11 Installing accessories specified under other sections of the specification referenced in Sub-section 23 00 05, including but not limited to, flow meters, control valves, thermowells, and taps for pressure sensors.

23 00 06 SUBMITTALS:

.1 The Contractor shall submit the following for approval in accordance with Subsection 20 00 43, Duties of the Contractor - Submittals.

.11 Piping materials, valves, and accessories as specified in Piping Materials Schedule(s) in this section of the specification.

.12 All specialties including, but not limited to, thermometers, gauges, relief valves, pressure regulators, backflow preventers, flow switches, and vacuum breakers.

.13 All HVAC equipment specified in this Division 23 including, but not limited to, pumps, packaged equipment, air handling units, fans, terminal units and steam humidifier.

.14 All general items specified under Division 20 utilized in the installation of work required by this section of the specification.

.2 Provide manufacturer's technical product data of each material and accessory item with engineering support information, installation manual, operation and maintenance manual. Data shall be specific to product specified and clearly identified on all data sheets, which contains multiple models or sizes.

.3 At the point where the mechanical system has been installed and checked by the Contractor and the systems are ready for testing and adjusting, submit a letter to the Architect/Engineer stating such. Refer to Section 20 10 85.

.4 At the completion of the project, submit a letter stating all materials are asbestos free, and meet the specified ASTM E-84 flame/smoke rating of 25/50, and that all piping and duct penetrations are smoke or fire stopped as required by the Code.

.5 Contractor shall submit coordination drawings to the Engineer for review prior to any fabrication or installation (Refer to Section 20 10 50).

23 10 00 HYDRONIC PIPING

.1 Itemization of the piping materials for specific system application are enumerated in the following sub-sections for the respective PIPING MATERIAL SCHEDULE. Specific requirements for materials shall be as listed in Division 20 Basic Materials and Methods.

.2 Manufacturer's mill reports and applicable documents to certify the validity of the procured piping materials shall be on file at the Contractor's office.

.3 Install all piping with pitch to vent or drain. Provide 150 pound ball valves with hose end adapter at all low points and manual key operated air vents at all high points. Use eccentric reducing fittings (installed top level) as required to avoid air pockets.

.4 Gaskets and packings containing asbestos are not acceptable.

23 10 01 PIPING MATERIAL SCHEDULE, M-1

.1 Service: Chilled water supply and return for HVAC. (Unless specified otherwise)
Hot water (heating) supply and return for HVAC.

.2 Rating: 125 psig at 350°F
175 psig at 150°F

.3 Pipe: (Refer to Section 20 10 11)

.31 3" and smaller Copper, type L.

.32 10" and smaller Black carbon steel, schedule 40, ASTM-A53, ERW.

.33 12" and larger Black carbon steel, standard (0.375" wall thickness), ASTM-A53, ERW.

.34 Contractor has the option on piping 3" and smaller to use either copper or black carbon steel. Fittings shall be as scheduled below for the piping material chosen.

.4 Fittings: (Refer to Section 20 10 10)

.41 3" and smaller Wrought copper, solder ends.

.42 2-1/2" and smaller Cast iron, screwed.

.43 3" and larger Black carbon steel, buttweld. Elbow fittings shall be long radius.
See Division 20 for acceptable branch arrangement in lieu of tee fitting.
Wall thickness consistent with connecting pipe.

.44 3" and larger Contractor's option at vertical branch drops to equipment located within mechanical rooms: Painted ductile iron, smooth (segmented or welded fittings are not acceptable), grooved ends. Wall thickness consistent with connecting pipe. To be used in conjunction with compatible rigid mechanical couplings designed specifically for this application.

.50 Joints in Steel Piping: (Refer to Section 20 10 12)

.51 2-1/2" and smaller — Screwed

.52 3" and larger — Welded
or

Contractor's option at vertical branch drops to equipment located within mechanical rooms: Victaulic Style 07 couplings except at connections to rotating equipment where (2) Style 77 couplings shall be used at each inlet and outlet connection.

.53 All sizes where concealed in chases or walls, or above gyp/plaster ceilings — Welded

.60 Joints in Copper Piping:

.61 All — 95/5 solder

.70 Valves: (Refer to Section 20 10 13)

.71 Shut-off/service:

.711 3" and smaller — Ball valve: two piece bronze body, stainless steel ball and trim. Three piece valves to be used to separate copper and steel piping systems per 20 10 65, part C.

.712 2 1/2" and larger — Butterfly valve, cast iron body.

.72 Balancing/Throttling:

.721 12" and smaller — "Circuit Setter"

.722 14" and larger — Butterfly valve with memory stops.

.73 Check valve:

.731 2-1/2" and smaller — Class 125, swing check.

.732 3" and larger — Class 125, cast iron body, silent check

.80 Strainers (Refer to Section 20 10 14)

.81 4" and smaller — Class 125, cast iron body, Y-pattern

.82 5" and larger — Class 125, cast iron body, basket type

.90 Unions:

.91 3" and smaller Wrought copper, solder ends.

.100 Flanges:

.101 4" and smaller Cast copper companion type, solder end, class 125 ASME standard or class 150.

.102 2-1/2" and Larger 150 lb, Black forged carbon steel, weld neck pattern (for welded pipe). 150 lb. ANSI Class flange equal to Victaulic 45 (for grooved pipe).

.110 Pressure Test: Hydrostatic test at 200 psi for two (2) hours minimum.

23 10 06 PIPING MATERIAL SCHEDULE M-2

.1 Service: Condensate drain piping.

.2 Design: Atmospheric

.3 Pipe: Type L copper

.4 Fittings: Wrought copper, solder ends. 90° elbows are not permitted, use (2) 45° elbows or 'Y' provided with cap in unconnected straight run.

.5 Valves: Two piece bronze body, stainless steel ball and trim.

.6 Extend piping from all cooling coil drain pans to the location of discharging indirectly to the building drain system. Pipe size shall be unit connection size unless indicated larger on the plans.

.7 Connections to the drain pans shall be made through a water seal trap with the downstream side vented to atmosphere.

23 10 09 HYDRONIC SPECIALTIES

.1 Air Separator

.11 Furnish and install centrifugal type or coalescing type air separator where shown on the plans or flow diagrams. Air separator shall be designed, constructed, and stamped for 125 psig at 350°F in accordance with Section VIII, Division 1 of the ASME Boiler and Pressure Vessel Code. Centrifugal type air separator shall have tangential or bottom outlet, tangential inlet, stainless steel collector tube without strainer. Coalescing type air separate shall have internal copper coalescing medium. Air separator shall have flanged inlet and outlet with a threaded drain connection.

.12 Air separator shall be Bell & Gossett Rolairtrol, Amtrol, Taco, Armstrong VA, Thrush, Spirovent model HV or equivalent.

.2 Automatic Air Vent

.21 Automatic air vents shall be furnished and installed for all centrifugal air separators. Automatic air vents shall be high capacity, float actuated, cast iron or cast brass body, stainless steel/brass trim and rated for 150 psi at 250°F.

.22 Automatic air vents shall have their discharges piped to a drain.

.23 Automatic air vents shall be Amtrol Model 720, Armstrong AAE-750, Bell & Gossett 107A, Spirotherm model Spirotop, Thrush model 720 or equivalent.

.3 Safety Valves, Relief Valves, Safety Relief Valves

.31 Pressure relief valves shall be furnished and installed for all and where shown on the plans, flow diagram, or details in all hydronic systems not containing boilers. Valves shall be factory set and field verified for 125 psi, bronze body, stainless steel trim and test/lift lever. Pressure relief valves shall be a minimum of ¾" Bell and Gossett Model 790, Watts 174A, Kunkle or equivalent.

.32 Hydronic systems containing heat exchangers or other unfired heating vessels shall have safety relief valves sized for the rated output of each device at the pressure rating of the lowest pressure device. Valves shall be ASME Code Section VIII rated, bronze body and brass trim. Safety relief valves shall be Kunkle, Bell and Gossett, Watts or equivalent.

.33 Discharges from valves shall be piped **to** floor drains for water valves and to the outdoors for steam valves.

.5 Make-up Water Connection

.51 At all make-up water locations to hydronic systems provide a line size reduced pressure backflow preventer, pressure reducing valve, water meter, and a pressure relief valve. In closed system the pressure reducing valve and water meter shall be ¾".

.52 Backflow preventer shall be of reduced pressure type. Assembly shall include shut off valves, strainer and air gap connection. Backflow preventer shall be Watts Series 909 or equivalent.

.53 Pressure reducing valves shall be furnished and installed for each system and field adjusted for each system to provide 10 psi at the highest point in the system with all pumps off for positive venting. Pressure reducing valves shall be Watts U5, Bell and Gossett #7, Taco 335, Armstrong HRD70 or equivalent.

.54 Water meter 1" and smaller shall be a totalizing positive displacement meter indicating in U.S. Gallons meeting AWWA Standard C-700 latest edition. Meters shall be Neptune T-10, Kent C-700, or Hersey MTX 123, or equivalent.

.6 Thermometers

.61 Thermometer wells and thermometers shall be provided at the inlet and outlet of all air handling unit coils, etc. and where shown on the plans, piping isometrics, flow diagrams and details.

.62 Thermometers shall be organic spirit filled in a 9” polyester or aluminum case, magnified lens, glass or acrylic front, black divisions and numbers. Accuracy shall be ± one scale division. Stem shall be tapered aluminum installed in a brass thermowell. Stem length and lagging length shall be coordinated with the piping and the insulation. A minimum 2" insertion length shall be in the moving fluid.

.63 Thermometers for use in chilled water having 1°F increments are preferred with a minimum range of 30°F - 100°F, in no case shall the range be greater than 0°F - 160°F having 2°F increments.

.64 Thermometers for use in heating water systems shall have 2°F increments with a range of 30-240°F.

.65 The submittal data shall clearly identify the range and the service the thermometers are used for.

.66 Thermometers shall be Weksler AA5, Trerice model Adjustable Angle, Weiss Vari-angle, MILJOCO 935, or equivalent.

.67 Where thermometer wells are installed below 5 feet they shall be installed on the side of vertical piping or on the top of horizontal piping so that they can be angled back beyond vertical to allow easy reading. Where thermometer wells are installed above 6 feet they can be installed on the face or the side of vertical piping and for horizontal piping it should be installed between 9 and 12 o'clock to allow the thermometers to be angled less than vertical without the pipe blocking the view of the thermometer.

.68 Prior to installing the thermometer wells, the contractor shall have the thermometers at the jobsite and shall demonstrate to the Architect/Engineer where he intends to install them where they will be easy to read. If the Contractor fails to perform the above, any thermometers which are unreadable, in the opinion of the Architect/Engineer, it shall be modified at the Contractor's expense.

.7 Test Ports

.71 Provide pressure and temperature test plugs at locations shown on the plans, flow diagrams and details. Test ports shall be pressure and temperature test plugs. Plugs shall be self-sealing plugs. EPDM seals rated for the temperature, pressure and fluid associated with the application and shall be capable of accepting a needle type temperature or pressure probe and reclosing when the probe is removed. Furnish extensions for test ports installed in insulated piping. Plugs shall be provided with threaded protective caps. One temperature and pressure test kit suitable for the plugs used on the job shall be provided to the Owner on all installations where the plugs are used. Acceptable manufacturers and models are as follows:

Manufacturer	Model
Peterson Engineering	Pete's Plug
Trerice	Pressure/Temperature Test Plug
Sisco	P/T Plugs
Bell and Gossett	Read-out Valve RV-125A

.72 Alternatively, access fittings may be provided in place of the Pete's Plugs. In this case, the fittings shall be provided with a retained cap and shall be Mueller Brass A-17130 or equivalent.

.8 Gauges

.81 Provide 1/4" ball valves gauge cocks at all inlet and outlet of air handling units and across control valves of air handling units and at the inlet and outlets where shown on piping isometrics, flow diagrams and details. Provide gauges where shown on piping isometrics, flow diagrams, and details.

.82 Gauges shall be 4-1/2" diameter, flangeless aluminum/stainless steel safety case with removable ring, bottom connection, with a recalibrator, and have stainless steel tube and stainless steel movement calibrated to ½% accuracy, ANSI B40.1 Grade 2A with a pressure range appropriate for each system. Open water condenser systems shall have compound gauges. Gauges located at pumps shall be provided with a porous stone type pressure snubber.

.83 Gauges shall be Weiss Instruments UG2, Trerice 500X Series, Weksler AA44Y or equivalent by Marsh, or Marshalltown. Accessories from the same manufacturer shall be acceptable.

.84 At pump locations utilizing factory taps in the casing or other locations where steel pipe is utilized, provide 1/4" brass screwed pipe and 1/4" 2-piece bronze threaded ball valve with lever handle for a gauge cock.

.85 At locations where copper pipe is utilized, provide a ½" tee by line size connection in the piping and a ½" 2-piece bronze threaded ball valve, and 1/4" NPT bushing with lever handle for a gauge cock.

.86 Provide a minimum of 3" straight gauge piping before any fittings or the gauge cock to allow insulation of the piping to a point where it will not sweat without the gauge cock being insulated.

.87 At pumps, tees with cleanouts shall be used rather than 90° ELS on the gauge cock piping.

.88 All gauges shall be positioned where their view is unobstructed and can be easily read. If any gauge is unreadable, in the opinion of the Architect/Engineer, it shall be modified at the Contractor's expense.

23 21 40 PUMPS

.1 General

.11 Furnish and install circulating pumps for water service of the base mounted or in-line configuration as scheduled on the drawings. Pumps shall be factory tested, aligned, painted, and shipped complete for installation. Electrical characteristics shall be as scheduled on the plans.

.12 Piping at pumps shall be arranged to facilitate pump maintenance. Piping shall be arranged so that the service valves can be closed and the piping and specialties between the service valves and pump removed for servicing and to allow clear access to the pump for removal as required. Where pump connection sizes are smaller than the line sizes associated with the suction and discharge piping, concentric reducers or increasers shall be installed immediately at the pump flanges to adapt to the indicated line size. All specialties and service valves associated with the pump such as strainers, check valves, etc., shall be line size, and not pump connection size.

.13 Where pumps are from manufacturers not scheduled the following criteria shall apply: Pumps shall be picked at scheduled flow and head with working fluid of the system which the pump is in, pump impeller shall not be within ½" of the smallest or largest size for the pump body, pump efficiency shall not more than 5% less efficient than scheduled pump, operation point shall not exceed nameplate horsepower, pump motor size shall not be larger than scheduled motor (Contractor can pursue equipment substitution as required in Subsection 20 00 51 for pumps with larger motors), pumps which are used in parallel installations shall be sized such that the brake horsepower does not exceed the motor horsepower when only one pump is running. This operating point shall not be off of the manufacturers published pump curve.

23 21 41 IN-LINE PUMPS

.1 General: In-line pumps and circulators shall be suitable for mounting in either vertical or horizontal piping with the motor mounted as specified below. Pumps shall be flanged and provided with a companion flange having NPT tappings or shall be ANSI Standard B16.1 flanges. Pumps shall have factory taps, shipped with plugs installed, for measuring suction and discharge pressure, and at the low point in the volute to allow draining. Where in-line umps are installed in horizontal or vertical piping, the pump shall be rigidly mounted to the piping with pipe hangers on each side of pump, but the motor shall not be supported. Where in-line pumps are supported from the floor using a pipe stand/column then two flexible mechanical couplings shall be used on each side of the pump for vibration isolation.

.2 Horizontal in-line pumps shall be bronze or iron construction as scheduled. Pumps shall be horizontal (motor and shaft installed position) in-line type, oil lubricated, one-piece cast bronze impeller dynamically balanced, and flexible coupled. Pumps shall be rated for a maximum working pressure of 175 psi at 150°F and 150 psi at 250°F. Mechanical seals shall be two piece design with a carbon seal face and ceramic seat rated for continuous operation at 225°F. Pump shall be of a three-piece design consisting of: the volute, bearing module, and the motor; with each section bolted to the next. The bearing module shall have oil lubricated bronze journal and thrust bearings. The motor shall be joined to the pump shaft through a flexible coupling. Motors shall be NEMA B letter design with a 1.15 service factory, open drip-proof, premium efficiency. Pumps shall be Bell and Gossett series 60, Taco 1600 series, Armstrong series 1060, or approved equivalent.

.3 In-line pumps shall be bronze fitted Class 30 cast iron body designed for either horizontal or vertical (motor and shaft installed position) in-line mounting, oil lubricated, one piece cast bronze dynamically balanced impeller, replaceable bronze wear rings, steel pump shaft with replaceable bronze shaft sleeve, close/split coupled. Pumps shall be rated for a maximum working pressure of 175 psi at 150°F and 150 psi at 250°F (125# ANSI flange). Mechanical seals shall be flushed two piece design with a carbon seal face and

ceramic seat rated for continuous operation at 225°F. Motors shall be NEMA JM, with a 1.15 service factor regreaseable ball bearings, vertical shaft, drip-proof enclosure, premium efficiency. Pumps shall be Bell and Gossett series 80, Taco KS model, Armstrong 4380/4300 series, or approved equivalent.

23 22 00 STEAM PIPING MATERIALS

.1 Itemization of the piping materials for specific system application are enumerated in the following sub-sections for the respective PIPING MATERIAL SCHEDULE. Specific requirements for materials shall be as listed in Division 20 10 00 Basic Materials and Methods.

.2 Manufacturer's mill reports and applicable documents to certify the validity of the procured piping materials shall be on file at the Contractor's office.

.3 Install all piping with pitch to vent or drain. Provide 150 pound ball valves with hose end adapter at all low points and manual key operated air vents at all high points. Use eccentric reducing fittings (installed bottom level) as required to avoid air pockets.

.4 Steam systems shall be defined as : low pressure when operating between 0-15 psig, medium pressure when operating between 16-50 psig, high pressure when operating above 51 psig.

.5 In steam systems service valves and strainers shall be installed with the stem/basket in the horizontal position so that condensate flow is not impeded.

.6 Install pigtail siphon at all pressure gauge and pressure transmitter locations. Refer to Section 23 10 09 for gauge specifications.

.7 Gaskets and packings containing asbestos are not acceptable.

23 22 01 PIPING MATERIAL SCHEDULE M-3

.1	Service:	Steam supply: Low pressure, medium pressure, steam vents, steam relief, boiler blowdown, boiler overflow.
.2	Rating:	125 psig at 350°F.
.3	Pipe:	
.31	10” and smaller	Black carbon steel, Schedule 40, ASTM-A53, ERW.
.32	12” and larger	Black carbon steel, standard (0.375” wall thickness), ASTM-A53, ERW.
.4	Fittings:	
.41	2” and smaller	Cast iron, screwed, 125#.

.42	2-1/2" and larger	Black carbon steel, buttwelded, standard schedule.
.5	Valves:	
.51	Shut-off/service:	
.511	2" and smaller	Gate valve, Class 125, bronze body.
.512	2-1/2" thru 12"	Gate vale, Class 125, iron body.
.52	Balancing/Throttling:	
.521		Globe valve, Class 125, bonze body.
.522	2-1/2" thru 10"	Globe valve, Class 125, iron body.
.6	Flanges:	150 lb., black forged carbon steel, weld neck pattern.
.7	Pressure Test:	Hydrostatic test at 200 psig for two (2) hours minimum.

23 22 04 PIPING MATERIAL SCHEDULE M-4

.1	Service:	Condensate return (all types) from steam trap to condensate receiver.
.2	Design:	125 psig. (Max) temperature: 220°F
.3	Pipe:	
.31	5" and smaller	Black carbon steel, Schedule 80, ASTM-A53, ERW. At Contractor's option for long runs without equipment connection Type L copper pipe may be used.
.32	6" and larger	Black carbon steel, standard, ASTM-A53, ERW.
.4	Fittings:	
.41	2-1/2" and smaller	Extra heavy 250 lb., threaded cast iron, [Black carbon steel, socket welded, Schedule 80
.42	3" thru 5"	Black carbon steel, buttwelded, Schedule 80
.43	6" and larger	Black carbon steel, standard schedule.
.5	Valves:	
.51	Shut-off/service:	
.511	2" and smaller	Gate valve, Class 125, bronze body
.512	2-1/2" and	

	larger	Gate valve, Class 125, iron body
.52	Check Valve:	
.521	2” and smaller	Swing check, Class 125, bronze body
.6	Flanges:	150 lb., black forged carbon steel, weld neck pattern.
.7	Pressure Test:	Hydrostatic pressure test at 150 psig for two (2) hours minimum.

23 22 05 PIPING MATERIAL SCHEDULE M-5

.1	Service:	Pumped condensate return through surge tank up to deaerator.
.2	Design:	125 psig. (Max) temperature: 220°F
.3	Pipe:	
.31	All sizes:	Type 304 stainless steel, Schedule 40, ASTM-A53, ERW.
.4	Fittings:	
.41	All sizes:	Type 304 stainless steel, standard schedule, butt-welded.
.5	Valves:	
.51	Shut-off/service:	
.511	2” and smaller	Gate valve, Class 125, bronze body
.512	2-1/2” and larger	Gate valve, Class 125, iron body
.52	Check Valve:	
.521	2” and smaller	Swing check, Class 125, bronze body
.6	Flanges:	150 lb., stainless steel, weld neck pattern.
.7	Pressure Test:	Hydrostatic pressure test at 150 psig for two (2) hours minimum.

23 22 08 STEAM SPECIALTIES

.1 In general, boilers and other fired heating equipment shall have factory furnished, Contractor installed. In the event that the valves are not factory furnished the Contractor shall furnish and install ASME Code Section IV and ASME Code Section I safety valve(s) for steam boilers with rated pressures above 15 psig. Discharges from valves shall be piped to the outdoors for steam valves.

.2 Vacuum Breaker (Steam Heat Exchangers and Steam Coils):

.21 Furnish and install at all heat exchangers and entering side of steam coils a vacuum breaker rated for a maximum working pressure of 150 psig and 366°F operating temperature.

.22 Vacuum breakers shall be Bell and Gossett No. 26, or approved equal.

.3 Pressure Regulators:

.31 Pilot-actuated, diaphragm type, with adjustable pressure range and positive shutoff. Valves shall have cast-iron body, hardened stainless-steel trim, replaceable head and seat, main head stem guide fitted with flushing and pressure-arresting device, cover over pilot diaphragm, and non-asbestos gaskets.

.4 Float and Thermostatic Traps (Modulation Loads):

.41 Float and Thermostatic Traps: ASTM A126, cast-iron body and bolted cap; renewable, stainless steel float mechanism with renewable, hardened stainless-steel head and seat; maximum allowable pressure of 125 psig; balanced-pressure, stainless-steel or monel thermostatic bellow element. Thermostatic air vent capable of withstanding 45°F of superheat and resisting water hammer without sustaining damage.

.42 Steam traps shall be Armstrong, Hoffman, Spirax Sarco, or Watson McDaniel.

.43 See schedule for sizes, capacities, and operating pressures.

.5 Inverted Bucket Traps: (Drip Legs)

.51 Inverted Bucket Traps: ASTM A126, cast iron body and bolted cap; renewable, stainless steel float mechanism with renewable hardened chrome steel valve and seat; maximum allowable pressure of 250 psig.

.52 Steam traps shall be Armstrong, Hoffman, Spirax Sarco, or Watson McDaniel.

.53 See schedule for sizes, capacities, and operating pressures.

.6 Flash Tanks:

.61 Shop or factory fabricated of welded steel according to the ASME Boiler and Pressure Vessel Code, for 150-psig (1035-kPA) rating; and bearing ASME label. Fabricate with tappings for vents, low-pressure steam and condensate outlets, high-pressure condensate inlet, air vent, safety valve, and legs.

23 23 00 MISCELLANEOUS PIPING

.1 Itemization of the piping materials for specific system application are enumerated in the following sub-sections for the respective PIPING MATERIAL SCHEDULE. Specific requirements for materials shall be as listed in Division 20 10 00 Basic Materials and Methods.

.2 Manufacturer's mill reports and applicable documents to certify the validity of the procured piping materials shall be on file at the Contractor's office.

.3 Gaskets and packings containing asbestos are not acceptable.

23 23 02 PIPE MATERIAL SCHEDULE M-6

.1 Service: Refrigerant - [liquid, hot gas/discharge, suction]

.2 Design: Pressure: 300 psig
Maximum temperature: 300°F

.3 Pipe: Type ACR copper pipe

.4 Fittings: Wrought copper, brazed

.5 Valves:

.6 Pressure Test: Refer to Section 20 10 60.

23 23 07 PIPING MATERIAL SCHEDULE M-7

.1 Service: Medical Gas, above ground

.2 Design: Pressure: 200 psig
Maximum temperature: 150°F

.3 Pipe: Oxygen service, Type L Copper Pipe

.4 Fittings: Wrought copper, brazed

23 23 08 PIPING MATERIAL SCHEDULE M-8

.1 Service: Medical Vacuum and WAGD, above ground

.2 Design: Pressure: 150 psig
Temperature: 150°F

.3 Pipe: Type L Copper Pipe

.4 Fittings: Wrought copper, long radius 90° elbows, 'Y' type tees provided with cap for unconnected straight run.

23 23 09 MEDICAL GAS AND MEDICAL VACUUM TESTING

.1 Medical gas and medical vacuum testing shall be performed per NFPA 99, System Verification. The technical aspects associated with this contract will be furnished by the Owner. This contractor shall provide labor for the adjustment of valve, and shall provide

nitrogen for testing. The Contractor shall notify the Owner in writing when all medical gas and medical vacuum systems are prepared for testing. Prior to Owner furnished testing, the Contractor shall perform Installer Performance Testing per NFPA 99. Installer performance testing includes the following:

.11 Blowdown: Prior to installing system outlets, pressure switches, etc., the contractor shall blowdown piping with dry nitrogen.

.12 Initial Pressure Test: Prior to installing pressure switches and system outlets, Contractor shall pressure test piping at 150 psig for oxygen, nitrous oxide and medical vacuum. Joints shall be tested with soapy water. Piping shall be tested until all leaks are repaired.

.13 Cross Connection Test: Contractor shall test all piping to verify that no cross connection between services exists. Each service shall be pressurized with nitrogen individually, and all services shall be tested to verify no cross connections exist. Pipe labeling shall also be verified.

.14 Piping Purge Test: At each station outlet, the Contractor shall purge the line until the purge produces no discoloration in a white cloth. Nitrogen shall be used for purging.

.15 Standing Pressure Test: After initial pressure test is performed, and all outlets and accessories are installed, the Contractor shall pressure test all services for 24 hours. Medical vacuum, oxygen, and nitrous oxide shall be tested at 60 psig. The only allowable pressure change during a 24-hour test shall be due to ambient temperature variation. If leaks occur, the leads shall be repaired, and the pipe retested.

23 23 10 MEDICAL GAS AND MEDICAL VACUUM VALVES AND SPECIALTIES

.1 Medical Gas and Medical Vacuum Valves:

.11 Shut-off/service: Medical gas ball valve per 15100. Valves in concealed spaces shall be provided with pad-lockable handles.

.2 Medical Gas and Medical Vacuum Pressure Gauge: Provide and install pressure gauge as indicated on plans. Pressure gauge shall comply with ANSI/ASME B-40.1 gauges< pressure indicating dial type, elastic elements, and 1-1/2" diameter face. Additional requirements are as follows:

.21 Oxygen, clinical air and nitrous oxide: Gauge shall have 0-100 psig pressure range, ±1 psig accuracy and shall be cleaned for oxygen service. Medaes #0841-0014-300, Allied Healthcare Products #77-90-0571 or approved equal.

.22 Medical Vacuum: Gauges shall have a 0-30 inch mercury vacuum range, ±1/3 inch mercury accuracy. Medaes #6812-2070-005 or approved equal.

.3 Medical Valve Box (MVB): Valve box shall be constructed of 18 gauge sheet steel with anodized aluminum cover frame. The frame assembly shall be capable of adjusting for variances in wall thickness. Box shall be provided with cover window and pull ring, color coded gas service labels, pressure gauges for each service per 15534.2, valves per 15534.1, valves shall be mounted so handles in closed position do not allow reinstallation of cover. Medaes Valve Box, Allied Healthcare Products Multiple Zone Valve Box or

approved equal. Medical valve boxes shall be provided with a label stating what zone is fed by the valve box. Submit labels for approval.

.4 Medical Gas Outlets:

.41 Wall outlets to be Diamond III compatible. Outlets to be by Ohmeda, Amico or approved equivalent. Diamon Ohmeda Oxygen (261010-1), vacuum (261010-5) with slide (261690), air (261010-13). Amico model O-QDWAL-U-XXX.

.42 Ceiling outlets to be Diss compatible. Outlets to be by Ohmeda, Amico or approved equivalent. Ohmeda Diss ceiling oxygen (261000-3), vacuum (261000-7), air (261000-15), Amico O-DISCEI-U-XXX.

.5 Medical Alarm Panel: Panel shall be a UL 1069 device with four (4) module spaces per panel. Power shall be double fused 110-250 VAC 50/60 hertz with a built-in transformer to convert to 24 VAC. Panel shall be Beacon Medaes Model MEGA2 "6-M2-L-OAVB". Provide pressure transducers with quick disconnect.

23 23 11 MISCELLANEOUS SPECIALTIES

.1 Natural Gas Specialties

.11 Pressure Regulators: Furnish and install Maxitrol, Schlumberger, Fisher or equivalent "pounds to inches" gas pressure regulators with changeable springs for outlet pressure adjustment.

.111 Furnish and install pressure gauges and gauge cocks on both the high pressure and low pressure side of the gas service entrance.

.12 Gas vales 2" and smaller: threaded end, two piece bronze body, UL listed natural gas, ball valve, Nibco 580/5-70-UL or equivalent.

.13 Gas valves 2-1/2" and larger: flanged end, class 125, short pattern cast iron body, lubricated plug, UL listed natural gas, Milliken 171M, Nordstrom 143, Resun R-1431

.14 Meter shall be Roots series B3 as manufactured by DMD Dresser with a Mercury Instruments model Mini-Max volume corrector.

23 30 00 AIR DISTRIBUTION

23 30 01 GENERAL

.1 This Section specifies air distribution systems.

.2 The Plans, the general provisions of the Contract including the General, Supplementary and/or Special Conditions and specification sections of Division 1 shall apply to Work of Divisions 20 - 29 of the Specifications.

.3 Provisions and conditions cited in this Section shall apply to Work for other sections of Divisions 20 - 29 of these Specifications.

23 30 02 REFERENCES, REGULATORY REQUIREMENTS:

.1 Work for this section of the specifications shall be performed in accordance with the Codes, Standards, etc. as identified in Division 20 in addition to the following:

.11 ASHRAE, “Handbook 2009 Fundamentals”; Chapter 21 - Duct Design.

.12 ASHRAE, “Handbook 2008 Equipment”; Chapter 18 - Duct Construction.

.13 ASTM A90-81 (1991), “Test Method for Weight of Coating on Zinc-Coated (Galvanized) Iron or Steel Articles”.

.14 ASTM A525-91b, “Spec for General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process”.

.15 ASTM A527/A527M-90, “Spec for Steel Sheet, Zinc-Coated (Galvanized) by Hot-Dip Process, Lock Forming Quality”.

.16 NFPA 90A, “Installation of Air Conditioning and Ventilating Systems.”

.17 SMACNA “HVAC Duct Construction Standard – Metal and Flexible” – Third Edition.

.18 UL 33, “Heat Responsive Links for Fire Protection Service.”

.19 UL 555, “Fire Dampers and Ceiling Dampers.”

.20 UL 181, “Factory Made Air Ducts and Connectors.”

23 30 03 REFERENCES, RELATED SECTIONS of the SPECIFICATIONS

Requirements of the following Sections of the Specifications apply to Work for this Section:

.1 Division 20 - Basic Mechanical Conditions and Basic Mechanical Materials & Methods
.3 Division 23 - Mechanical Equipment
.4 Division 25 - Temperature Control

23 30 04 DEFINITIONS

.1 The size of the ducts shown on the drawings and in this Section of the Specifications shall be the outside dimension of the ductwork which will take into account any internal acoustical lining thickness specified for duct system or sub-system.

.2 The term **“supply air”** where used in this Section of the Specifications shall mean downstream of a coil.

.3 The term **“outdoor air”** where used in this Section of the Specifications shall mean ambient air that has not been conditioned.

.4 The term **“return air”** where used in this Section of the Specifications shall mean conditioned air that is returned from the space.

.5 The term **"mixed air"** where used in this Section of the Specifications shall mean air streams that are a mixture of **"outdoor air"** and **"return air".**

.6 The term **"relief air"** where used in this Section of the Specifications shall mean excess return air that relieved from the building.

.7 The term **"exhaust air"** where used in this Section of the Specifications shall mean air that is removed due to contaminates, odors, or heat.

23 30 05 WORK INCLUDED

Furnish material, labor and services necessary for and incidental to the installation of the following systems where shown on the Plans and as hereinafter specified. Include all necessary considerations in the related sections of the Specifications (Sub-section 20 30 03) to perform the Work completely.

.1 Sheet metal ducts, sheet metal plenums, duct linings, flexible ductwork, dampers and accessories.

.2 Air devices including adjusting the pattern controllers.

.3 Louvers, louvered penthouses, intake/relief hoods.

.4 Installing accessories specified in referenced sections above.

.5 Smoke stopping of all penetrations of ductwork, and firestopping of the same through fire rated partitions as shown on the Architectural drawings including, but not limited to stairways, shafts, corridors, floors, roofs, and required exits (Refer to Section 20 10 20).

.6 Contractor shall coordinate his work with the work of other trades, and with the architectural and structural drawings.

23 30 06 SUBMITTALS

.1 The Contractor shall submit the following for approval in accordance with Subsection 20 00 43, Duties of Contractor - Submittals.

.2 Contractor shall submit coordination drawings to the Engineer for review prior to any fabrication or installation (Refer to Section 20 10 50).

.3 Submittals shall include drawings showing joining methods, location of duct transverse joints, and duct support locations.

.4 Submittals shall be required for all shop fabricated balancing dampers.

.5 At the completion of the project, submit a letter stating all materials are asbestos free, and meet the specified ASTM E-84 flame/smoke rating of 25/50, and that all piping and duct penetrations are smoke or fire stopped as required by the Code.

23 30 07 SPECIAL REQUIREMENTS

.1 Contractor shall inspect each component of the heating and air conditioning system to eliminate rattles, air whistles, vibration, and mechanical system sound transmission.

Rough edges in ducts, insecure dampers, turning vanes, fire dampers, etc., shall be corrected to assure no recurrence of the noise source. Each vibration isolator and flexible connector shall be adjusted to limit transmission of sound to the occupied space.

23 31 00 SHEETMETAL DUCTWORK

23 31 01 MATERIAL

.1 All ducts unless specified otherwise shall be constructed from sheets or rolls of G-90 or better-galvanized steel, LFQ, Chemtreat. Fiberglass ductboard is prohibited.

.2 All supply and return ductwork, unless specified otherwise, shall be constructed of gauges and reinforcement to 4" w.g. static pressure in SMACNA Duct Construction Standard – Latest Edition.

.3 All exhaust, outdoor air, relief, and supply and return ductwork downstream of terminal units shall be constructed of gauges and reinforcement to 2" w.g. static pressure in SMACNA Duct Construction Standard – Latest Edition.

.4 Where local code requires gauges heavier than required by SMACNA then the local code shall govern.

23 31 02 CONSTRUCTION

.1 All ductwork shall be neatly constructed, stiffened, on the outside surfaces where necessary to prevent perceptible vibration or buckling. Panels in all ducts 12" and larger shall be cross-broken. All ducts, housings, etc., shall be fabricated as detailed on the drawings and in the SMACNA Duct Construction Manual –Latest Edition.

.2 All rectangular ducts unless specified otherwise shall be "Pittsburgh Lock" longitudinal joints. Snaplock is not acceptable.

.3 All round ducts and flat oval ducts shall have spiral seams or continuously welded longitudinal seams.

.4 All transverse joints in rectangular ductwork 24" and larger shall be Ductmate, SMACNA T-25, or approved equivalent. Formed on flanges shall not be used in ductwork over 42". All flanged ductwork, regardless of pressure class, shall use gaskets, corner closures, and be TEK screwed or riveted on 10" centers with a minimum of two (2) per side. Transverse joints in rectangular ductwork smaller than 24" shall be made in accordance with SMACNA suitable with the pressure class.

.5 All transverse joints in round and oval ductwork 24" and larger shall be Ductmate, or approved equivalent. Transverse joints in round and oval ductwork smaller than 24" shall be beaded sleeve joints.

.6 Ducts shall be securely supported in accordance with SMACNA Duct Construction Manual – Latest Edition and in no case less than double thickness 1" x #24 gauge galvanized metal. Cable hangers are not allowed.

.7 Ducts that are to be externally insulated shall not be supported on unistrut channel unless it required based upon loading. Hanger rods for trapeze bars shall be spaced to allow for insulation installation.

23 31 03 SEALING

.1 Duct sealant shall be flexible, water-based, adhesive sealant designed for use in 4" static pressure systems. Sealer shall be UL listed and conform to ASTM E84. Sealer shall be equal to Ductmate PROseal, United McGill Uni-Mastic, Duro-Dyne DSW, or equivalent.

.2 All supply ductwork unless specified otherwise shall be SMACNA's seal class A.

.3 All return, exhaust, outdoor air, relief and supply ductwork downstream of terminal units shall be SMACNA's seal class B.

23 31 06 FITTINGS

.1 Branch take-offs on rectangular ductwork shall be 45°-boot fitting, spin in fittings are not acceptable.

.2 Branch take-offs on round or oval ductwork shall be conical or 45° conical as shown on plans.

.3 Proportional splits shall be made the sizes as shown on the drawings. Where duct sizes are changed from the original design, Contractor shall proportion split equal to the split in airflow.

.4 Elbows in round, flat oval, and rectangular radius elbows shall have a minimum centerline radius of 1-1/2 that of duct size.

.5 When approved by the Engineer ducts may be notched at structural steel. The converging angle shall be no greater than 30°, the diverging angle shall be no greater than 15°.

.6 When approved by the Engineer objects may penetrate a duct. An airfoil shape shall be placed around the object to minimize turbulence.

23 31 07 PLENUMS

.1 Sheetmetal plenums shall be constructed of a minimum of 18 ga. or greater as determined by the pressure class of the plenum. Sheetmetal and shall be braced and reinforced to support the weight of a 200-lb. person. Tie rods shall not be used.

.2 Plenums shall be constructed without air turning vanes.

.3 Plenums shall have access doors as sized on drawings, where no size is shown provide a minimum size of 18" x 36".

23 31 08 AIR THERMOMETERS

.1 Air thermometers shall be provided and in the supply air, coil discharge of all air handling unit coils, return air, mixed air, and outside air of the air handling units.

.2 Airstream thermometers shall be bimetal type, with an accuracy of ±1°F throughout the range with 5" dial size, 12" stem length, ½" N.P.T. back side connector with plain slip ring case of 304 stainless steel, and recalibrator. Thermometer shall be Trerice Model No. B85212 or approved equal as manufactured by Weksler, Marsh, or Marshalltown Instruments. Thermometers for use in the mixed air shall have flexible averaging elements strung with the mixed air temperature sensor and freezestat sensor elements. Mixed air thermometers shall be Trerice No. V80445 with bulb number 4-3-1.

.3 Range shall be as follows:

Outdoor air	-40-160°F
Mixed air	0-100°F
Supply air	25-125°F
Return air	25-125°F
Preheat coil discharge	25-125°F
Reheat coil discharge	25-125°F
Chilled water coil discharge	25-125°F

23 33 00 AIR DISTRIBUTION ACCESSORIES

23 33 01 BALANCING DAMPER

.1 Furnish and install volume dampers at locations where required to properly balance the air distribution systems.

.2 All dampers, except those located downstream from terminal units used to adjust individual grilles, shall have frames and bearings and shall have quadrant lock regulators with thread screw to allow damper to be securely locked into place.

.3 Balancing dampers downstream from terminal units that are contactor fabricated or apart of manufactured branch fitting shall be a minimum of 18-ga. plate, 3/8" continuous shaft with locking quadrant handle equal to Duro Dyne model Quadline.

.4 Rectangular dampers up to size 24" x 12" shall be Ruskin MD25, Nailor 1870, Arrow, Air Balance, NCA, or shop fabricated equal, approved by the Engineer.

.5 Round dampers up to size 20" diameter shall be Ruskin MDRS25, Nailor 1890, Arrow, Air Balance, NCA or shop fabricated equal, approved by the Engineer.

.6 Rectangular dampers larger than 24" x 12" shall be Ruskin MD35, Nailor 1820 or equivalent manufactured damper by NCA.

.7 Where volume dampers are to be adjusted through walls or ceilings, such dampers shall be operated by regulators designed for recessed installation and provided with a cover plate which shall be flush to the surface of the wall or ceiling. Concealed regulators, as manufactured by Duro Dyne Corporation or Elgen shall be of the indicator type. Regulator shall be provided with a spring washer for non-binding adjustment and hex lock nut in addition to wedge pin which shall be installed to prevent damper rattle. Cast alloy regulator housing, with "open to shut" range positioning markers, shall be secured with removable cover to expose regulator for adjustments.

.8 All automatic dampers and control dampers shall be as specified in Division 25, "Temperature Control". Dampers shall be furnished under Division 25 for installation under Division 23 30 00.

.9 Control Damper Installation

.91 Dampers installed in walls shall be installed with wall sleeves to allow direct coupled actuator installation.

.92 Large damper installations with multiple actuators shall be installed with 8" sheetmetal blank-off/spacers between them to allow direct coupled actuator installation. Provide structural supports as required for a straight, true, level and square installation.

.93 Dampers shall be attached with fasteners on 6" centers with a minimum of 2 per side.

23 33 02 FIRE DAMPERS

.1 Fire dampers shall be provided as indicated on the plans. Dampers shall be U.L. 555 listed under N.F.P.A. Pamphlet #90-A. Dampers for rectangular ductwork shall be Style B, round or oval ductwork shall be Style C. In both cases the curtain shall be located outside of the airstream. Closure springs shall be furnished for both horizontal and vertical installations.

.2 Dampers rated for installation in up to 2-hour fire resistive construction shall be Ruskin Type IBD2, Nailor model 0120/0130, Air Balance model 119, Greenheck model FD-150, or approved equivalent. Fire dampers rated for installation in greater than 2-hour fire resistant construction shall be Ruskin Type IBD23, Nailor model 520/530, Air Balance model 319, Greenheck model FD-350, or approved equivalent.

.3 Diffusers and returns in two (2) hour rated floor/ceiling assemblies shall be equipped with ceiling fire/radiation dampers suitable for this application. Ceiling radiation dampers shall be Ruskin type CFD-2 for damper areas up to 324 square inches and in CFD-4 for areas between 324 square inch minimum and 576 square inch maximum. Dampers shall have 2" x ½" x 16 gauge galvanized steel frame. Damper must be classified and approved under UL Fire Resistance Directory, 1985 Edition. Similar products by National Controlled Air, and Prefco Products, Inc., will be considered for approval. Where volume dampers are indicated on the air device schedule along with ceiling radiation dampers, provide a fusible volume adjustment on the radiation damper blades equal to Ruskin CFD-2A, CFD-4A or Nailor as identified above.

.4 Dampers are to be witness tested by the Owner. The Contractor shall remove the fusible link and demonstrate that the damper closes freely. After acceptance by the Owner, the Contractor shall reset the damper and replace the fusible link.

23 33 03 AIR TURNING VANES

.1 Furnish and install in ductwork at all elbows directional air turning vanes and in mitered change of direction fitting greater than 45°, vanes shall be trimmed on the leaving air side to match the angle of fitting. Vanes shall be single rolled types rolled to a radius of 4-1/2". Vanes shall be solidly installed and rattle-free locked into each slot of preformed vane guide rails as manufactured by Duro Dyne Corporation or Elgen. Rails shall be

constructed of 24 gauge galvanized steel, specially embossed for extra strength and sturdiness. Vane slots shall not exceed 3-1/2" on centers.

23 33 04 FLEXIBLE CONNECTORS

.1 Furnish and install flexible connections at the connections to air handling equipment as indicated on the plans. Flexible connections shall be U.L. listed fabric that meets NFPA 90A. It shall weigh not less than 24 oz per sq. yd and have a tensile strength of not less than 500 psi. Flexible connections shall be preassembled "Super Metal-Fab" with 6" fabric attached to 3" metal on either side by means of "Grip-Loc" seam. At least one inch of slack shall be allowed when making connection to insure that no vibration is transmitted from fan to ductwork. The flexible connectors shall be fastened to ductwork and equipment by screws, rivets or spot welding. Flexible connectors shall be No. MF6N as manufactured by Duro Dyne Corporation, or equivalent by Vent-Fabrics or Elgen.

23 33 05 ACCESS DOORS and PANELS

.1 Access panels with windows shall be provided at all fire and smoke dampers and as shown on drawings. Door shall be SMACNA Standard, 12" x 12", double skin, 1" fiberglass insulation, hinged, wired plate glass, Ruskin ADH22, Nailor 08SH or equivalent. Access panels without windows are required at (all duct mounted automatic control dampers, duct mounted reheat coils, multi-zone dampers). Access panels for fire dampers must meet NFPA 90A requirements.

.2 Access doors in casings and housings shall be fabricated double skin doors with 1" thick insulation between inner and outer surface as detailed in the SMACNA Duct Manual. Provide two compression latches equal to Ventlok #260 on each door. Where access doors provide for personnel entry into the system, they must be provided with inside/outside latch hardware. Provide access doors at all locations indicated on the drawings and into the mixing chamber of all air handling units. Size shall be 18 x 36, unless indicated otherwise on the drawings. Ruskin GPAD or equivalent.

.3 For access panels required in ceiling, walls, etc. of the building construction, see Section 20 10 10.

23 33 06 FLEXIBLE DUCTWORK

.1 Flexible duct shall be factory-fabricated units constructed of galvanized steel formed and mechanically locked to fabric covering. The units shall have an inside bending radius of 3/4 of the inside dimension of the pipe, and the entire installed unit, using manufacturer's apparatus and installation methods shall be flexible duct assemblies shall be rated for working pressures of 6" w.g. positive and 1" w.g. negative. Flexible duct assemblies shall be U.L. 181, Class I air duct listed and shall meet fire resistive standards of NFPA 90A. Flexible ducts shall be factory insulated with 1-1/2" thick glass fiber insulation with flame resistant, metallic vapor barrier finish. Flexible ductwork shall be attached to ductwork and diffusers.

.2 Flexible duct length shall not exceed 8' for diffusers and 3' at VAV box inlets.

.3 Support flexible duct on 4' centers maximum.

.4 Flexible duct shall be attached with zinc plated or stainless steel worm drive duct hose clamps.

.5 Flexible duct shall be Flexmaster Type 8M, no substitutions allowed.

23 34 00 FANS

.1 General

.11 All fans shall be licensed to bear the AMCA Performance Air and Sound Certified Ratings Seal. Fan air performance ratings shall be based on test conducted in an AMCA registered laboratory in accordance with AMCA 210 Air Performance Testing and AMCA 300 Sound Performance Testing. Fan curve families (tables will not be accepted) and octave band sound data shall be furnished with submittal data.

.12 All fans shall have premium efficiency open dripproof motor unless indicated otherwise. Fans with variable speed drives shall have inverter duty motors. All fans with V-belt drives shall be equipped with adjustable pitch sheave rated for 1.5 times the motor horsepower, shall have sliderail base, and shall have a belt-guard.

.13 All fan shafts shall be designed so that the first critical speed is at least 20% over the maximum operating speed. Bearings shall be self-aligning, grease lubricated, anti-friction, pillow block bearings with a minimum life (L50) of 200,000 hours.

.14 Where fans are other than scheduled the following criteria shall apply: Fans shall be picked at the scheduled flow and static pressure, fan efficiency shall not be more than 5% less efficiency than scheduled fan, fan motor shall not be larger than scheduled motor (manufacturer shall notify Contractor of any larger motor sizes, Contractor can pursue equipment substitution as required in subsection 150620), the fan rpm shall not be within 15% of the maximum or minimum allowable rpm, and in general the fan selections shall be based upon maximum energy efficiency but in no case shall the fan wheel be smaller than what is scheduled. Where selection point is within 15% of the maximum allowable rpm of the fan class, provide a higher fan class.

23 34 02 ROOF EXHAUSTERS

.1 Furnish and install where indicated on the drawings centrifugal roof exhaust fans of the sizes and capacities as scheduled. Centrifugal impeller is to be of heavy aluminum construction with backward inclined or curved hollow airfoil blades. Hoods shall be constructed of aluminum with rolled bead for additional strength and shall be easily removable for servicing. Overall height from the curb shall not exceed that of the models scheduled. Motor and drive assembly shall be vibration isolated from the base and housing. All units shall have U.L. wired safety disconnect switch, sound attenuating roof curb and backdraft damper, in addition to any other accessories listed in the schedule.

.2 Contractor shall install a vinyl coated steel cable from the motor cover to the base to allow the motor cover to be removed for service but will not permit the cover to be blown away. Cable shall have eyelet or swagged ends with aluminum or galvanized fasteners.

.3 Units shall be Cook ACE-B, Greenheck GB, Penn-Barry, Domex, ACME PNN or approved equal.

23 37 00 AIR DEVICES

23 37 01 GENERAL

.1 Furnish and install diffusers, grilles, and registers as shown on the drawings and specified herein.

.2 Air devices shall be installed in the orientation and the pattern controllers adjusted as indicated on the plans, as indicated on the shop drawing, or through supplemental information.

.3 Submittal data for all distribution devices shall contain the following information:

1) Room Number
2) Model Number
3) Flow Rate
4) Size: Neck and where applicable
5) Throw in feet: Based on 50-fpm velocity
6) Air patterns: Such as one-way, two-way opposite, corner, four-way, etc.
7) Pressure drop in inches of water
8) Sound rating
9) Airflow factor: Such as K factor or as required for airflow rate measurements.
10) Accessories: Such as volume dampers, deflectors, etc.
11) Three-color charts and balance instructions shall be furnished with submittal data.

.4 Devices described below and indicated on the drawings are based on Titus. Similar design characteristics as manufactured by Price, Carnes, Metal Aire, Nailor, or Tuttle & Bailey will also be acceptable. Such substitute equipment shall be sized on the basis of ADPI performance, and shall be selected for a maximum of 0.05 inches w.c. static pressure drop and a maximum noise criterion curve of NC30. Return or exhaust devices shall not be smaller than sizes shown.

.5 Ceiling diffusers shall be of the type, service, size, and finish as scheduled on the drawings. Border types shall be coordinated by the Contractor to be suitable for ceiling types grid width, tile types, drywall, plaster, concealed spline) in which diffusers will be installed.

23 37 02 LOUVERED CEILING DIFFUSERS

.1 In dry areas diffusers shall be steel construction, Titus OMNI or equivalent. In wet areas diffusers shall be aluminum construction, Titus OMNI-AA or equivalent.

.2 Return or exhaust diffusers shall be similar to the supply air diffusers less the adjustable pattern controllers. In dry areas diffusers shall be steel construction, Titus OMNI or equivalent. In wet areas diffusers shall be aluminum construction, Titus OMNI-AA or equivalent.

23 41 02 FILTERS

.10 2” and 4” filters shall be dust spot efficiency on ASHRAE Test Standard 52.1 and MERV 8 on ASHRAE Test Standard 52.2. The filter media shall be a self-extinguishing, non-woven cotton and synthetic fabric, UL Class 2. The enclosing frame shall be a rigid, heavy duty, moisture resistant, high wet strength beverage board die cut for dimensional accuracy with diagonal support members. The pleated media pack shall be bonded to the inside of the frame on all four edges to prevent leakage. The media support shall be a welded wire grid bonded to the filter media to reduce media oscillation. The media support shall be contoured shape allowing total use of the filter media for longer life.

.11 2” filters shall not have less than 14 pleats per linear foot and not less than 17 square feet of effective media (based on 24” x 24”). Filters shall be as manufactured by Camfil-Farr Filter model 30/30, American Air Filter model 300X, or approved equivalent.

.20 Second stage filters shall be high-efficiency pleat-in-pleat V-bank disposable type. Filter media shall be microfine glass formed into uniformly spaced pleats separated by fiberglass thread separators and formed into a minipleat pack design. Each minipleat pack shall be assembled into a V-bank configuration. Filter shall be rated as UL Class 2.

.21 12” deep 65% dust spot efficiency on ASHRAE Test Standard 52.1 and MERV 11 on ASHRAE Test Standard 52.2. Filters shall have not less than 200 square feet of effective media based on 24” x 24” size. Filters shall be as manufactured by Camfil-Farr Filter model Durafil 65, American Air Filter model Vari-Plus MC-65, or approved equivalent.

.22 12” deep 95% dust spot efficiency on ASHRAE Test Standard 52.1 and MERV 14 on ASHRAE Test Standard 52.2. Filters shall have not less than 200 square feet of effective media based on 24” x 24”. Filters shall be as manufactured by Camfil-Farr model Durafil 95, American Air Filter model Vari-Plus MC-95, or approved equivalent.

.3 Each filter assembly shall have a gauge arranged to measure pressure across each filter type in housings containing more than one filter. Provide all necessary pressure taps, tubing, fittings, valves, and mounting hardware. Gauges shall be Dwyer Model 2001 or equivalent (0-1" range for single stage 30% filters) (0-2" range for 65% or greater filters or multiple stages). Each filter assembly shall have an engraved plastic plate indicating what the final change-out pressure is for each type of filter.

23 70 00 PACKAGED EQUIPMENT

<u>DX MINI SPLIT SYSTEM (AC-1)</u>

.1 Install packaged DX Split system as shown on the drawings. Unit shall include wall-mounted indoor unit with 3 fan speed. Outdoor compressor unit to be mounted on roof. Condenser pump should come with the unit. Unit shall be R410A refrigerant.

.2 Capacity shall be 21,501 btuh sensible cooling at space conditions of 75 DB, 50% RH with 104°F ambient. Unit shall include low-ambient option. Unit shall be 208V, single phase.

.3 Unit shall be Mitsubishi PKA-A3KA.

23 73 00 AIR HANDLING UNITS

23 73 02 PACKAGED DOUBLE WALL ROOFTOP UNITS

.1 Furnish and install air handling units as specified below, and as described in diagrams and schedules on the drawings. The unit shall include frame casing, insulated drain pans, heating and cooling coils, fan assemblies, access panels for easy access to all service points, bearings, motors and drives and guards.

.2 The units shall be constructed of welded or bolted angle or channel steel frames. The casings shall be a minimum of 18 ga. G90 galvanized sheet metal. The entire frame assembly shall be hot dipped galvanized after fabrication, or suitably treated with a rust inhibitor coating. The interior of the casing shall be solid lining of a minimum of 20 ga. G90 metal insulated with 2" 1 ½ lb. high-density fiberglass insulation. Hinged access doors with camlocks and heavy duty hinges shall be provided for ready access to bearings, motors, drives, coils, piping devices and connections, and other points required for maintenance service or inspection. Condensate drain pans shall be installed with 2" of insulation provided between the drain pan and the casing and shall drain both the coil and the fan; units with multiple vertically stacked coils shall have an intermediate drain pan. The pans shall be of continuously welded seams, Series 300 stainless steel construction, 'V' shaped and/or sloping to the drain connection, flat pans will not be acceptable. Drain pans shall be located in the coil section and in the fan section.

.3 Entire air handling unit shall set on base rails which are capable of mounting on a roof curb and supporting the unit during shipment, installation, and operation. Base rail shall overhang curb to facilitate water run-off and protection of the curb to base connection from water intrusion. Base shall include a formed pocket that sets on the roof curb gasketing to provide a positive weather-tight seal. Roof shall be standing seam pitched opposite of access door openings at a minimum roof pitch of ¼" per foot. All seams in the roof shall be gasketed and capped to prevent water infiltration into the unit. No penetration shall be made in the pressure sensitive inner panel. The exterior of the unit shall be G90 galvanized metal and shall be painted with a minimum of two coats of factory applied enamel finish.

.4 Fans shall have capacities and minimum wheel diameters as indicated on the schedules. Each fan shall be of the non- overloading centrifugal type with deep drawn inlet rings, streamlined housing and scroll, with blades continuously welded to the flange, solid backplate, full curved shroud, and flanged discharge collar. Where Class II construction is required, wheels shall be reinforced with a welded intermediate ring. Fan bearings shall be heavy duty, self-aligning, grease lubricated, antifriction type with double row rollers and labyrinth grease seals. Grease fittings shall be extended to the fan support bracket on the motor side. Provide drain openings at the bottom of each fan scroll. Each fan shall be equipped with an adjustable pitch V-belt drive selected for 1.5 times the motor horsepower, motor sliderail base and dripproof motor. Fans and motors shall be resiliently mounted on a single structural base, internally mounted with resilient mounts on the unit structural frame. Fans shall be airfoil or backward inclined as scheduled. Forward curved fans may be used only where specifically scheduled. Internal resilient mounting shall be spring type with minimum 1-1/2" static deflection and provided with seismic restraints.

.5 Manufacturer shall use the most energy efficient fan option within the manufacturer's line for the unit size but in no case will the wheel be smaller than the diameters scheduled.

.6 The units shall be provided with coils of the types and capacities scheduled. Cooling coil casing shall be Series 300 stainless steel, others shall be galvanized steel. Coils shall be constructed with no less than ½" diameter x .020" wall thickness copper tubes and .0075" aluminum or copper fins spaced not closer than 8 per inch. Fins shall be permanently secured to the tubes by mechanical bonding or soldering and shall be plate type. Frame shall be shall include intermediate tube supports to prevent sagging of the tubes. The coil shall be removable with removing casing panels (i.e., casing shall have its own internal frame and shall not use the coil for support).

.61 Water coil headers and "U" bends shall be arranged so that the entrained air is carried along with the flow of water through the coil to the high point on the leaving water header. High points in the coil shall be provided with vent connections. Multi-row coils shall be arranged for counterflow heat exchange between the air and water.

.7 The units shall be Trane T Series, York Curbpack, McQuay RDS, or Carrier 39NC.

23 82 00 TERMINAL HEATING UNITS

23 82 01 UNIT HEATERS

.1 Furnish and install unit heaters of types, arrangements, and capacities as indicated on the drawings.

.2 Cabinet type units shall include a 16 gauge furniture steel casing, inclined blade type inlet and discharge grilles, removable panels, 120/1/60 fan motors, quiet operating centrifugal fans, non-ferrous hot water heating coils, throwaway filters, vandal proof fasteners, and air vent tappings. The heaters shall be arranged for mounting as indicated. Heater casings shall be finished in baked enamel with colors as selected by the Architect/Engineer. The units shall be Trane Force Flow, Sterling, Airtherm, McQuay, Engineered Air or equivalent.

.3 Propeller type units shall have a heavy gauge enameled steel casing, deep pitch propeller fan direct connected to a resiliently mounted capacitor start squirrel cage induction motor 120/1/60, adjustable discharge louvers, fan guard, non-ferrous hot water heating coil with supply and return connection in rear of unit, arranged for hanging from top side hanger rod connections, and finished in the manufacturer's standard color baked enamel finish. The propeller units shall be Trane Model S, Airtherm Model HU, or Vulcan Model HV, Sterling Model HS.

23 82 03 FIN TUBE RADIATION

.1 Contractor shall furnish and install lengths and heating capacities as indicated on the drawings. Where the element length is less than cover length the Contractor shall install pipe, of the same material and size, between the elements. Verify the intent with the Engineer to space the elements evenly, or centered on the windows. Heating elements shall be copper tube with full hard temper aluminum fins 0.016" thick. All heating capacities shall be I-B-R certified.

.2 Enclosure shall be 16 gauge galvanized steel with 20 gauge galvanized steel partial back plate. Color shall be selected from manufacturer's standard colors. Finish shall be baked enamel power coat. Extruded grilles shall be clear anodized finish and pencil-proof spacing. Furnish all necessary mitered corners, end caps, access doors, column covers, and accessories required for flush butting joints.

.3 Low profile, wall mounted, open bottom, architectural type shall have a maximum enclosure height of 7" (10" installed height) with extruded aluminum outlet grille. Fin tube shall be Vulcan Dura-Vane model DV3W, Sterling model JVA-AR-LP7 or approved equal.

23 82 04 VARIABLE VOLUME UNIT WITH HOT WATER HEAT

.1 Unit casing shall be welded, galvanized steel. Leak rate shall be not more than 1% of rated capacity at 4" wg. Interior surface of unit casing shall be acoustically and thermally lined with 1/2 inch thick, minimum of 1.5 lb./cu. ft. density glass fiber with foil face. Insulation shall be UL listed and meets NFPA-90A and UL 181. Factory mounted, removable panel on bottom of unit providing access to air valve and entering airside of coil. Straight flange or slip and drive rectangular discharge duct connection.

.2 Factory mounted one or two row coil with maximum of 12 fins per inch. Full fin collars for accurate fin spacing and maximum tube-fin contact, 5/8 inch O.D. seamless copper tubes mechanically expanded into the fin collars, leak tested at 300 psig.

.3 Air valve shall be a 90° rotational damper flow control device with factory installed direct digital controls (DDC). All controls shall be furnished under Division 25 and mounted and wired in the factory by unit manufacturer. Manufacturer shall provide multiple point averaging flow sensing ring with high and low pressure pneumatic tubes compatible with DDC velocity pressure sensor. A calibration chart shall be provided on each unit.

.4 At the Contractor's option Division 25 may field mount controls at no additional cost to the Owner.

.5 Units shall be as manufactured by Titus, Anemostat, Carnes, Enviro-Tech, Krueger Metal Aire, Nailor, Price, Tuttle and Bailey.

23 82 06 HOT WATER REHEAT COILS

.1 Hot water reheat coil casings shall be galvanized steel. Coils shall be constructed with no less than ½" diameter x .020" wall thickness copper tubes and .0075" aluminum or copper fins spaced not closer than indicated on equipment schedule. Fins shall be permanently secured to the tubes by mechanical bonding or soldering and shall be plate type. Frame shall include intermediate tube supports to prevent sagging of the tubes.

.2 Headers and "U" bends shall be arranged so that the entrained air is carried along with the flow of water through the coil to the high point on the leaving water header. High points in the coil shall be provided with vent connections. Multi-row coils shall be arranged for counterflow heat exchange between the air and water.

.3 Hot water reheat coil shall be as manufactured by Heatcraft, Marlo, Technical Systems or approved equal.

END OF SECTION

25 00 00 TEMPERATURE CONTROL SYSTEMS

25 00 01 GENERAL

.1 This Section specifies an Automation/Energy Management System to control and monitor HVAC systems.

.2 The Plans, the general provisions of the Contract including the General, Supplementary and/or Special Conditions and specification sections of Division 1 shall apply to Work of Divisions 20 - 29 of the Specifications.

.3 Provisions and conditions cited in this Section shall apply to Work for other sections of Divisions 20 - 29 of these Specifications.

25 00 02 REFERENCES, REGULATORY REQUIREMENTS

.1 Work for this Section of the Specifications shall be performed in accordance with the Codes, Standards, etc. as identified in Division 20 in addition to the following:

.11 N.E.C., NFPA 70 – 2008

.12 FCC rules, Part 15, Subpart J, regarding Class A radiation for computing devices and low power communication equipment operating in commercial environments.

.13 UL 916 Underwriters Laboratories Standard for Energy Management Equipment.

25 00 03 REFERENCES, RELATED SECTIONS of the SPECIFICATIONS

Requirements of the following Sections of the Specifications apply to Work for this Section:

.1 Division 20 - Basic Mechanical Conditions and Basic Mechanical Materials and Methods
.2 Division 23 - Mechanical Equipment and Air Distribution System
.3 Division 26 - Electrical Power and Lighting.

25 00 04 DEFINITIONS

.1 The term “DDC or Direct Digital Control” where used in this Section of the Specifications shall be defined as a control technique through which the process variable is continuously monitored by a digital computer which accomplishes loop control by calculating a control solution for output to a control device.

.2 The terms “EMS” Energy Management System, “BAS” Building Automation System, may be used interchangeably in this Section of the Specifications to mean a system to control mechanical equipment using DDC. This definition includes both hardware and software components that are integrated to form a working system.

.3 The term “Control Wiring” where used in this Section of the Specifications shall be defined as all wiring, 120 VAC line voltage or lower other than power wiring, required for the proper operation of the mechanical system and the BAS. This includes applications where line voltage serves as the control circuit such as a line voltage thermostat or involves interlocking with a damper.

.4 The term “Power Wiring” where used in this Section of the Specifications shall be defined as all line voltage wiring to the mechanical and BAS equipment that is required for proper operation of the equipment. Typically, this wiring will support voltage at or above 120 VAC and is connected to the equipment for the purpose of providing motive power.

25 00 05 WORK INCLUDED

Furnish material, labor and services necessary for and reasonably incidental to the installation of the following work where shown on the Plans and as hereinafter specified. Include all necessary work in the related sections of the Specifications (section 25 00 03) to perform the Work completely.

.1 All engineering, labor, material, components, tubing, wiring, software, data base generation, graphics development, etc., as required for a complete operational control system as described on the drawings, in the specification, and as required by good practice.

.2 Furnishing of sensor wells, calibration wells, valve bodies, control dampers, smoke dampers, air flow measuring stations, etc. for installation, by the respective trade contractors, under other sections of the specification.

.3 Coordination as required with Division 16 for proper interlocking, control wiring, and start-up. Furnish and supervise the installation of all control equipment required by Division 16 for interlocks as indicated on the drawings and specified herein.

.4 Coordination with other Divisions 20 - 29 sections as required to assure proper equipment interlocking and installation including, but not limited to, damper installations, mixing box arrangements, terminal unit controls, and adjustment required by the testing and balancing work.

.5 Provide technicians to assist the balancer, and to adjust the economizer dampers to maintain design cfm during economizer modulation with no greater than a 10% variation.

.6 Provide technicians to assist with the commissioning process as required, see Section 152300 for requirements.

25 00 06 WORK NOT INCLUDED

The following considerations are not included in the Scope of Work for the proposal for this Section of the Specifications:

.1 Installation of sensor wells, calibration wells, valve bodies, control dampers, and smoke dampers furnished under this section of the specification for installation under other sections of the specification.

.2 Power wiring and relays shown on the electrical drawings furnished and installed under Division 16.

25 00 07 SUBMITTAL

.1 The Contractor shall submit the following for approval in accordance with Section 20 00 40, Duties of Contractor, sub-section 20 00 43.

.11 Schematic diagrams for each system, identifying by make and model number, size, capacity, throttling range, spring range, design control setpoint action, etc., of each device. Each device shall have an identifying number unique to that device.

.12 Detailed sequence of operation of each system or device including specific references to each of the components in the system describing specifically how the component affects system operation in the various operating modes. This detailed sequence shall be preceded by a generalized overview of the sequence describing in broad terms how the system functions.

.13 Complete engineering data and descriptive literature for each component.

.14 Complete wiring diagrams including: the system riser diagram showing the network architecture; floor diagrams showing sensor locations, panel locations, and equipment locations; point to point wiring diagrams for each electrical and electronic device showing all internal wiring and all interlock wiring required to complete the intent of the sequence of operations of the systems described in this section of the specifications.

.15 At the time of submittal drawings, temperature control subcontractor shall submit the name of the superintendent who will be responsible for the project, and the name of the engineer who will be in charge of the engineering aspects.

.16 Control panel layout drawings showing internal and external component arrangements, entry and exit points for wiring and tubing, and a list of all cover mounted labels indicating label size and inscription.

.18 Program flow charts for all sequences and an example of a typical program listing with comment lines shall be submitted for review and approval as a part of the shop drawing review process. Program code shall not be developed prior to flow chart approval.

.22 After the shop drawings have been approved the Contractor shall prepare and submit four (4) copies of Catalog Data per Section 20 00 47, four (4) copies of Operations and Maintenance Manuals per Section 20 00 46, and two (2) copies of Software Manuals. All submittals shall also be submitted electronically in PDF format.

.23 After the installation is complete the Contractor shall prepare and submit two (2) copies of As-Built drawings for the Owner's records and at each Building Controller and Device Controller provide one (1) copy of the panel's As-Built drawing. All submittals shall also be submitted electronically in PDF format.

.24 Provide as-built drawings containing the actual field point names and numbers as determined by the Control Contractor and the Owner, plans shall show all cable routing and all device locations, panel locations, and equipment locations. As-built drawings shall contain a wiring schematic of all hand-off-auto switch monitoring circuits. Provide hard copy as well as electronic PDF copy.

.25 At the completion of the project, submit a letter stating all materials are asbestos free, and meet the specified ASTM E-84 flame/smoke rating of 25/50, and that all piping and duct penetrations are smoke or fire stopped as required by the Code.

.26 After system acceptance the Contractor shall submit four (4) sets of 'hard copies' of all programs.

.27 After each 120 day testing the Contractor shall submit a log of all changes to PID values and a report of any program changes with explanation of what the conditions were and why the changes were required.

25 00 08 SPECIAL REQUIREMENTS

.1 START-UP

.11 Upon completion of the installation, the Contractor shall start up the system and perform all necessary testing and run diagnostics to ensure proper operation. A start-up test in the presence of the Owner's representative and the Engineer shall be performed. When the system performance is deemed satisfactory the system will be placed into operation.

.12 At completion of the installation, and before final acceptance by the Owner, the temperature control subcontractor shall calibrate all control devices in a systematic manner. A complete calibration report showing each device by identification number (T-41, V-20, etc.) shall be listed, its use or function identified (discharge air controller, damper motor, etc.), system (S-1, P-8, etc.), calibration temperature, calibration branch line pressure, actual operating pressure range, sensitivity, date of calibration, and initial of technician. The format of this calibration report shall be included with the submittal drawings, and the final report must be presented for approval before the final acceptance of the installation is considered.

.2 TESTS AND ADJUSTMENTS

.21 This subcontractor shall adjust and regulate all control devices relating to the work contained herein and shall instruct the Owner's representative in the proper operation and care of the control system. The subcontractor shall test and operate each component of the control system under actual performance conditions to assure proper function of all devices. Adjusting of controllers and instruction to the operators shall be performed at approximately 120-day intervals during the first year of operation. The test and adjustment shall be scheduled with the Owner's Representative and the Engineer.

.22 Proportional plus integral plus derivative (PID) control loops shall be tuned for minimum error and no hunting under all load conditions. The control contractor shall simulate various load conditions at the time of initial calibration and demonstrate that upsetting the control loop results in a typical PID response with stable control re-established following two or three oscillations of decreasing amplitude around set point. At the 120 day inspection intervals specified above, the control contractor shall upset each PI or PID loop and confirm proper response and readjust the loop tuning parameters as required to achieve proper response at the load condition existing at the time. The intent is to re-tune the control loop as required over the period of the warranty year so the system will be stable under all load conditions encountered through seasonal changes experienced by the building.

.23 Owner instruction at the 120-day intervals shall consist of up to 4 hours of answering any specific hardware or software questions of the Owner's Representative. In addition, the Owner's Representative and the Engineer may choose to witness the Contractor Testing and Adjusting, the Contractor shall answer any questions that arise.

.24 During the first year of operation, the control subcontractor shall be available upon request to answer questions regarding the system, and shall assist the Owner in diagnosing any problems or difficulty encountered in the operation or care of same, in addition to the scheduled visits outline in the preceding paragraphs.

.3 TRAINING

.31 The contractor shall provide a representative from the company used as the source for the electronic controllers used in the systems installed under this contract. The representative shall conduct the training class on the project site at a time scheduled in advance with the Owner and shall occur during or immediately following system start up. These instructions are to be conducted during normal working hours. All pertinent costs shall be included in this contract.

.4 COORDINATION WITH OTHER TRADES

.41 Control contractor shall cooperate with unit manufacturers to assure proper arrangement of control items. Control valves, dampers, thermostat wells, and other control devices that are to be built into the field assembled ductwork or piping systems shall be furnished by the temperature control subcontractor and installed by the Mechanical or Electrical Contractor as directed by the supplier and indicated in other portions of the specifications and drawings.

.42 The control contractor shall provide coordination as required for a properly functioning system and as specified in this section via shop drawings, coordination drawings, site visits, etc. Final responsibility for proper application, installation, and operation of all control system components falls under this section of the specification including equipment provided for installation by others.

.43 Where it is specifically mentioned that design and engineering work associated with equipment provided under this section of the specification is by others, then the responsibility for only the performance and application of the equipment provided to the defined interface point falls under this section of the specification. Responsibility for proper application of the equipment and proper performance of the system controlled by the equipment from the interface point is the responsibility of the designer, installer and equipment supplier.

.5 INTERFACES TO EQUIPMENT PROVIDED BY OTHERS

.51 All equipment and control panels provided under this section of the specification and under other sections of the specification shall be provided with terminal strips. These terminal strips shall serve as the contract boundary between sections of the specification for trouble shooting purposes and bidding purposes. All wiring and connections external to the device shall be the responsibility of the section responsible for field wiring of the device. All internal wiring, connections, and internal components shall be the responsibility of the section providing the piece of equipment. The requirements of this section are intended to apply to but are not limited to motor starters, motor control centers, unit mounted control panels by the unit manufacturer, and control panels.

25 00 09 ACCEPTANCE TESTING and WARRANTEE

.1 Acceptance testing shall consist of demonstrating to the Owner's Representative that the complete system has been available for operation and operating satisfactorily for at least 99% of the time during a continuous 60 day period. The Contractor shall provide the Owner's Representative with acceptable records and logs of operations to substantiate the availability of the system. Failure of one or more DDC panels, or software, or the main CPU, or the Network shall constitute system unavailability.

.2 The building control system, including all hardware and software components shall be warranted for a period of one year following the date of acceptance. Any manufacturing or installation defects arising during this period shall be corrected without cost to the Owner.

.3 During the warrantee period the Contractor will be permitted to monitor and make adjustments to the automatic system via a remote internet connection. The Contractor shall advise the Owner prior to making any changes to the system and shall follow up, immediately after making the modifications, with the Owner, informing the Owner of what changes were made.

.31 On a non-emergency warrantee call from the Owner/Engineer the Contractor shall respond via remote access within two (2) hours of the time the problem was reported. If the problem cannot be resolved with on-line support, the Contractor shall dispatch the appropriate personnel to the job site before the end of the next business day.

.4 The Contractor shall have proof of 24 hour “on call” technicians for emergency service.

25 10 00 CONTROL SYSTEM REQUIREMENTS

25 10 01 GENERAL

.01 This specification defines the minimum equipment and performance requirements for a direct digital control building control system.

.02 All products will be as specified in the following portions of the specification. Equivalent devices will not be substituted or accepted without review and approval by the Engineer prior to the bid date. Not all of the items presented in the products paragraphs will be required for the specified sequence of operation, depending on the specific design selected by the successful contractor. However, all items used in a design by the contractor must be from the list or approved by the engineer prior to the bid date. The system architecture and building design must be submitted for approval prior to the bid date.

.03 Model numbers specified are based on information currently available. The Bidders are responsible for confirming that the equipment they are supplying will conform to the specifications presented. Deviations from the specifications should be brought to the attention of the Engineer.

.04 In addition, suppliers should feel free to present to the Engineer for approval, equipment that meets the specifications or could meet the specifications if minor adjustments were made to the specification but is not listed as acceptable. The intention of the specifications is not to exclude manufacturers or equipment but rather to provide an

opportunity for various suppliers to bid the job while at the same time retain control over the level of quality.

.05 All materials and equipment used shall be standard components, regularly manufactured for this system and shall not be custom designed especially for this project. All components shall have been thoroughly tested and proven in actual use. The building control system shall possess a fully modular architecture, permitting expansion through the addition of more stand-alone control units, sensors, actuators, operator terminals, and/or a general purpose CPU.

.06 The building control system specified herein shall be a direct digital control system, which can, without additional equipment, perform all of the automatic temperature control, and energy management functions as required in this specification. The system, as specified, shall independently control the building's HVAC and auxiliary equipment to maintain a comfortable environment in an energy efficient manner. Stand-alone control units shall be capable of performing all specified control functions in a completely independent manner. Additionally, control unit shall be capable of being networked for single point programming and for the sharing of point information and control instructions between panels.

.08 Input and output to all control loops shall reside in the field panel in which the control loop algorithm is operating. Communication trunks shall not be a part of any control loop.

.11 All controllers except for Application Specific Controllers (ASC) shall be fully custom programmable in the standalone mode. Building or Device controllers (BC or DC) using packaged software solutions shall be unacceptable. Packaged software shall only be used for ASC associated with zone temperature control if the package software can accomplish the exact sequence specified.

.12 Control systems installed under this section of the specification shall be directly engineered, designed, and installed; or directly engineered, designed and installed under the direct supervision of companies or their authorized branch offices or distributors. These companies, and/or their branch offices or distributors shall have been in the control contracting business for a minimum of 8 years unless otherwise approved by the Engineer prior to the bid date.

.13 Acceptable manufacturers are Automated Logic.

25 10 02 BUILDING CONTROLLERS

.1 Building Controllers (BC) shall function as communications/network controllers supporting both communications to other Building Controllers on a high level, high speed bus as well as communications to Device Controllers (DC) and Application Specific Controllers (ASC) on lower level Local Area Networks (LANs). The controllers shall also be capable of supporting modems, printers, Ethernet connections and terminals that can access data from any location in the system. The following specific functions shall be required.

.11 Support for a high level communications using Ethernet, Arcnet, or other high-speed protocol. The files and data transferred on the network may be proprietary and use proprietary file and data string structures. The minimum communication rate shall be 56K bps.

.12 Support for a low-level communications bus or busses for communications between lower level controllers such as Device Controllers and Application Specific Controllers.

Device Controllers are stand-alone controllers that are fully custom programmable.

Application Specific Controllers are small, low point density, low memory stand alone controllers with pre-programmed sequences geared to a very specific application lacking in the ability to do custom control sequences but providing "fill in the blank" programming simplicity. Controllers are suitable for use in controlling terminal equipment such as reheat coils, constant volume regulators, variable volume boxes, fan coil units, fan terminal units, etc.

The low level communications bus may be a proprietary or open protocol. Minimum communications speed shall be 19,200 baud.

.13 Support for one or more RS-232C type devices such as printers, terminals and modems. Note that it may be necessary to provide more than one Building Controller device to provide the number of peripheral support ports required. Peripheral devices shall be required to operate regardless of the status the Operator workstation.

.14 Support to communicate on LonWorks, BACnet IP, BACnet MS/TP or Modbus RTU. Additional protocol converters may be used as required to facilitate this function, but controller shall be capable of such.

.15 Each Building Controller shall perform the following energy management routines as a minimum:

Event based programming
Time of day programming
Optimized time of day programming
Demand control
Duty Cycling
Global data sharing (one point used by multiple controllers)
Ramping
Programmable schedule over rides
Hours of operation accumulation
Event driven reports
Event driven messages
Time synchronization of controllers
Customized start-up on power failure

.16 Each Building Controller shall perform customized control strategies based upon arithmetic, Boolean or time delay logic. The arithmetic functions shall permit simple relationships between variables as well more complex relationships (i.e., square root, exponential). The system shall permit the generation of job-specific control strategies that can be activated in any of the following ways:

Continuously
At a particular time-of-day
On a pre-defined date

When a specific measured or controlled variable reads a selected value or state
When a piece of equipment has run for a certain period of time

.2 Upon a loss of commercial power to any Building Controller, the other units within the network shall not be affected, and the loss of operation of that unit shall be reported at the designated operator's terminal. All control strategies and energy management routines defined for the BC shall be retained during a power failure with the unit for a minimum of seventy-two (72) hours. Upon resumption of commercial power, the control unit shall resume full operation without operator intervention: update all monitored functions; resume operation based on current, synchronized time and status, and implement custom start-up strategies.

.21 Each Building Controller shall contain an un-interruptible hardware real time clock accurate to ten (10) minutes per year. The clock shall contain the time of day, day, month, year, and day of the week. The system shall automatically correct for daylight savings time and leap years.

.3 The BC shall contain self-diagnostics that continuously monitor the proper operation of the unit. A malfunction of the unit will be reported, and will inform the operator of the nature of the malfunction, and the control unit affected. It shall be possible to annunciate malfunctions as well as other control unit alarms at a selected central operator's terminal. The system shall also allow on-line diagnosis via telephone modem from a remote location (vendor's headquarters or local branch office or other remote site).

.6 Each Building Controller (BC) shall be capable of being networked on a peer to peer network with other and BCs as well as being networked to a campus Ethernet LAN as standard or through an additional module. The supporting firmware and hardware shall be configured and arranged so that a dedicated LAN is not required for networking of the system controllers. In other words, the system shall be capable of interfacing with an existing Ethernet LAN which is on line and handling communications between other data systems, and using this LAN for handling its own inter controller communications without interference from or interference to the original communications occurring on the network. Having only a proprietary communications bus available at this level will be unacceptable. The files and data transferred on the network may be proprietary and use proprietary file and data string structures. The minimum communication rate shall be 10 M bps.

.61 Acceptable Products: Automated Logic LGR

25 10 03 DEVICE CONTROLLERS

.1 General

.11 Each Device Controller (DC) shall operate as a standalone controller capable of performing its specified control responsibilities independently of other controllers in the network. Each unit shall be a microprocessor-based, multi-tasking, real-time digital control processor. Device Controllers shall be fully programmable controllers capable of supporting and executing user defined programs in addition to firmware based routines. Programming in the modules shall function independently of the Building Controller and shall not depend on a functional communications network for execution. Loss of communications with other Device Controllers, or Building Controller, shall result in the programming either continuing to execute in its most recent state or returning to some user defined default routine based on the detection of the communications failure by the

Device Controllers firmware or software. The ability to detect and respond to a communications failure will be required.

.12 Each controller shall support its own real-time operating system. Provide a time clock with battery backup to allow for stand-alone operation in the event communication with its Building Controller is lost and to insure protection during power outages.

.13 Provide each unit with sufficient memory to accommodate point databases, operating programs, local alarming and local trending. All databases and programs shall be stored in non-volatile EEPROM or a minimum of 72-hour battery backup shall be provided. All programs shall be field-customized to meet the user's exact control strategy requirements. Controllers utilizing pre-packaged or canned programs shall not be acceptable.

.14 Programming of Device Controllers shall utilize the same language and code as used by Building Controllers to maximize system flexibility and ease of use. Should the system controller utilize a different control language, provide a Building Controller to meet the specified functionality.

.15 Local alarming and trending capabilities shall be provided for convenient troubleshooting and system diagnostics. Alarm limits and trend data information shall be user-definable for any point.

.16 Each controller shall have connection provisions for a portable laptop PC. It shall allow the user to display, generate or modify all point databases and operating programs.

.17 The unit shall be capable of direct interface to a variety of industry standard sensors and input devices. It shall be possible for each unit to monitor the following types of inputs:

Analog inputs
- 4-20 mA
- 0-10/0-5 Vdc
- Thermistors
-RTDs

Digital inputs
- dry contact closure
- pulse accumulator

.18 The unit shall directly control electronic actuators and control devices. Each unit shall be capable of providing the following control outputs:

Digital outputs (contact closure)
- motor starters, sizes 1 to 4 (relays may be used)

Analog outputs
- 4-20 mA
- 0-10 Vdc
- 3-15 psi

.19 Each DC within the building control system shall perform control functions as defined by the operator. All control functions shall be executed within the DC unit. Loop control shall

be executed via direct digital control algorithms. The user shall be able to customize control strategies and sequences of control, and shall be able to define appropriate control loop algorithms and choose the optimum loop parameters for loop control. Control loops shall support any of the following control modes:

Two-position (on-off, open-close, etc.)
Proportional, integral, plus derivative (PID)
Temperature Reset (air, water)

.20 It shall be possible to fully create, modify or remove control algorithms within a specific DC unit while it is operating and performing other control functions. Changes shall be made either through a direct connection of the DC and a laptop PC or via the network with a laptop PC connected to another controller or via the network from the Operator Workstation. Each control loop shall be user definable in terms of:

Sensors/actuators that are part of the control strategy
Control mode
Gain
Control action
Sampling time

.21 Each DC shall communicate on a lower level LAN under a BC, a twisted pair type. A DC shall not relay on campus Ethernet connection to communicate with other controllers.

.3 Controllers shall include all point inputs and outputs necessary to perform the specified control sequences. Provide a hand/off/automatic switch for each digital output for manual override capability. Each switch position shall be supervised in order to inform the system that automatic control has been overridden. As a minimum, 50% of the point inputs and outputs shall be of the Universal type, allowing for additional system flexibility. In lieu of Universal inputs and outputs, provide a minimum of two spare points of each type via additional point termination boards.

.31 Acceptable Products:

Automated Logic ME812u

25 10 04 APPLICATION SPECIFIC CONTROLLERS

.1 Each Application Specific Controller (ASC) shall operate as a standalone controller capable of performing its control responsibilities independent of controllers in the network. Each unit shall be microprocessor based, digital control processor.

.12 Each ASC shall either have a battery backed-up real time clock or shall receive occupied/unoccupied status from a supervisory controller. Upon restoration after a loss of power, the ASC shall revert to its previous state prior to loss of power, or scheduled status based upon the value of the real time clock.

.13 All programs and user-defined configurations shall be stored in non-volatile EEPROM or have a minimum of 72-hour battery backup.

.2 Each terminal unit shall be individually controlled using an ASC controller. ASC controllers shall communicate with the Building Controller on a lower level LAN, a twisted-

pair type, to implement global control strategies including occupied/unoccupied, space setup/setback, warm-up/cooldown. ASC controller or the thermostat shall have a service jack to allow local configuration at the terminal unit. ASC controller shall be mounted in the terminal unit control cabinet or as shown on the drawings.

.21 ASC for use with VAV or fan powered terminals (FTU) shall have a differential pressure transducer based flow sensor. Standard control routines shall include pressure independent VAV, constant volume, parallel FTU, series FTU, and dual duct as required by the sequences of operation. The control routines shall include: shutdown mode, power fail restart mode, occupied/unoccupied mode, temporary occupied mode, warm-up mode, setpoint calculation, temperature control loops, damper control, fan control, exhaust box control, baseboard heat, box heat, lighting control, and auto zero.

.22 ASC for use with fan coil units, heat pumps, unit ventilators, small packaged rooftop, or generic point multiplexer shall include the following control routines: shutdown mode, power fail restart mode, occupied/unoccupied mode, temporary occupied mode, warm-up mode plus those required by the sequence of operations for the type of equipment being controller.

.3 Where ASC controllers are to be installed on terminal units, such as VAV boxes, reheat boxes, fan coil units, etc., the units may be field or factory installed or field installed**.** Regardless of whether the units are factory or field installed, all responsibilities and costs associated with coordinating this installation shall be carried by and under this section of the specification. This includes, but is not limited to, actuator coordination, velocity sensor coordination, relays, auxiliary contacts, enclosure requirements, power requirements, failure mode, normal position upon loss of power and signal, etc.

.4 Acceptable VAV controllers:

Automated Logic ZN341Vt

.5 Acceptable FCU, Heat Pump, etc. Controllers:

Automated Logic U-Line

25 10 05 OPERATOR COMMUNICATIONS and SOFTWARE

.1 WORKSTATION OPERATOR INTERFACE

.11 Basic Interface Description

.111 Operator workstation interface software shall be English language prompting, 30-character English language point identification, on-line help, and industry standard PC application software. The software shall provide, as a minimum, the following functionality:

Real-time graphical viewing and control of environment.
Scheduling and override of building operations.
Collection and analysis of historical data.
Definition and construction of dynamic color graphic displays.
Editing, programming, storage and downloading of controller databases.
Alarm reporting, routing, messaging, and acknowledgment.
Display of dynamic trend data plot.

.112 Provide a graphical user interface, which shall minimize the use of the keyboard through the use of a mouse or similar pointing device and a “point and click” approach to menu selection.

.113 Provide functionality such that any of the following may be performed simultaneously on-line, and in any combination, via user-sized windows:

Dynamic color graphics and graphic control
Alarm management, routing to designated locations, and customized messages
Week at a Glance Time-of-day scheduling
Trend data definition and presentation
Graphic definition and construction
Program and point database editing on-line.

.114 Operator specific password access protection shall be provided to allow the user/manager to limit workstation control, display and data base manipulation capabilities as deemed appropriate for each user, based upon an assigned password. Operator privileges shall “follow” the operator to any workstation that they log onto. A minimum of 200 passwords shall be supported.

.115 Scheduling and override shall be accomplished via a graphical spreadsheet-type format for simplification of time-of-day scheduling and overrides of building operations. Schedules reside in both the PC workstation and DDC Controller to ensure time equipment scheduling when PC is off-line. The PC shall not be required to execute time scheduling. Provide override access through menu selection or function key. Provide the following spreadsheet graphic types as a minimum:

Weekly schedules.
Zone schedules, minimum of 200 unique zones.
Monthly calendars, up to 365 days in advance.

.1151 Provide trending capabilities that allow the user to easily monitor and preserve records of system activity over an extended period of time. Any system point may be trended automatically at time-based intervals or change of value, both of which shall be user-definable. Trend data may be stored on hard disk for future diagnostics and reporting. Additionally, trend data may be archived to network drives or removable disk media for future retrieval.

.1152 Trend data reports shall be provided to allow the user to view all trended point data. Reports may be customized to include individual points or predefined groups of at least six points. Provide additional functionality to allow predefined groups of up to 250 trended points to be easily transferred on-line to Microsoft Excel. BAS contractor shall provide custom designed spreadsheet reports for use by the owner to track energy usage and cost, equipment run times, equipment efficiency, and/or building environmental conditions. BAS contractor shall provide setup of custom reports including creation of data format templates for monthly or weekly reports.

.1153 Provide additional functionality that allows the user to view real-time trend data on trend graph displays. A minimum of six points may be graphed, regardless of whether they have been predefined for trending. The dynamic graphs shall continuously update point values. At any time the user may redefine sampling times or range scales for any point. In addition, the user may pause the graph and take “snapshots” of screens to be stored

on the workstation disk for future recall and analysis. Exact point values may be viewed and the graphs may be printed.

.12 Dynamic Color Graphic Displays

.121 The operator interface shall allow users to access the various system schematics and floor plans via a graphical penetration scheme, menu selection or text-based commands. Graphics software shall permit the importing of AutoCAD or Bitmap drawings for use in the system.

.122 Dynamic values, with the appropriate units, for temperature, humidity, flow, position, and status indication shall be shown in their actual respective locations and shall automatically update to represent current conditions without operator intervention and without pre-defined screen refresh rates.

.123 Sizable analog bars shall be available for monitor and control of analog values; high and low alarm limit settings shall be displayed on the analog scale. The user shall be able to "click and drag" the pointer to change the setpoint.

.124 Provide the user the ability to display blocks of point data by defined point groups; alarm conditions shall be displayed by flashing point blocks.

.125 Equipment state can be changed by clicking on the point block or graphic symbol and selecting the new state (on/off) or setpoint.

.126 Colors shall be used to indicate status and change as the status of the equipment changes. The state colors shall be user definable.

.127 The windowing environment of the PC operator workstation shall allow the user to simultaneously view several applications at a time to analyze total building operation or to allow the display of a graphic associated with an alarm to be viewed without interrupting work in progress.

.1291 A dynamic display of the site specific control architecture showing the status of all controllers, operator workstations, and networks shall be provided.

.1292 A button shall be available on the graphics which is a link to the sequence of operation for the controlled equipment.

.13 System Configuration & Definition

.131 Network wide control strategies shall not be restricted to a single DDC Controller, but shall be able to include data from any and all other network panels to allow the development of Global control strategies.

.132 Provide automatic backup and restore of all DDC controller databases on the workstation hard disk. In addition, all database changes shall be performed while the workstation is on-line without disrupting other system operations. Changes shall be automatically recorded and downloaded to the appropriate DDC Controller. Changes made at the DDC Controllers shall be automatically uploaded to the workstation, ensuring system continuity.

.133 System configuration, programming, editing, graphics generation shall be performed on-line. If programming and system back-up must be done with the PC workstation off-line, the BAS contractor shall provide at least 2 operator workstations.

.14 Alarm Management

.141 Alarm Routing shall allow the user to send alarm notification to selected printers or PC locations based on time of day, alarm severity, or point type.

.142 Alarm messages shall be customizable for each point to display detailed instructions to the user regarding actions to take in the event of an alarm.

.15 Workstation Communications - Provide automatic dial-up communications for buildings as required by the contract documents. Automatic dial-up communications shall include the following features as a minimum:

.152 Trend data shall be scheduled for automatic updating to the workstation at operator-selected times. The operator shall also have the option of manually collecting trend data at any time.

.2 IMPLEMENTATION/DEVELOPMENT OF SEQUENCES OF OPERATION

.21 General: Software sequences shall be provided as described on the drawings and/or as specified herein and as required to initialize and load the field point data base.

.22 All software sequences shall be documented with liberal use of comment lines in the installed program code. Comment lines shall include the following information.

Name and/or number of all equipment controlled by the panel and the name, number, and location of the panel in which the routine runs.

A complete listing of the variable and constant names, identification of their functions, and initial setpoint values.

Identification of each segment of the program and what its function is.

.23 Program for all sequences shall be submitted for review and approval as a part of the shop drawing review process.

.24 Software testing requirements shall include testing in the field of all logic sequences including actual simulation of different processes and events and observing program response to the process or event. All deviations from the requirements of the sequence as specified shall be corrected immediately at no additional cost to the Owner.

.25 Where several analog outputs are to be controlled in sequence by one control loop, software shall be arranged so that the sequence is guaranteed regardless of the spring range of the actuators and to prevent simultaneous heating and cooling.

.26 Programs controlling several pieces of equipment as one system shall reside in one field panel. Where programs use data points that reside in other panels the programs shall employ logic (either in software, firmware, hardware, or a combination of all three) to detect loss of communications with the remote panels containing the required data.

When such a failure is detected, the program logic shall revert to a safe operating mode that will allow the controlled systems to remain in operation until normal system communication resumes. A light on the controller shall indicate when such a failure mode exists. In addition, an alarm shall be generated at the Central Processing Unit location (CPU). The Engineer shall approve all failure modes prior to implementation.

.27 Data Base Generation: Provide all required standard data base development, input, and debugging as required by the project and point list including but not limited to point names, point groupings, point ranging, point alarm limits, backup file creation, message development, graphics development, etc.

.271 The following points from VAV controllers shall, as a minimum, be regular points on the network.

Damper Position (%)
Reheat Valve Position (%)
Space Temp (°F)
Space Setpoint Temp (°F)
Deadband (°F)
VAV Box Discharge Air Temp (°F)
Airflow (cfm)
Occupied/Unoccupied Status
Cooling Maximum cfm – Occupied
Cooling Minimum cfm – Occupied
Cooling Maximum cfm – Unoccupied
Cooling Minimum cfm – Unoccupied
Heating Maximum cfm – Occupied
Heating Minimum cfm – Occupied
Heating Maximum cfm – Unoccupied
Heating Minimum cfm - Unoccupied
Setback Temperature
Setup Temperature

.272 VAV point naming, hardware naming, software naming, etc. shall all be named the same and shall be a unique name including the AHU name and the VAV box numbering on the mechanical drawings. The point description shall be the actual room number(s) on the building signage plus the space description agreed upon with the Owner. Any proposed deviation from this shall be approved in writing by both the Engineer and the Owner.

.28 Point Lists: The point lists indicated on the drawings are minimum requirements for the job. The contractor shall provide all input and output points required by his system to perform the indicated sequence of operation, regardless of whether or not they are specifically listed on the drawings.

.281 All set points shall be developed as software points stored at memory locations so that set points can be changed by recommending the data stored at the memory location rather than by entering the program and changing parameters and lines in programs.

.29 Outdoor Air Conditions: Control sequences that use outdoor air conditions to trigger certain specific operating modes shall use data generated by one (1) outdoor air temperature sensor and one (1) outdoor humidity sensor. In other words, the data from one pair of sensors shall be shared by the entire system.

.30 Reset Schedule: Where reset schedules are specified or required the schedules shall be set up so that the operator enters the following points into memory locations.

Two points on the reset schedule line.
A high limit value (maximum reset value).
A low limit value (minimum reset value).

The computer system shall then use these values as input parameters to the appropriate program or programs and calculate the reset schedule based on these values.

.4 GRAPHICS

.41 Color graphic floor plan displays and system schematics for each piece of mechanical equipment, including air handling units, chilled water systems, hot water boiler systems, and zone controls shall be provided by the BAS contractor to optimize system performance analysis and speed alarm recognition. System schematic to include a link on the graphic to a copy of the sequence of operation for that particular piece of equipment.

.411 A floor plan graphic shall display zone temperatures. Where a single VAV box is controlling multiple spaces, it should clearly identify which is the master and which are the slaves. There shall also be a graphic displaying all VAV boxes each having a "box" indicating: the VAV box number, space setpoint, space temperature, cfm, heat or cool.

.413 Each graphic shall contain the controller date, controller time, outdoor air temperature and humidity.

25 10 06 LABELING and IDENTIFICATION

.1 All devices relating to the work or systems included herein, including controllers, valves, motors, relays, auxiliary panels, etc., shall be identified with a unique identification number or name on the submitted engineering drawings. This identification number or name, along with the service of the device (discharge air controller, mixed air controller, etc.), shall be permanently affixed adjacent to the respective device. Identification shall be printed on ½" high vinyl labels.

.2 Terminal strips shall be labeled using plastic labels designed to snap into the label mounting slots on the terminals. Tagging shall be computer generated. For input/output wiring, cabling, or tubing, the panel side of the terminals shall be labeled with the automation panel circuit board and terminal numbers associated with the point. The field side shall be labeled with the point number. Cable, wiring and tubing not specifically associated with an input or output shall be labeled with a number and function.

.3 All wiring, tubing, and cabling both inside and outside of control panels shall be labeled at both ends using Thomas and Betts EDP printable wire and cable markers using style WSL self-laminating vinyl. Input and output cables and wiring shall be labeled with the point identifier as indicated above.

Cable and wiring not specifically associated with an input or output shall be labeled with a number and a function description such as:

+120 vac power
Panel DP2 Ckt. 1

.4 Contractor shall provide labels at each control damper and valve. Labels shall be coordinated with Owner's Representative.

25 10 07 CALIBRATION REQUIREMENTS

.1 Calibration shall be checked at a minimum of two points on the span of the device for temperature, pressure, and humidity sensors. The two points shall be taken as far apart as practical.

.2 For flow elements provide a "dry calibration" certification where in manufacturing tolerance are verified to prove geometric similarity to the original design standard upon which the product accuracy statements are based.

.3 Specified accuracy shall be achieved at the field termination points of the device and shall include both sensor errors and transmitter errors.

25 10 08 AUXILIARY PANELS INSTALLATION and FABRICATION

.1 Auxiliary panels shall be fabricated to match the approved shop drawings submitted by the control contractor. Fabrication shall be in a neat and workmanlike manner and shall facilitate repair, maintenance, and adjustment of the equipment contained therein.

.2 All equipment that is not providing an input from a field sensed process (static pressure, temperature, proof of flow, etc.) shall be installed in an auxiliary panel located as indicated on the drawings or as directed by the engineer.

.3 Auxiliary panels shall be fabricated and laid out to incorporate the following features:

.31 Identification of all internally and cover mounted devices. Cover mounted labels shall be engraved labels. Labels for internal devices may be printed vinyl tape type labels at the contractor's option. Labels shall be mounted adjacent to the device they are associated with so that replacement of the device does not eliminate the label.

.32 All input and output wiring entering the stand alone control units shall be terminated on sliding link or knife switch type disconnecting type terminal strips to allow the field wiring to be isolated from the stand alone unit for trouble shooting and to allow current loops to be tested without lifting any of the wiring. If such terminal strips are not furnished as a standard part of the stand alone control unit termination points, then they shall be installed in an auxiliary panel located immediately adjacent to the stand-alone unit.

.33 All internal wiring shall be run inside plastic wiring duct as manufactured by Tyton. Wire duct shall be sized to hold the required number of wires without crimping the wires and with sufficient space to allow wiring to be traced during troubleshooting operation. Minimum size is 2" wide by 3" high.

.34 Wires that pass from the panel interior to cover mounted devices shall be provided with a flex loop that is anchored on both sides of the hinge and protected within wire loom.

.35 All control panels shall be provided with removable sub-panels to allow the panel enclosures to be installed at the job site during rough in while the panels are fabricated off-site for later installation.

.36 Provide strain relief type cord and cable connectors for all cables that leave the panel as individual cables not in conduit.

.37 Provide one duplex outlet mounted inside the control panel and separately fused with a non-time delay fuse at 5 A at any panel location containing electronic or electrical control components. This receptacle may be served from the control panel's 120 VAC power source.

.38 Provide one under cabinet type fluorescent light with switch mounted internally in the control panel. Panels with external light hoods will also be acceptable if the light will illuminate the panel interior with the door open.

.39 Each panel shall be provided with a control power disconnect switch located and wired so as to disconnect all control power in the panel. The leaving side of this switch shall be wired to the panel and field components through a fuse or fuses sized and applied to protect both the components of the system as well as the wire and as required for code compliance.

.40 Enclosures shall be NEMA 12 for indoor locations and NEMA 4 for outdoor locations or panels rated for both NEMA 4 and 12 may be used at either indoor or outdoor locations. Enclosures shall be fabricated from a minimum of 16-gauge steel with continuously welded and ground smooth seems. Doors shall have hinges to open 180°, oil resistant gasket, a removable print pocket, quarter turn latch mechanism with key lock handle and lock cylinder. Grounding studs shall be welded to both the body and the door. Collar studs shall be provided to mount a sub-panel. Finish shall be gray ANSI 61 polyester powder inside and out over phosphatized surfaces. Sub-panels shall be white polyester power finishes. Enclosures shall be E.M. Wiegmann model N412 with WA-L2 latch kit or approved equivalent by Hoffmann.

.41 All wiring leaving the panel shall be separated by classification; i.e., Class 1 circuits shall not be run with Class 2 circuits, etc. Segregation shall be maintained inside the panel to the fullest extent possible. Where low voltage wires carrying low level ac and dc signals cross wires containing power and high level ac signals, the wires shall cross at a 90° angle.

.42 Panels shall be shop fabricated and tested prior to installation in the field. The panels may be inspected and approved by the Owner's representative at the assembly location prior to installation in the field.

25 10 09 NETWORKING and WIRING (Edit to suit project requirements)

.1 Furnish and install a completely networked system as described herein and/or shown on the drawings. The network shall consist of a Lower Level Network (LLN) that is an extension of an existing network, already connected to a Building Controller.

.2 The LLN: This level of communication shall support a family of Application Specific Controllers and Device Controllers to allow communication with the Building Controllers. Device Controllers DC4,3,2,1 and Application Specific Controllers shall reside on the FLN.

This network may be a proprietary network or open network at the Contractor's option, but should remain a consistent extension of existing network infrastructure in a building.

25 20 00 AIR SIDE CONTROL EQUIPMENT

25 20 01 TEMPERATURE MEASUREMENT

.1 Outdoor Air Temperature Sensor:

.11 The element shall be 10,000 ohm thermistor, with a temperature coefficient of resistance (TCR R25/125) compatible with the system installed, ±1% at 25°C. Element may be a 2-wire or 3-wire type.

.12 The housing shall be a NEMA 4 aluminum box with gasket cover or ABS enclosure that will accept conduit connections. The sensor shall be shielded from sunlight and weather with good ventilation for accurate readings.

.13 Acceptable sensors are Minco model TS429TB, Precon model ST-OX, BAPI model BA/10K-X-O-WP, or approved equivalent.

.14 Outdoor air sensor shall be located where shown on the drawings or in a place as directed by the Architect/Engineer.

.2 Duct Temperature Sensor:

.21 Sensor shall be tip sensitive 10,000-ohm thermistor.

.22 The element shall be 10,000 ohm thermistor with a reference temperature coefficient of resistance (TCR R25/R125) compatible with the system installed, ±1% at 25°C. Element may be a 2-wire or 3-wire type.

.23 The housing shall be a galvanized steel utility box with cover or ABS enclosure that will accept conduit connections. The back of the housing shall have a foam gasket to seal the housing to the duct to minimize air leakage.

.24 Acceptable sensors are Minco model TS431TB, Precon model ST-DX-XH, BAPI model BA/10K-X-D-8", or approved equivalent.

.25 Sensor length shall be coordinated with ductwork; length shall be at least 6" beyond insulation or inner wall of duct.

.3 Duct Temperature Bendable Averaging Elements

.31 Sensor shall be bendable copper or aluminum sheath, continuous sensing 10,000-ohm thermistor.

.32 The element shall be 10,000 ohm thermistor, with a reference temperature coefficient of resistance (TCR R25/125) compatible with the system installed, ±1% at 25°C. Element may be a 2-wire or 3-wire type.

.33 The housing shall be galvanized steel utility box with cover or ABS enclosure that will accept conduit connections. The back of the housing shall have a foam gasket to seal the housing to the duct to minimize air leakage.

.34 Sensor length shall provide coverage of 20' element per 25 square feet of installed area.

.35 Acceptable sensors are Precon model ST-FZX-X, BAPI model BA/10K-X-A-X, or approved equivalent.

.36 Temperature sensing elements shall be strung in free air and shall not be supported from the face of the coil to prevent the temperature of the coil media from affecting the element reading. Where averaging elements must be strung across a duct/plenum, provide conduit or pipe supports spanning the duct at the top and bottom and serpentine the element horizontally between them. Use capillary mounting clips with insulating material to prevent conduction at mounting clips.

.4 Low Limit Thermostat (Freezestat):

.41 Thermostats shall have a 20-foot long remote bulb strung in free air downstream of the cooling coil. Provide conduit or pipe supports at the top and bottom of the unit casing and serpentine the element between them. The coil shall have the manufacturer's recommended coverage with a minimum of one thermostat per 25 square feet of coil face. Provide multiple freezestats wired in series where the coil area exceeds the maximum coverage. Mount all freezestats so they are accessible for reset.

.42 Switch shall change state when any one-foot portion of the element drops below the setpoint (setpoint 40°F). The normally closed contacts wired to the starter safeties shall be rated for 6A inductive load at 120 VAC. The normally open contacts shall be wired to dampers, valves, etc. to return them to their normal state. Where specified in the sequence of operation, a connect shall also be provided for a digital input to the DDC as a supervisory alarm.

.43 Manual reset shall be required to return contacts to their normal positions.

.44 Acceptable thermostats are JCI A70GA-IC or approved equal.

.5 Room Temperature Sensor/Room Thermostat:

.51 Sensor/thermostat shall be 10,000-ohm thermistor with an accuracy of ±0.5°F.

.52 Type S1 shall be sensors with plastic covers to match the thermostats.

.55 Type T2 shall be similar to Type T1 with local override button.

.58 All sensors/thermostats shall have service jack for local configuration.

.59 In general, the following shall apply unless noted differently elsewhere: S1 shall be used in public spaces (i.e., corridors, restrooms, lounges, etc.), S2 shall be used in spaces where damage could occur (i.e., gymnasiums), T2 shall be used in Offices and Conference Rooms, T2 shall be used in all other spaces.

.6 Room Mounted Device Installation:

.61 All devices shall be installed on boxes or mounting plates secured to the building structure, wall studs, etc., prior to the installation of the wall covering or finish.

.62 Rough-ins for low voltage electric and/or electronic devices shall consist of a box or plate with the required number of conductors or cables securely fastened to it and extended to a location out of the wall in which the thermostat is mounted for connection to the control system. Conduit shall be provided at locations where the conductors will be embedded in plaster, concrete, or masonry to protect the conductors and allow easy replacement if necessary.

.63 Rough-ins for line voltage devices shall be in conduit in all cases.

.64 Mounting heights for all devices located on walls in occupied spaces shall be 60" unless otherwise directed by the Architect/Engineer.

25 20 02 HUMIDITY SENSOR

.1 Duct Relative Humidity Sensor:

.11 Sensor shall employ bulk polymer resistance or capacitance technology, 2% RH accuracy, 4-20 mA or 0-5 VDC transmitter factory matched and calibrated and replaceable tip. Sensor may incorporate integral temperature sensor. Sensor shall be BAP1 BA/xx-x-HWxx-D-WP, Minco HT2D1xx, General Eastern MRH-2-D-x or approved equal.

.2 Room Relative Humidity Sensor:

.21 Sensor shall employ bulk polymer resistance or capacitance technology, 2% RH accuracy, 4-20 mA or 0-5 VDC sensor transmitter factory matched and calibrated and replaceable tip.. Sensor may incorporate internal temperature sensor. Sensor shall be BAP1 BA/xx-x-H2xx-x-x-x-xx-Z, Minco HT2S1xx, General Eastern MRH-2-5-x or approved equal.

.4 High Limit Humidistat:

.41 Humidistat shall be duct-mounted (or internal unit-mounted with a bracket) as indicated on the drawings. Sensor shall have a nylon ribbon sensing element, 15% to 95% RH setpoint dial and a nylon ribbon sensing element, 15% to 95% RH setpoint dial and a snap-acting SPDT switch.

.42 Humidistat shall change state when sensed humidity is above setpoint (5% RH differential). The contacts shall be rated for 8A resistive load at 120 VAC. The normally closed contacts shall be wired to the humidifier valve safety circuit as indicated on the drawings and sequence of operation.

.43 The humidistat shall automatically reset when sensed humidity is below setpoint (5% RH differential).

.44 Humidistat shall be TAC I/A Series model HC-201 or approved equal.

25 20 03 PRESSURE SENSOR

.1 Low Differential Pressure Transmitter:

.11 Transmitters shall be 0-10 inches w.c. for all applications where measured pressure exceed 1-inch w.c.

.12 Transmitters shall be a two-wire device producing a 4-20 mA output. Accuracy shall be 1% or better.

.13 Fan discharge pressure transmitters shall be uni-directional with the smallest range, which is larger than 1.2 times greater than fan pressure.

.14 Transmitter shall be Setra Model C-264.

25 20 04 AUTOMATIC CONTROL and SMOKE DAMPERS

.1 General:

.11 Control dampers shall be provided where indicated on the drawings or as required for proper system operation.

.12 Actuators shall be direct coupled.

.13 Provide pin extensions.

.14 Provide external bearing bracket assembly.

.15 Jack shafts are not permitted.

.16 All dampers shall be tested with Owner's Representative present.

.2 Airfoil Dampers: Dampers shall be constructed from minimum 12 gauge extruded aluminum blades and frames. Blades shall be locked to the blade shaft by a positive means other than setscrews. Such means include ribs extruded into the blade that fit slots in the damper shaft and hexagonal shafts that fit tightly in hexagonal holes extruded into the blades.

.21 Shafts shall be provided with bearings at all support locations.

.22 Dampers shall be equipped with blade and jamb seals and shall have a leakage rate less than .1% of maximum flow.

.23 Linkage shall be concealed in the jamb out of the air stream where such an arrangement will be accessible for maintenance and lubrication without removal of the unit from the duct system or fan system that it is installed in. In all other cases the linkage shall not be concealed in the frame.

.24 Dampers with vertically oriented blades shall be provided with thrust bearings to support the vertical blades.

.25 Airfoil dampers shall be provided where fan discharge dampers are required and/or where minimum pressure drop at full flow is necessary.

.26 Dampers shall be Ruskin Model CD-40 or approved equal.

.3 Non-Airfoil Blade Dampers shall be constructed from minimum 16-gauge steel or minimum 12 gauge extruded aluminum blades and frames. Blades shall be locked to the blade shaft by a positive means other than setscrews. Such means include ribs extruded into the blade that fit slots in the damper shaft and hexagonal shafts that fit tightly in hexagonal holes extruded into the blades.

.31 Shafts shall be provided with bearings at all support locations.

.32 Dampers shall be equipped with blade and jamb seals and shall meet the leakage specifications indicated on the damper schedule.

.33 Linkage shall be concealed in the jamb out of the air stream where such an arrangement will be accessible for maintenance and lubrication without removal of the unit from the duct system or fan system that it is installed in. In all other cases the linkage shall not be concealed in the frame.

.34 Dampers with vertically oriented blades shall be provided with thrust bearings to support the vertical blades.

.35 Non-Airfoil dampers shall be provided at locations where Airfoil dampers are not required. Dampers shall be sized to provide adequate pressure drop at full flow to insure adequate control without hunting.

.36 Dampers shall be Ruskin CD-36 or approved equal.

.4 Smoke Dampers: Smoke dampers shall comply with all of the requirements indicated in the preceding sections and in addition shall meet the following specifications.

.41 Smoke dampers shall be UL listed for the service and shall be installed in a manner consistent with the listing and shall bear a UL label indicating that the damper is a leakage rated damper for use in smoke control systems. Smoke dampers shall be qualified to the latest version of UL555S. Smoke dampers shall be provided with factory installed (pneumatic, electric) actuators and shall fail to the closed position.

.42 Smoke dampers shall be UL listed for the service and shall be installed in a manner consistent with the listing and shall bear a UL label indicating that the damper is a leakage rated damper for use in smoke control systems. Smoke dampers shall be qualified to the latest version of UL555S. Smoke dampers shall be provided with factory installed (pneumatic, electric) actuators, integral and switches, and shall fail to the closed position.

.43 Dampers shall be Ruskin Model SD-36 or approved equal.

.5 Modulating damper sizing shall be based on the following conditions.

Minimum velocity - 2000 fpm
Maximum velocity - 3000 fpm

Minimum pressure drop - 0.2 inches w.c.
Maximum pressure drop - 0.3 inches w.c.

.51 Coordinate with the installing trade contractor any required blank-off plates for dampers that are smaller than duct size.

.6 Two position dampers shall be the full size of the duct they are associated with unless otherwise specified.

.7 Flow rates for damper sizing shall be based upon the flow rates indicated on the equipment schedules.

25 20 05 DAMPER ACTUATORS

.1 General:

.11 Actuators shall be sized with enough torque to close damper against fan shut off pressure. Provide multiple dampers and actuators as required to obtain close off. In all cases torque shall be a minimum 7.5 in-lb/ft2 for opposed blade dampers and 10.5 in-lb/ft2 for parallel blade dampers.

.12 All multiple section dampers shall be provided with an actuator per each damper section. Jack shafts or blade to blade attachment of separate dampers is not permitted. Dampers shall be mounted on the linkage side of the damper on the drive blade per the manufacturer's instruction.

.13 Modulating multiple section dampers shall each have a separate output signal per actuator to allow staging for better control.

.14 Control logic: Control loops shall be programmed to cause productive actuation with each movement of the actuator. PID constants shall be set so that midpoint dithering of actuators does not occur, A 2 to 3% (0.2 VDC) output change is the minimum incremental control action that shall occur when 2-10 VDC proportional actuators are utilized. Integral wind up shall be avoided by resetting the loop as necessary during shutdown. When incremental or floating point control is used, the total run time of the actuator shall be entered into the program logic. When the actuator is either at full open or full closed position, continual pulsing of the actuator against the end stops is not permitted. Actuator shall either drive and hold or drive continuously against the end stop.

.2 Direct Coupled Electric Actuator:

.21 For power-failure/safety applications, a mechanical, spring return mechanism shall be used. Non-mechanical forms such as battery back-up and capacitor discharge, are not acceptable. The normal position is the position that the actuator must fail to upon loss of control signal or power.

.22 Proportional actuators shall accept a 2 to 10 vDC or 4-20 mA input signal. Actuators shall operate on less than 10VA.

.23 Actuators shall be Belimo, no substitutions allowed.

.3 In general, unless noted elsewhere, the following shall apply:

.31 Air handling unit control dampers shall be 4-20 mA proportional, spring return actuators. Outdoor air and relief air shall be NC, return air shall be NO.

.32 VAV box shall be Triac (tri-state).

.33 Smoke dampers shall be 2-position, spring return NO**.**

.34 Face and bypass dampers shall be 4-20 mA proportional, spring return, fail to face.

.35 Multi-zone dampers shall be 4-20 mA proportional, non-spring return.

25 20 06 FLOW MEASURING STATION

.1 Flow measuring stations shall be installed in accordance with the manufacturer's recommendations. Sensing elements shall be installed to maximum reading accuracy and minimize error due to non-uniform velocity profiles created by upstream and downstream obstructions.

.2 Sensing elements shall be adequately supported for the velocities and spans encountered in the duct system.

.3 For use in outside air intake applications, consult a manufacturer for appropriate sensor orientation and density for installed location, either in the duct or upstream of the intake dampers as indicated on the drawings.

.4 Transmitters shall be located at the sensing elements. All necessary power requirements for the transmitter shall be provided under this section of the specification.

.5 Flow measuring stations shall be Ebtron ELF series, no substitutions allowed.

25 30 00 HYDRONIC CONTROL EQUIPMENT

25 30 01 TEMPERATURE MEASUREMENT

.1 The contractor shall provide for installation under other sections of the specification thermometer wells for all temperature transmitters, remote bulb sensors, etc., installed in piping systems and at other locations as indicated on the plans, flow diagrams, details and specifications. When two (2) wells are shown at the same location: One well will be installed for the sensing element. The second well will be installed to allow a separate calibration instrument to be used to calibrate the sensor without removing it from the line; it shall have a cap and chain for protection when not in use.

.2 Thermometer and calibration wells (see above) shall be 316 SS ¾" NPT or ½" NPT pipe connection size with ½" NPT female threads. Thermometer wells shall have an overall length of 6". For larger pipe the fluid insertion length shall be 4-1/2". For smaller pipes the insertion length shall be 2-1/2" with a 2" lag length. For general use, a straight stepped shank may be used, provided it is less than 70% of the manufactures critical velocity rating, otherwise use a heavy duty tapered shank to meet the required stiffness.

Sensor wells internal bore shall match sensor provided; calibration wells shall have 3/8" internal diameter.

.3 The contractor shall be responsible for coordination, with the installing trade contractor of the other sections of the specification, the location of all thermometer wells and insertion depths required by this section. The tip of the sensor shall be completely in the process fluid. Thread-o-lets and any required bushings shall be coordinated the installing trade contractor. Sensor shall be installed with thermally conductive paste equal to Omegatherm -201 manufactured by Omega Engineering.

.4 Insertion Element Fluid Temperature Sensor with Transmitter

.41 Sensor shall be 100-ohm platinum RTD combined with a 4-20 mA transmitter factory matched and calibrated.

.42 The element shall be 100 ohm platinum of 0°C, with a reference temperature coefficient of resistance equal to 0.00385 ohm/ohm/°C, Class B +/- 0.12 ohm at 0°C, per IEC Standard 751. RTD element may be a 2-wire or 3-wire type. RTD probes shall be 6" long with either 3/8" or ¼" diameter.

.43 The transmitter shall be a high quality HVAC grade with an accuracy of +/- 0.1% of full scale or better (including linearity, hysteresis, and repeatability) referenced to mV input, with a drift of 0.1% of span per year or less. The transmitter shall be for a 100-ohm platinum RTD input and with a 4-20mA output.

.44 The housing shall be a weather tight cast aluminum 'LB' elbow or utility box, stamped aluminum cover, with a full gasket.

.45 The RTD shall be factory calibrated to the specified ranges using a minimum of (3) points. Unless otherwise indicated the range shall be: 30°F - 80°F for chilled water, and 30°F - 250°F for heating water and domestic hot water.

.451 Chilled water transmitters shall be "sensor matched" and calibrated (with temperature) as an assembly with the actual RTD connected, for an accuracy of +/- 0.1°F plus 0.1% of span referenced to the actual temperature input.

.46 Acceptable sensors are Weed model 723, Minco model S479PD, RdF model 2801, Graystone series TE500, or approved equivalent.

25 30 03 CONTROL VALVES

.1 Valve actuator requirements shall be as follows.

.11 Torque rating shall be based on the valve manufacturers operating torque requirements at the design flows and pressure drops or shall be based on the manufacturers required shut-off torque to achieve 100% flow shut off at pump shut off head on the system in which they are installed, whichever is greater.

.12 Actuators shall be installed to maximize the linearity between actuator stroke and actuated device travel.

.13 For power-failure/safety applications, a mechanical, spring return mechanism shall be used. Non-mechanical forms such as battery back-up and capacitor discharge, are not acceptable. The normal position is the position that the actuator must fail to upon loss of control signal or power.

.14 In general the following types of actuators shall be used unless otherwise indicated: Proportional spring return valves (4-20 mA, 0-10V) will be used for heating coils on units with outdoor air connections, refer to sequences or points list for failsafe position. Proportional non-spring return valves (4-20 mA, 0-10V) will be used for cooling coils, and reheat coils. Triac or floating valves will only be allowed on VAV box reheat coils, fan coil units, terminal heating equipment, etc.

.15 In general the following types of valves shall be used unless otherwise indicated: Cooling and heating valves shall be ball valves for 3" and smaller, and butterfly valves for 4" and larger. Steam valves shall be globe valves for all applications..

.16 Globe valves shall be Belimo, Delta Control, TAC VA Series, Johnson, Siemens or equivalent. Globe valves shall be threaded bronze body or flanged cast iron body, stainless steel stem, brass plug, composition disk, bronze seat, rated at 250 psi working pressure, and 35-psi differential pressure.

.17 Ball valves shall be Belimo. Ball valves shall be threaded bronze body, chrome plated ball, blowout proof stem, teflon seat, rated at 600-psi W-O-G working pressure, and 35-psi differential pressure. Two-position valves shall be full port valves.

.18 Electrical actuated valves shall be provided with Belimo actuators. Actuators shall be rated for 24 vac power, unless otherwise noted on the drawings.

.19 Butterfly valves shall be lug body style and shall be Keystone Model 222, ABZ Model 102, or equivalent. Valves shall be cast iron body, aluminum bronze disk, EPDM seats and stainless steel shaft.

.2 Modulating valve sizing shall be based on the following conditions.

.21 Water Valves:

Minimum pressure drop - 3 psi or equivalent to the waterside pressure drop of the coil it is associated with, which ever is greater.

Maximum pressure drop - 5 psi

.3 Two position valves shall be the full size of the pipe they are associated with unless otherwise specified.

.4 Two-way valve actuators shall be sized to close off tight against the full pump shut off head on the system in which they are installed.

.5 Three-way valve actuators shall be sized to close off tight in both directions against 2.5 times the valve pressure drop at full flow.

.6 Flow rates for valve sizing shall be based upon the flow rates indicated on the equipment schedules on the drawings.

.7 Valve sizing shall consider the valve cavitation coefficient. In no case shall a valve be sized so that the pressure drop through the valve causes cavitation with fluid temperatures and pressures encountered in the system during start up or normal operation.

25 40 00 AUXILIARY EQUIPMENT

.1 Current Operated Switches

.11 General: Current operated switches shall be provided with additional relays as required to perform the indicated functions in the sequences of operation. In addition, contact resistance associated with solid state relays shall be taken into consideration and accounted for in the design of the circuits using solid state relays to prevent problems associated with voltage drops through closed switches and leakage currents through open switches. Switches shall be securely mounted and located such that they are easily adjustable without the possibility of shock from the starter components.

.12 Current Operated Switch: Devices shall be capable of changing the state of an isolated dry contact or switch when a flow of current is sensed in the wire they are monitoring. The isolated output must be capable of switching up to 1 A at 30Vac or Vdc minimum as required by the application. Trip points shall be adjustable from a minimum of 1A to a maximum of 135A. Devices shall be provided with all necessary mounting hardware. Acceptable manufacturers and models are as follows:

MANUFACTURER	MODEL
Hawkeye	H-908

.3 24 Vac Control Power Transformers

.31 Transformers shall be NEC Class 2 general purpose transformers with primary windings as required by the application and 24 Vac secondary windings rated for 40 VA at 100% power factor. Transformers shall be installed in a suitable enclosure to prevent contact with the primary and/or secondary terminals when the cover is on the enclosure. Where transformers are provided for installation by others, the transformers shall be provided mounted in the enclosure. The mounting arrangement shall be such that the terminals are accessible for connection without removing the transformer from the enclosure.

.32 Transformers with higher VA ratings may be supplied but must be designed and installed to meet all requirements of NEC article 725 when used to serve Class 1, Class 2, or Class 3 low voltage circuits.

.33 Where fuses are provided, a minimum of two (2) spare fuses of the same type and rating at each location.

.4 24 Vdc Control Power Supplies

.41 Power supplies shall be NEC Class II, UL Listed, 120 vac or 24 vac input voltage, 24 vdc output voltage, enclosed or track mount, full wave rectified, regulated to 1.5% at full rated current and include over-current protection. If unit is not supplied with integral power disconnect switch, one shall be provided in the control enclosure adjacent to the power

supply and labeled (provide Carling Technologies Model 11-16-73 or equivalent). Power supply shall be sized to deliver concurrent maximum current draw for all connected devices. The mounting arrangement shall be such that the terminals are accessible for connection without remove the power supply from the control enclosure.

.42 Where fuses are provided, a minimum of two (2) spare fuses of the same type and rating at each location.

.5 Specialty Terminal Blocks

.51 Disconnecting Terminal Blocks: Terminal block shall be arranged to allow the entering conductor to be disconnected from the leaving conductor without lifting the conductor from its termination point. Disconnection shall be by screw driver actuated sliding link, knife link, or plug switch. Terminals shall be rated for the voltage and current of the circuit they are contained in at a minimum. Termination points shall be arranged with test jacks to allow a meter to be connected without interfering with the operation of the disconnecting means. Terminals shall be suitable for and mounted on a standard DIN EN 50022 mounting rail. Acceptable models and manufacturers are as follows:]

[MANUFACTURER	MODEL	COMMENTS]
[Weidmuller	SAKC10	With accessories as required for a complete assembly.
Weidmuller	SAKT1	With accessories as required for a complete assembly.
Weidmuller	SAKT2	With accessories as required for a complete assembly.
Entrelec	4/6.SNT	With accessories as required for a complete assembly.
Entrelec	M6/8.ST2	With accessories as required for a complete assembly.
Phoenix	URTK/SP	With accessories as required for a complete assembly.
Phoenix	MTK-P/P	With accessories as required for a complete assembly.
Phoenix	UK4-TP	With accessories as required for a complete assembly.

.52 Fuse Holder Terminal Blocks: Terminal block shall be arranged to allow a fuse to be installed in the terminal strip between the entering and leaving wires of the termination point. Terminals shall be provided with LED, Neon, or mechanical fuse status indicators. Terminals shall be rated for the voltage and current of the circuit they are contained in at a minimum. Terminals shall be suitable for and mounted on a standard DIN EN 50022 mounting rail. Provide two spare fuses of the same type and rating at each location. Acceptable models and manufacturers are as follows:]

[MANUFACTURER	MODEL	COMMENTS]
[Weidmuller	SAKS Series	With accessories as required for a complete assembly.
Entrelec	MB10/12 Series	With accessories as required for a complete assembly.
Phoenix	UK5 Series	With accessories as required for a complete assembly.]

.53 Feed Through Terminal Blocks: Feed through terminal blocks shall be compatible with the special purpose terminals specified above and shall mount on the same DIN rail system. Terminals shall be clamp type terminals suitable for solid or stranded wire from #18 AWG to #12 AWG (minimum range). Terminals shall be rated for the voltage and current at which they are applied and shall be provided with all necessary end caps, separators, etc., required for a complete installation.

.54 Grounding Type Terminal: Terminals shall be color-coded green and yellow and shall be compatible with the other specialty terminals specified above and shall mount on the same DIN rail system. Units shall be arranged so that the wiring connected to them is grounded to the enclosure via the mounting rail. Terminals shall be Phoenix USLKG, MSLKG, or equivalent as manufactured by Wiedmuller or Entrelec. These terminals shall be provided for grounding cable shields at the points where the cables enter a control panel and terminate on the control panel terminal strip.

25 50 00 WIRING MATERIALS and METHODS

25 50 01 POWER for CONTROL PANELS, EQUIPMENT and SYSTEMS

.1 Power for control panels shall be as shown by Division 16, where no power is shown or additional power is required for panels shown or additional panels required but not shown on the plans, then this section shall be responsible for bringing all power required by the control systems from the source (lighting panel, distribution panel, etc.) to the point of use.

.2 This section shall be responsible for bringing all power required by, but not limited to, actuators, transmitters, VAV boxes, etc. from the source (lighting panel, distribution panel, etc.) to the point of use. This includes furnishing and installing any branch circuit protection equipment and disconnecting equipment required to comply with code requirements.

.3 The section shall be responsible for coordination of power requirements with the Electrical Contractor for the project and/or the Owner.

.4 The following power circuits shall be furnished at a minimum:

.5 The Contractor shall extend existing equipment grounding system. The Contractor shall use only approved grounding clamps and connectors as manufactured by Penn-Union, Burndy, or O-Z Manufacturing Company.

.51 Install a green equipment grounding conductor inside all conduits. Bond all junction boxes, conduit, and equipment. Terminate equipment grounding conductor at electrical panel grounding bus.

25 50 02 WIRING

.1 All wiring required for work under this section of the specification shall be provided under this section of the specification unless otherwise specified.

.2 Interlock wiring as shown on the electrical drawings is the responsibility of Division 16 utilizing equipment provided under this section of the specification. Generally this will mean that Division 16 wires the series safety circuit in the starter as shown on the drawings using switches and devices furnished by this section. Equipment not normally mounted by Division 16 shall be mounted as well as furnished by this section. Starter automation as required by the sequences of operation shall be provided and wired by this section with connections made to terminals on the automatic side of the selector switch and on starter coil auxiliary contacts. It is the intention that Division 16 provide all wiring necessary to make the starter run with the selector switch in the hand position and this section provide all additional automation required. Relays, electro-pneumatic switches, etc., required by this section to operate in parallel with the starter coil shall be piloted by auxiliary contacts on the starter furnished under Division 16 and shall not be directly paralleled with the starter coil.

25 50 03 CONDUIT and WIRE

.1 All wiring will comply with applicable codes and regulations and will be as specified in the applicable portions of this section of the specification, the electrical section of the specification, and as indicated on the drawings.

.11 Conduit shall be required for: all power wiring, all wiring exposed to view in finished spaces, all thermostat rough-ins, all exterior wiring, wiring below 8’ AFF exposed to view in unfinished spaces.

.12 Open wiring will be permitted: above lay-in ceilings, and unfinished spaces above 8’ AFF.] Cables shall be supported with "J-Hooks" a minimum of every six feet. Bridal rings can be used when supporting a maximum of 6 wires. Support devices are to be attached to permanent structure.

.20 Conduit Material:

.21 Electrometalic tubing shall be installed for all exposed work and for all concealed work in applications where conduit is required.

.22 PVC conduit shall be used for all conduit installed below ground or under concrete. Where installed under concrete, provisions shall be made to assure a minimum cover of 2 inches of concrete during and after the pour. Where installed underground, a minimum of 18 inches of cover shall be provided. PVC conduit shall transition to heavywall conduit or electrometalic tubing (as required by the application and defined in the specification) within 2 inches of the point where it emerges from the ground or concrete in which it is installed.

.23 Jacketed flexible steel conduit (Sealtite) shall be used in wet areas where flexible conduit connections are required and at connections to all motorized equipment and motors. For work under this specification, all equipment rooms are considered to be wet areas. Heavy wall conduit shall be used for exterior locations unless specified otherwise. Aluminum conduit shall be used at the following locations:

.24 Conduit shall be by Allied, Triangle, Republic, Youngstown, Carlon, Rob Roy, or approved equal.

.30 Conduit Installation:

.31 Conduit bends shall be made with standard hickeys of proper size; radius of bends to be at least 6 times the diameter of the conduit. Runs between outlets shall not contain more than the equivalent of three-quarter bends. Conduit runs shall be continuous from outlet to outlet, outlet to cabinet, etc.

.32 Conduits shall be installed with pitch toward outlet box wherever possible. All heavy wall conduits shall have two locknuts and a bushing at each termination outlet box, junction box, etc., except where terminated in a threaded hub. Fittings on electrometalic tubing shall be compression type.

.33 A bushing shall be used where conduit enters a panel box. Bushing for No. 4 AWG or larger shall be insulated type with provisions for grounding as type “BL” made by O-Z Electric Company, or approved equal.

.34 All exposed conduits shall be installed parallel or at right angles to the building walls or floors.

.35 Expansion fittings shall be provided at all conduits across the building expansion joints. Fittings shall be Type “AX” or “TX” as made by O-Z Electric Company, or approved equal. Provide copper bonding jumper at each expansion fitting.

.36 Exposed conduit shall be securely fastened in place on maximum 5 ft. intervals for ¾” through 2-1/2 inch nominal sizes. Supports may be one hole malleable straps or other approved devices. No perforated metal straps will be permitted.

.37 Pull boxes and junction boxes shall be installed where indicated on the drawings or where required to facilitate wire installation. Locate in conjunction with other trades so as to install without conflict with other materials or equipment.

.38 Care shall be used to avoid proximity to heat ducts and/or steam lines. Where crossings are unavoidable, conduit shall clear covering of line by at least six inches.

.39 All conduit for automation wiring shall be identified by painting junction box covers as follows: Voltages above 24 shall be blue and red, voltages at 24 or below shall be blue.

.4 Provisions for Wiring: Wire and cable of the sizes and types shown on the plans and/or hereinafter specified shall be furnished and installed by the Contractor. All wire and cable shall be new soft drawn copper and shall conform to all the latest requirements of the National Electrical Code, IPCEA, and shall meet the specifications of the ASTM.

.5 Power Conductors: All feeder and branch circuit wire shall be 600 V insulated of THHN type unless shown or specified to be otherwise. No wires less than No. 12 gauge shall be

used except for control circuits or low voltage wiring. Wire sizes No. 14 to No. 10 shall be solid except where otherwise indicated. Wire sizes No. 8 and larger shall be stranded. All wire sizes shown are American Wire Gauge sizes. Where power conductors are run in cable tray, furnish and install conductors or multi-conductor cable rated for use in cable trays per NEC articles 318 and/or 725.

.51 Acceptable Manufacturers: Cable and wire shall be a standard type as manufactured by General Electric Company, National Electric Company, U. S. Rubber Company, Simplex, General Cable Company, Carol, Anaconda, Rome, Southwire, Belden, Alpha, Houston Wire and Cable, or ITT Royal.

.6 Motor Interlock Wiring: Interlock circuit wiring shall be No. 14 solid or stranded wire. Stranded wire only shall be used where wiring is used for flexible wiring harnesses. Stranded control wire shall be provided with crimp type spade terminators. Interlock circuit wiring shall be color-coded or numbered using an identical number on both ends of the conductor. Wire numbers shall be installed before conductors are pulled. Where motor interlock conductors are run in cable tray, furnish and install conductors or multi-conductor cable rated for use in cable trays per NEC articles 318 and/or 725.

.7 Automation Input/Output Wiring: Wiring serving inputs and outputs from the automation system shall be cables consisting of single or multiple twisted pairs, an overall aluminum foil type shield with a 22 AWG stranded drain wire. Cables installed with out conduit shall be plenum rated and comply with NEC article 725. Multi-conductor cable shall only be used where all the points are at a single location and for the same device (i.e., variable frequency drives, each individual motor starter). Single conductor cables shall be used for all temperature transmitters, pressure transmitters, flow meters, differential pressure switches, control valves and any other locations where the points are not grouped together at the same device. Where automation input/output wiring is run in cable tray furnish and install conductors or multi-conductor cable rated for use in cable trays per NEC articles 318 and/or 725. Conductors shall be minimum #18 wire gauge, strained copper. All wires shall be continuous from outlet to outlet and there shall be no unnecessary slack in the conductors.

.8 Lower level network (LLN): Wiring serving communication trunks from the automation system shall be as required by the network protocol. Cables installed without conduit shall be plenum rated and comply with NEC article 725. Where wiring is run in cable tray furnish and install conductors or multi-conductor cable rated for use in cable trays per NEC articles 318 and/or 725.

.9 Splices: All splices, taps, and terminations shall be made at outlet, junction, or pull boxes. Wire to No. 6 gauge shall be spliced using Scotchlok wire nuts. No Bakelite wirenuts shall be used. Wire No. 6 and larger shall be spliced using solderless connectors as manufactured by Penn Union Company. Splices No. 6 and larger shall be insulated by taping with plastic vinyl tape as manufactured by (3M) Minnesota Mining and Manufacturing Company. Splices shall not be permitted in automation input and output wiring without specific written authorization from the Engineer. If such a splice is approved, the location of the splice shall be clearly documented on the “As Built” drawings. Splices in automation wiring, if necessary, shall be made using Thomas & Betts STA-KON connectors installed per the manufacturers directions to maintain NEMA specified voltage drops and wire retention forces.

25 50 04 JUNCTION BOXES, FITTINGS and WIREWAYS

.1 Quality: All switch, pull, junction boxes, etc., shall be hot dipped galvanized or sherardized, concrete tight, with interlocking ring or multiple point locking devices. Connectors shall be three piece. Indentation fittings are not acceptable.

.2 Attaching: Boxes shall be attached by fasteners designed for the purpose and shall provide adequate mechanical strength for future maintenance.

.3 Size: Junction and pull boxes not dimensioned shall be minimum 4 inch square.

.4 Furnish and install at all control panel locations a NEMA 1 lay in wire way system to bring cable into and out of the panel as detailed on the drawings and specified here-in. Furnish 3 wire-ways at each panel location; one for tubing, one for Class 1 wiring, and 1 for Class 2 and Class 3 wiring.

.5 Wireway systems at locations where cables are to be run without conduit or in a cable tray shall consist of a connection to the control panel with a vertical extension to 8'-0" or the pipe rack or cable tray level, which ever is higher. The vertical section shall terminate in a 90° fitting with a closure plate. The closure plate shall be provided with a conduit nipple with locknuts and bushings as a wire entry point into the square duct. The conduit nipple shall be 1 size smaller than the wireway it is associated with.

.6 Wireway systems at locations where cables are to be run in conduit shall consist of a horizontal section of wire way with a length equal to the control panel width and located above the control panel and connected to the control panel with 3 conduit nipples, locknuts, and bushings; one for tubing, one for Class 1 wiring and one for Class 2 and 3 wiring. Conduits for cable runs shall terminate on the wireway.

.7 The intent of the wireway configurations outlined above is to provide a method for adding input and output wiring to the control panel with out having to drill directly into the electronics enclosure after the system is on line and running. The installation of the wireway shall be made with this consideration in mind.

25 50 05 CONTACT LOCATIONS in STARTER CONTROL CIRCUITS

.1 Three Phase Starters

.11 All contacts controlling motor starters, including overload contacts, shall be located on the hot side of the coil (ungrounded control power leg). Coordination of this requirement with the electrical contractor and compliance with this requirement shall be the responsibility of this section of the specification.

.2 Single Phase Motor Control

.21 The wiring of single phase motors and all devices and equipment where the circuit that is interrupted by control devices is also the circuit carrying power to the equipment shall be coordinated with the Division 16.

.22 Division 16 shall be responsible for bringing power to the motor and providing a disconnecting means and overload protection as specified in his contract. This section shall furnish a horsepower rated control device or devices as required by the plans and specifications to Division 16 for installation at the disconnecting means location. Division

16 shall mount this device(s) and wire the power circuit through the device(s). This section shall extend the pilot signal for the device from the signal source to the device and terminate the signal at the device.

.23 All contacts interrupting single-phase motor circuits shall be horsepower rated and match the voltage, amperage, and horsepower characteristics of the motor they serve.

25 50 06 SAFETY CIRCUITS

.1 All safety circuits shall be hard-wired circuits using standard snap acting electric or pneumatic switches as required by the function, and shall be totally independent of the DDC system controllers. Operation of safeties shall be independent of the position of any Hand-Off-Auto selector switches. This includes interlocks that return dampers and valves to some normal, fail-safe position when the system they are associated with shuts down. It is the intent of this paragraph that the systems have the capability to be operated manually complete with safeties and fail safe interlocks even if the DDC system is off line. Software safeties will not be accepted.

25 50 07 HANGERS and ANCHORS

.1 Where control system tubing is run on trapezes and/or hangers used by and or installed by other trades, supports for the trapezes shall be coordinated by all trades using the trapeze to assure that the anchor system is not overloaded and is sufficient for the load imposed including a margin of safety and seismic considerations. Under no circumstances shall a trapeze or hanger system installed by the electrical trades be used to support work by any other trade, nor shall the electrical trades use the trapezes installed by any of the other trades for the support of electrical equipment, all as required by the National Electric Code. Similarly, under no circumstances shall a trapeze or hanger system installed by the sprinkler trades be used to support work by any other trade, nor shall the sprinkler trades use the trapezes installed by any of the other trades for the support of sprinkler systems or equipment, all as required by NFPA 13, Standard For The Installation Of Sprinkler Systems.

.2 Anchors to be loaded in tension for use in existing concrete structure and anchors loaded in tension and not cast in place shall be epoxy resin set anchors installed per the manufacturers recommendations for technique, size, loading, embedment, etc. Where anchors are loaded in shear at these locations, suitably sized and installed wedge type anchors may be used.

.3 In all cases, anchor loading shall be based on hanger spacing, weight of the pipe to be supported when full and insulated, weight of any additional loads imposed upon the anchor, wind loading, seismic loading, quality of the material that the anchor is being installed in, etc. The contractor shall verify in the field that the anchors used and the materials that they are being installed in are suitable for the load imposed and shall bring any problems to the attention of the Owner's Representative in writing immediately and not proceed without direction from the Owner's representative.

.4 Wedge type anchors shall be Hilti Kwik Bolt II. Adhesive anchors shall be Hilti HVA.

END OF SECTION

ATTACHMENT A

SEQUENCE OF OPERATION

SEQUENCES OF OPERATION

1. AIR HANDLING UNIT AHU-12 SEQUENCE OF OPERATION

A. Overview: This system consists of a rooftop air handling unit including a return air fan, mixing box, outdoor air dampers, return dampers, relief dampers, preheat coil, humidifier, cooling coil, supply fan, and filters. This unit serves pressure independent supply variable air volume units.

B. Supply Fan Control: A static pressure sensor located in the supply duct 2/3 of the way down from the AHU shall provide an input to a software based PID type control loop. The output shall modulate the fan speed to maintain the static pressure setpoint. As the pressure falls below setpoint, the fan speed shall increase. As the pressure increases above setpoint, the fan speed shall decrease. Static Pressure Setpoint shall be 1.0" wg (adjustable).

C. Return Fan Control: A static pressure sensor located in the return duct 2/3 of the way from the fan shall provide an input to a software based PID type control loop. The output shall modulate the fan speed to maintain the static pressure setpoint. As the pressure falls below setpoint, the fan speed shall increase. As the pressure increases above setpoint, the fan speed shall increase. Static Pressure Setpoint shall be -0.75" wg (adjustable).

D. Economizer Dampers Control: The Economizer dampers shall consist of the outside air economizer damper (ECN) and return air damper (RAD). The dampers shall be controlled by a 4-20mA output from the DDC system such that on a 0% economizer command the OAD is full closed and the RAD is full open. On 100% economizer command, the OAD is full open and the RAD is full closed. The OAD damper and the RAD shall modulate together from the output.

On startup of the supply fan, the economizer dampers shall remain closed for 5 minutes.

The economizer control damper shall be controlled by the Supply Air Temperature Loop in sequence with the pre-heat coil and the cooling coil. However, the economizer shall only be enabled when outdoor air conditions meet the following requirements. Outside air dry-bulb temperature must be 62°F or less AND the outside air dewpoint temperature must be 53°F or less.

The economizer dampers shall control to the maximum position commanded the following PID control loops: discharge air temperature (DAT) and economizer damper command.

E. Discharge Air Temperature, Preheat Valve and Chilled Water Valve Control: A discharge air temperature sensor located in the supply duct downstream of the supply fan shall provide an input to a software based PID type control loop. The output shall control the preheat valve, economizer dampers, and chilled water valve in sequence as required to maintain the discharge air temperature setpoint. The discharge air temperature (DAT) setpoint shall be set at 53°F. A rise in temperature above setpoint causes the preheat valve to modulate from open to closed. If the temperature continues to rise, the DAT economizer damper command shall be commanded from 0% open to 100% open. On a further rise (when the DAT economizer damper command is 100% open), the chilled water valve modulates from closed to open. On a drop in temperature below setpoint, the sequence reverses.

When the supply fan is not running or outdoor air temperature is below 40°F, the chilled water valve shall be forced closed by software. At an outdoor air temperature above 40°F, the preheat valve shall be forced closed by software.

A software logic routine shall force the preheat valve to control mixed air temperature to 80°F any time the unit is not in operation and the outdoor air temperature is below 40°F.

F. Minimum Outside Air Control: After a 5 min start up of the unit the minimum outside air damper (OAD) shall open. This damper will stay open as long as the unit is in occupied mode. If the unit goes to unoccupied mode the damper will close.

G. Relief Air Damper Control: A static pressure sensor located in the relief air plenum shall provide an input to a software-based PID type control loop. The output shall modulate the relief air damper to maintain the setpoint. As the pressure falls below setpoint, the damper shall close. As the pressure increases above setpoint, the damper shall open. The set point shall be 0.1" wc (adjustable).

H. Humidifier: The humidifier shall be furnished with two control valves. One is a two-position humidifier enable valve which shall be active when the following 3 conditions are present:

1. The supply fan is running as indicated by the proof of operation circuit.
2. The outdoor air temperature is below 55°F.
3. The Supply Air High Humidity safety switch is not active. The Supply Air High Humidity safety switch shall be located in the supply duct just downstream of the supply fan and shall be set at 90%RH. This safety switch should be hardwired to the DDC system so that it can reset the humidifier PID control loop.

A second valve shall modulate as required to maintain return air humidity at 30%RH (adjustable). The actual return air temperature and return air humidity shall be used to calculate return air dewpoint. The actual return air temperature and return air humidity setpoint shall be used to calculate the return air dewpoint setpoint. These values shall be used as inputs to a PID-type control loop, the output of which will reset the supply air dewpoint setpoint to maintain the return air dewpoint setpoint. This supply air dewpoint setpoint, along with a calculated supply air dewpoint (using actual supply air temperature and relative humidity as sensed at the air handler discharge) shall be used as inputs to a second PID-type control loop, the output of which will modulate the humidifier valve. An increase in supply air dewpoint above setpoint shall modulate the valve from opened to closed. A decrease in supply air dewpoint shall act in reverse.

A hard-wired interlock shall close the humidifier modulating valve anytime one of the following conditions occur:

1. The fan system is shut down as indicated by the proof of operation circuit.
2. Condensate return temperature shall be monitored by a temperature safety switch located on the humidifier steam jacket condensate return. On sensed temperatures below 200°F, the humidifier modulating valve shall fail closed. This status shall be monitored by the DDC system as well.

I. Supply and Return Fan Start/Stop Control: If all the safeties are satisfied, the supply fan shall run continuously when the selector switch is in the Auto position and the computer has commanded the supply fan on. The return fan shall be commanded to start after the start of the supply fan (as indicated by the supply fan proof of operation). If the supply fan stops without a command to stop (as indicated by the proof of operation), the return fan shall stop. If the return fan stops without a command to stop (as indicated by the

proof of operation), the supply fan shall stop. The DDC system shall issue a warning to the computer operator on supply or return fan failure. The warning shall indicate whether the supply or return fan failed.

The supply fan shall operate 24/7/365.

J. Safeties and Hardware Interlocks: A hardwired interlock is tripped any time the freezestat is tripped, stopping the supply and return fan, and opening both the cooling valve and the preheat valve. Manual reset will be required to resume normal operation. Freezestats shall be set at 35°F. This function shall be provided by Division 15950 and Division 16 as indicated on the drawings.

Supply and return duct smoke detectors will be furnished and installed under Division 16 to shut down the supply fan. A fire alarm relay provided under Division 16 will shut down and lock out the supply fan regardless of the position of the selector switch. Manual reset will be required to resume operation. This function shall be provided by Division 15950 and Division 16 as indicated on the drawings.

A hardwired interlock is tripped any time the pressure safety switch is tripped, stopping the supply and return fan. The low pressure safety switch (located on the return fan inlet) shall be set to trigger at –2" w.c. Manual reset will be required to resume normal operation. This function shall be provided by Division 15950 and Division 16 as indicated on the drawings. Division 15950 shall be responsible for setting differential pressure safety switches.

Overload relay trip on the supply fan or relief fan shall shutdown and lock out the respective fan. Manual reset will be required to resume normal operation. This function shall be provided by Division 16.

A relay piloted by the supply fan proof of operation circuit returns the outdoor air damper, return air damper, relief air damper and humidifier control valve to normal positions when the supply fan is not in operation.

K. Air Handling Unit Graphics: In addition to updating the hospital air handler summary report, one graphic shall be developed that displays a flow diagram of the Air Handling Unit shall have all points as indicated on the AHU control points list.

L. Air Handling Unit Trending: The following trends shall be set up for the air handling unit:

1. System Stability Point Trend: The following data values shall be trended at 30 second intervals for a period of 120 samples:
   a. Supply Air Temperature
   b. Mixed Air Temperature
   c. Return Air Temperature
   d. Total Connected Supply VAV Box Airflow Quantity
   e. Total Connected Return VAV Box Airflow Quantity

2. Minimum Outside Air Control Loop Trend: The following data values shall be trended at 30 second intervals for a period of 120 samples:
   a. Outside Air Flow Minimum CFM Setpoint
   b. Outside Air Damper Command
   c. Outside Air Flow CFM
   d. Min Outside Air Damper Command

3. Supply Air Temperature and Relative Humidity Control Loop Trend: The following data values shall be trended at 30 second intervals for a period of 120 samples:

a. Heating Water Valve Command
b. Chilled Water Valve Command
c. Outside Air Damper Command
d. Humidifier Valve Command
e. Supply Air Temperature
f. Supply Air Relative Humidity
g. Supply Air Temperature Setpoint
h. Supply Air Relative Humidity Setpoint

4. Supply Fan Control Loop Trend: The following data values shall be trended at 30 second intervals for a period of 120 samples:
   a. Supply Fan Speed Command
   b. Supply Fan Speed Feedback
   c. Supply Duct Pressure
   e. Supply Duct Pressure Setpoint

5. Return Fan Control Loop Trend: The following data values shall be trended at 30 second intervals for a period of 120 samples:
   a. Return Fan Speed Command
   b. Return Fan Speed Feedback
   c. Return Duct Pressure
   e. Return Duct Pressure Setpoint

6. Relief Damper Control Loop Trend: The following data values shall be trended at 30 second intervals for a period of 120 samples:
   a. Relief Pressure
   b. Relief Damper Command
   c. Relief Pressure Setpoint

TABLE OF CONTENTS

DIVISION 26

26 00 00 ELECTRICAL

26 00 01 GENERAL

A. The Plans, the general provisions of the Contract including the General, Supplementary and/or Special Conditions and specification sections of Division 1 shall apply to Work of Division 26 of the Specifications.

B. Provisions and conditions cited in this Section shall apply to Work for other sections of Division 26 of these Specifications.

26 00 02 REFERENCES, REGULATORY REQUIREMENTS

A. Work for this Section of the Specifications shall be performed in accordance with the Codes, Standards, etc., as identified in Division 26.

26 00 03 REFERENCES, RELATED SECTIONS of the SPECIFICATIONS

Requirements of the following Sections of the Specifications apply to Work for this Section:

A. Division 20 - Basic Mechanical and Electrical Conditions
B. Division 27 – Communications
C. Division 28 – Electronic Safety and Security

26 00 04 DEFINITIONS

(none)

26 00 05 WORK INCLUDED

A. Furnish material, labor and services necessary for, and incidental to, installing the following systems where shown on the Plans and as hereinafter specified. Include all necessary work in the related sections of the Specifications to provide for complete systems.

26 00 06 SUBMITTALS:

A. The Contractor shall submit the following for approval in accordance with Subsection 20 00 43, Duties of the Contractor - Submittals.

B. Provide manufacturer's technical product data of each material and accessory item with engineering support information, installation manual, operation and maintenance manual. Data shall be specific to product specified and clearly identified on all data sheets, which contains multiple models or sizes.

26 05 00 COMMON WORK RESULTS FOR ELECTRICAL

A. Extent: The work in this division consists of furnishing material and labor required to completely execute the electrical work for this project as per drawings and as specified herein.

B. Interface with Other Trades: This contractor shall connect some items furnished in place by others such as prewired mechanical control assemblies. This will require coordination and cooperation with the other contractors. The extent of the required electrical work is shown on the drawings.

26 05 19 LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

A. Material

1. Provisions for Wiring: Wire and cable of the sizes and types shown on the plans and/or hereinafter specified shall be furnished and installed by the Contractor. All wire and cable shall be new soft drawn copper and shall conform to all the latest requirements of the National Electrical Code IPCEA, and meet the specifications of the ASTM.

2. Power Conductors: All feeder and branch circuit wire shall be 600V 90°C insulated of the THHN *&* THWN-2 type unless shown or specified to be otherwise*.* No wire less than No. 12 AWG shall be used except for control circuits or low voltage wiring. All wire sizes shown are American Wire Gauge sizes.

   a. 20A Branch Circuit Homeruns shall be sized as follows:
      120V: 0 – 100 feet shall be #12AWG wire minimum
      101 – 200 feet shall be #10AWG wire minimum
      In excess of 200 feet shall be #8AWG wire minimum
      277V: 0 – 250 feet shall be #12AWG wire minimum
      In excess of 250 feet shall be #10AWG wire minimum

3. Control Conductors: Control circuit wiring shall be No. 12 AWG or smaller stranded wire. Stranded control wire shall be provided with crimp type spade terminators. Control circuit wiring shall be color-coded or numbered using an identical number on both ends of the conductor.

4. Acceptable Manufacturers: Cable and wire shall be a standard type as manufactured by General Cable Company, Carol, Anaconda, Rome, ITT Royal, or Southwire.

B. Installation

1. Continuity: All wires shall be continuous from outlet to outlet. All wires shall be tested for continuity prior to use.

26 05 26 GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

A. Material

1. Contractor shall install 1) a system grounding system and 2) an equipment grounding system in accordance with the National Electrical Code and local AHJ requirements and shall use only UL Listed grounding clamps and connectors.

B. Installation

1. The system grounding electrode conductor shall be connected to the neutral bar inside the main panel or at the Main Grounding Bar (if indicated to be provided).

2. The equipment grounding system shall consist of a continuous conduit installation where metallic conduit is required and a green insulated equipment grounding conductor. This grounding conductor shall be installed in every conduit or raceway with the feeder or branch circuit conductors. This grounding conductor shall be extended from the housing of every electrical load, or panel to the supplying panelboard or switchboard equipment grounding bus.

3. The grounding bus shall be bonded to the grounded neutral bar inside the main panel using a Main Bonding Jumper.

4. When transformers are used to provide a separately derived system, the Contractor shall connect the grounding electrode conductor to the neutral bar inside the secondary system panel or service rated disconnect switch as indicated on the drawings.

5. The equipment grounding terminal buses of normal and emergency branch circuit panelboards serving the same Patient Care vicinity shall be connected together in accordance with NEC Article 517.

26 05 29 INSTALLATION REQUIREMENTS FOR ELECTRICAL SYSTEMS

A. Installation

1. Conduit bends shall be made with standard benders of proper size; radius of bends to be at least 6 times the diameter of the conduit. Runs between outlets shall not contain more than the equivalent of three 90-degree bends. Conduit runs shall be continuous from outlet to outlet, outlet to cabinet, etc.

2. All exposed conduits shall be installed parallel or perpendicular to the building walls or floors.

3. Conduits shall be securely fastened to or supported from the building structure. Conduits not fastened directly to building structure shall be supported by a rigid assembly, free of sway and adequately braced, connected directly to the building structure. The use of ‘pencil’ wire, ceiling wire, and cable hangers shall not be permitted.

4. All exposed conduit installed in a finished space will be painted to match the background.

26 05 31 FIRE SEALS

A. General Requirements

1. All penetrations through fire rated walls and floors shall be fire sealed in accordance with ASTM E814/UL1479 or manufacturer’s recommendations.

2. Materials and installation details shall be submitted for approval.

3. All materials shall be by Specified Technologies, Inc. Spec Seal Firestop products *only.*

4. All penetrations shall be labeled with U.L. System number.

26 05 33 RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

A. General Requirements

1. Minimum conduit size shall be ¾ trade size for branch circuits except for switch legs which may be ½" trade size.

2. A bushing shall be used where conduit enters a panel box or equipment enclosure. Bushing for 1-1/4" conduit and larger shall be insulated type.

3. Grounding Bushings shall be used to bond conduits entering a panel box or equipment that are not mechanically connected.

4. Expansion fittings shall be provided at all conduits across building expansion joints. Fittings shall be Type "AX" or "TX" as made by O-Z Electric Company, or approved equal. Provide copper bonding jumper at each expansion fitting.

5. Avoid proximity to heat ducts and/or steam lines. Where crossings are unavoidable, conduit shall clear covering of line by at least six inches.

B. Electrical Metallic (EMT) Conduit

1. Thin wall EMT conduit shall be installed for all work concealed in partitions or in concrete block walls and for all conduits run in ceiling plenums and exposed runs, except where noted otherwise. EMT shall not be used outdoors.

2. EMT couplings and connectors shall be steel, set screw or compression type.

C. Galvanized Rigid Steel (GRS) Conduit

1. Galvanized rigid steel conduits shall be installed for all exposed outdoor conduit, in all mechanical rooms where not supported directly to walls or ceilings, and for entry into underground building walls and manholes.

2. All GRS couplings and threaded hubs shall have no less than five threads of the coupling engaged. Running threads shall not be used. All GRS conduits shall be reamed.

3. All GRS conduits shall have two locknuts and a bushing at each termination outlet box, junction box, etc., except where terminated in a threaded hub. Threaded hubs shall be used for all outdoor equipment connections.

4. GRS conduit shall be installed where underground conduits and duct banks enter through existing building, tunnel walls, and drilled holes in manhole walls. The heavy wall conduit shall enter through core drilled holes and the annular space between the conduit and wall sealed using Thunderline Corp. "Link-Seal" Catalog No. 10-LS-300-C seals. This catalog number is for a 4 inch heavy wall steel

conduit and requires a 6 inch I.D. core drilled hole. Refer to the manufacturer's installation requirements prior to drilling holes and for other conduit sizes. Seals as manufactured by Innerlynx Model C and Flexicraft Type E are acceptable equivalents.

D. Polyvinyl Chloride (PVC) Conduit

1. Conduit shall not be installed in concrete floor slabs.

E. Metal Clad (MC) Cable

1. Hospital grade AC cable shall be permitted for wiring the final portion of light fixture branch circuits. Cable may be supported by light fixture support wires, but shall not be supported by ceiling grid support wires. "Daisy chaining" of light fixtures is not permitted.

.11 Hospital grade AC cable is permitted for use under remodel conditions. Where walls must be finished, length of AC cable shall not exceed 15'.]

.12 Hospital grade AC cable is permitted for wiring from local distribution junction boxes to devices or equipment in nearby walls or ceiling space. The local distribution junction boxes should be located within 15' of device or equipment served. Conduit and wiring shall be used for all other branch circuiting. Hospital grade AC cable shall not be run where exposed.

.13 AC cable shall be supported within 12 in. of any J-box, and at intervals not exceeding 4 ½ feet.

.14 Hospital grade AC cable must contain an insulated copper equipment grounding conductor.

.2 Type MC cable may be used for "homeruns" where installed in indicated cabletray below raised access floor/above ceiling.

.3 Flexible metallic cables and raceways shall be supported within 12 inches of any termination and at intervals not exceeding 4 ½ feet.

F. BX/AC Cable

1. Type BX/AC cable is not permitted.

G. Jacketed Flexible Steel Conduit

1. Jacketed flexible steel conduit ('Sealtite') shall be used in wet areas where flexible conduit connections are required and on all motorized equipment and motors in all locations.

H. Flexible Steel Conduit

1. Flexible steel conduit ('Greenfield') shall be used where vibration isolation is required, including all transformers and uninterruptible power systems.

I. Surface Mounted Raceway

1. Surface mounted raceway shall be as manufactured by Wiremold, Mono-Systems, or equivalent. Part numbers listed in these specifications or the drawings refer to Wiremold products unless noted otherwise.

2. V500/V700 Series raceways shall be used on existing walls in finished spaces where conduit and wiring cannot be concealed unless noted otherwise.

   a. Furnish raceways with all elbows, fittings, boxes, clips, supports, and accessories for a complete installation.

   b. Furnish and install dividers in all raceways for which dividers are an option.

J. Outlet Boxes, Junction Boxes, Fittings

1. Mounting: Outlets must be centered with regard to paneling, furring, trim, etc. Outlets shall be set plumb or horizontal and shall extend to finished surface of wall, ceiling, or floor without projecting beyond or behind finished surface. Outlet boxes shall not be installed “back-to-back”.

2. Attaching: Boxes shall be attached by fastener designed for the purpose and shall provide adequate mechanical strength for future maintenance.

   a. Boxes installed in metal stud partitions shall be secured to the metal studs using appropriate clips, fasteners, hangers, or supports as required, and shall provide adequate far side box support to fulfill the intent all applicable codes.

3. Pull boxes and junction boxes shall be installed where indicated on the drawings or where required to facilitate wire installation.

   a. Size: Outlet, junction, and pull boxes not dimensioned shall be 4 inch square minimum and comply with sizing as required by Article 370 of the National Electrical Code.

4. In fire rated drywall walls, 24” spacing must be maintained between boxes on opposite sides of walls. Moldable fire protective putty pads, firestopping coverplate gaskets, internal fire rated pads or other acceptable fire sealing means shall be installed on outlet boxes where the 24” spacing cannot be maintained.

5. Steel faceplates must be used on fire rated drywall walls and painted to match device color. Faceplates shall be Mulberry Metal Products or equal.

6. Pull boxes and junction boxes shall be readily identified with paint as follows:

   Normal Power- Blue
   Emergency Equipment – White
   Emergency Life Safety – Yellow
   Emergency Critical – Red

7. Pull boxes and junction boxes shall be readily identified with panel designation and circuit numbers.

26 05 36 CABLE TRAYS FOR ELECTRICAL SYSTEMS

A. Cable tray shall be steel, electro-plated zinc galvanized, sized as indicated on the drawings.

1. Cable tray shall be installed in such a manner and with proper parts to maintain an equipment ground path. Bend cable tray where non-continuous. Bond tray at each end to the nearest effectively grounded material.

2. Furnish cable tray with all required accessories for a complete installation.

3. Supports shall be wall brackets or center hangers as indicated on the drawings. Adequate bracing shall be provided to prevent twisting of the tray when loaded.

4. Cable tray shall be B-Line Wire Basket Runway, GS Metals “Flextray”, Cablofil "EZ Tray", WBT or equivalent.

26 06 00 SCHEDULES FOR ELECTRICAL

26 06 20 SCHEDULES FOR WIRING DEVICES

A. General: Furnish and install wiring devices as scheduled in Table 1 below, in types, characteristics, grades, colors, and electrical ratings for applications indicated which are UL listed and which comply with NEMA and FedSpec standards. Provide ivory color devices and nylon wall plates except as otherwise indicated.

B. Listings and Standards:

Switches - UL20, FedSpec WS896-E
Receptacles - UL948, FedSpec WC-596F, NEMA WD-1 and WD-6
GFI – UL943

TABLE NO. 1

DEVICES

Receptacles	Hubbell	Leviton	Cooper	P & S
20A Duplex	HBL5362-I	5362A-I	5362V	5362A-I
20A GFI	GF20IL	7899-I	VGF20V	2095-I
Tamper Resistant	HBL8300SGI	5262-SG	TR8300V	SG62-HI
Hospital Grade	HBL8300I	8300-I	8300V	8300-I
Hospital Grade, Tamper Resistant	HBL8300SGI	5262-SG	TR8300V	SG62-HI
Hospital Grade, GFI	GF8300H-I	8898-HGI	VGFH20V	2094-HGI
Switches				
20A Single	HBL1221-I	1221-2I	AH2221V	20ACI-I

20A 3-way	HBL1223-I	1223-2I	AH2223V	20AC3-I
20A 4-way	HBL1224-I	1224-2I	AH2224V	20AC4-I
20A 2 pole	HBL1222-I	1222-2I	AH2222V	20AC2-I
20A Momentary SPDT	HBL1557-I	1257-I	1995V	1251-I
20A Pilot Light	HBL1221PL/PL7	1221-PLR/7PR	2221PL	20ACI-RPL

Nylon Plates

Duplex	P8	80703-I	5132V	TP8-I
Quadplex	P82	80716-I	5150V	TP82-I
Single Toggle	P1	80701-I	5134V	TP1-I
2-Gang Toggle	P2	80709-I	5139V	TP2-I
WP GFI	WP26	6196-V	1966	WP26-I
GFI	HPS1I	80401-N1	5151V	TP26-I

D. All receptacles shall be identified with a black-on-color printed adhesive label affixed to the coverplate. This label shall include the panel and branch circuit number supplying power to the receptacle.

E. Switches serving emergency lighting shall be red with red coverplate. At no time shall emergency and normal power be in the same raceway or junction box.

26 06 30 SCHEDULE FOR SYSTEM SYSTEM CABLES

System	Jack	Cable
Telephone	Ivory	Blue
Data	Orange	Blue
Dictation	Yellow	White
Telemetry	Blue	Orange
Paging	N/A	White
TV	N/A	White
Fire Alarm	N/A	Red
CCTV	N/A	Black
Med Gas Alarm	N/A	Purple
Building Automation	N/A	Orange

26 09 00 INSTRUMENTATION AND CONTROL FOR ELECTRICAL SYSTEMS

26 09 23 LIGHTING CONTROL DEVICES

A. OCCUPANCY SENSORS

1. Ceiling mounted occupancy sensors shall be dual-technology: Watt Stopper #DT-300, Hubbell #ATD2000C, Novitas #01-BAS300, Leviton #ODC20-M0, Sensorswitch #CM-PDT or approved equivalent.

2. Wall mounted occupancy sensors shall be dual-technology: Watt Stopper #DT-200, Hubbell #ATD1600W, Leviton #ODW12-M0, Sensorswitch #WV-PDT or approved equivalent.

3. Wallswitch occupancy sensors shall be Watt-Stopper #WA-200, Hubbell #AT1277, Novitas #01-400, Leviton #ODS10-ID, Sensorswitch #WSD-PDT or approved equivalent.

4. Provide occupancy sensors with relay packs as required or shown on the drawings.

5. Provide open plenum rated wiring in accordance with manufacturer's wiring diagrams.

6. Rooms or areas with multiple sensors shall be wired so that any sensor activates all lights.

B. DIGITAL COUNTDOWN TIMERS

1. WattStopper TS-400 Digital Time Switch or approved equivalent.

C. WALLBOX DIMMERS

1. Modular preset dimmer switches for incandescent fixtures; switch poles and wattage as indicated, 120-volts, 60Hz, with continuously adjustable slide operator, and soft-tap or other quiet on-off switch. Equip with electromagnetic filter to eliminate noise, RF and TV interference, and 5-inch wire connecting leads. Dimmers shall be Lutron Nova Series, Leviton Decora Series, Prescolite Preset Series, or equivalent.

26 20 00 LOW-VOLTAGE ELECTRICAL TRANSMISSION

A. SHORT CIRCUIT RATINGS

1. All short circuit ratings shall be Fully Rated device ratings, not Series Rated.

26 22 00 LOW-VOLTAGE TRANSFORMERS

26 22 13 DRY-TYPE TRANSFORMERS

A. 600 Volts and Below

1. Furnish and install, as indicated on the electrical plans, dry-type transformer as manufactured by Square D Company, General Electric, Hevi-duty, Siemens or Cutler-Hammer.

2. Three phase transformers shall be 480 delta primary and 208Y/120 secondary. Transformer shall have a minimum of 4 - 2-1/2% full current below normal and 2 - 2-1/2% full current above normal taps.

3. Transformers shall be ANSI Class AA (Self-Cooled), as defined by ANSI-C57.12.01. Transformers shall be 115°C-temperature rise above 40°C ambient. 115°C rise transformers shall be capable of carrying a 15% continuous overload without exceeding a 150°C rise in a 40°C ambient. All insulating materials to be in accordance with NEMA St20-1992 standards for a 220°C UL component recognized insulation system.

4. Provide a 4"wide x 1½" high phenolic nameplate reading the following for each switch:

__kVA TRANSFORMER IDENTIFICATION	(3/8" Lettering)
FEEDS LOAD NAME	(3/8" Lettering)
FED FROM SOURCE NAME	(1/4" Lettering)

26 24 00 SWITCHBOARDS AND PANELBOARDS

26 24 16 PANELBOARDS

A. DISTRIBUTION PANELBOARDS:

1. Panelboards shall be installed as shown on the drawings and specified below.

2. Panels shall be dead front type, with fusible switches or circuit breakers furnished in sizes as indicated on drawings.

3. The panels shall include an equipment grounding bus.

4. Main buses and connectors shall be copper of sufficient current carrying capacity to limit the temperature rise to 65KC per UL tests and have a short circuit rating as indicated on the drawings.

5. All main bus joints, tap connections and contact points shall be silver or tin-plated.

6. Provide a 6" wide x 2" high phenolic switchboard nameplate reading the following:

PANELBOARD IDENTIFICATION (5/8" Lettering)

___V __Ph __W ____ A (3/8" Lettering)
__kAIC FULLY RATED (3/8" Lettering)
FED FROM _____ (3/8" Lettering)

7. Fusible Switches and Circuit Breakers: Fusible switches and circuit breakers shall be provided in the sizes and arrangements shown on the drawings. Fusible switches shall accept Class R fuses. Provide a 3" wide x 1" high phenolic nameplate for each switch as follows:

   EQUIPMENT IDENTIFICATION (3/8" Lettering)
   __AS/__AF (XX AMPS WITH/XX AMP FUSE) (1/4" Lettering)

   a. The switches shall be provided with a door interlock to prevent access to fuses and switch when energized and manually operated interlock defect mechanism. The door is to be furnished with "on-off" handle position markings and a means to lock the switch in the open position is to be provided.

8. Manufacturer: The panelboard shall be as manufactured by Siemens, Square D Company, General Electric, or Cutler Hammer.

9. Refer to Section 201074 for support of equipment and "housekeeping pad" requirements.

B. CIRCUIT BREAKER PANELBOARDS

1. Panels shall be dead front, safety type, furnished with branch circuit protecting devices, equipment grounding bus, phenolic nameplate, main bus, cable lugs, and door in door cover. Factory assembled, with all components in place, ready for installation.

2. The circuit breakers shall be of the molded case, bolt-on type suitable for voltage and ampere ratings indicated on drawings and in schedules and shall have a minimum interrupting capacity of 10,000 amperes (120/208V) or 14,000 amperes (277/480V.

3. Buses and connectors shall be silver or tin plated hard drawn copper of 98% conductivity, with current carrying capacity to maintain established rise tests as defined in UL Standard UL 67.

4. A directory frame shall be attached to inside face of hinged door. The directory card shall be neatly typed to identify circuits. A transparent plastic facing shall protect the directory card. Room numbers shall be included in directory descriptions. Furnish a copy of each panel directory to the Architect/Engineer.

5. All flush mounted panelboards shall have spare 1" conduits stubbed up out of the panelboard and extended to above an accessible ceiling or as indicated on the drawings. Panelboards in interior wall shall have two conduits stubbed out on both sides of the wall (four conduits total). Panelboards in exterior walls shall have three conduits stubbed out into the building interior.

6. Panelboards to be by Square D Corporation, Siemens, General Electric Company, or Cutler-Hammer.

7. Where existing panelboard loads are modified, the panel directories shall be updated. (Typewritten).

26 28 00 LOW-VOLTAGE CIRCUIT PROTECTIVE DEVICES

26 28 13 FUSES

A. Electrical Contractor shall furnish and install a complete set of fuses as manufactured by Cooper Bussmann, sized for ordinary service of motors and other loads served and at each safety switch installed as shown on the drawings and as hereinafter specified.

B. Fuses for motor loads and all other loads up to 600 A and up to 600 V shall be Buss "Low-Peak" dual element fuses, having a minimum interrupting capacity of 200,000 A RMS symmetrical. The fuses shall be UL Class RK1.

C. Fuses for all loads above 600 A and up to 600 V shall be Buss "Low-Peak" current limiting, time delay fuses, with a minimum interrupting capacity of 200,000 A RMS symmetrical. The fuses shall be UL Class L.

D. The installation of fuses of mixed manufacturers shall not be accepted. Fuse of only one manufacturer shall be installed.

26 28 16 DISCONNECT SWITCHES

A. Type of Switch: Furnish and install disconnect switches as specified where shown on the drawings.

1. All disconnect switches shall be classed Heavy Duty and enclosed as required by NEMA Standards. Switch sizes and fusing shall be as shown on the drawings.

2. Switch shall have a quick make, quick break mechanism operating through the box and not the cover. The switchblades shall be visible when the hinged door is open.

3. The cover shall be interlocked with the operating handle to prevent opening door when switch is "ON" and a means provided to lock switch in the "OFF" position. This mechanism shall be capable of being defeated.

4. Provide a 4"wide x 1½" high phenolic nameplate reading the following for each switch:

EQUIPMENT IDENTIFICATION	(3/8" Lettering)
SERVICE DISCONNECT	(3/8" Lettering)
FED FROM SOURCE NAME	(1/4" Lettering)

B. Manufacturer: Switches shall be by Siemens, Square D, Cutler Hammer, or General Electric.

26 29 00 LOW-VOLTAGE CONTROLLERS

A. CONTROL AND INTERLOCK WIRING

1. The Electrical Contractor shall furnish and install control and interlock wiring as shown on the electrical drawings. Control and interlock wiring required by Division 26 but not shown on the electrical drawing shall be the responsibility of the Division 23 Contractor requiring the wiring.

2. Generally this will mean that Division 26 wires the series safety circuit to the magnetic starters, furnished with Hand-Off-Auto selector switches, using switches and devices furnished by the Mechanical Contractor.

3. Starter automation, as required by the temperature control sequence of operation, will be provided and wired by Division 23 with connections made to terminals on the automatic side of the selector switch and on starter coil auxiliary contacts.

4. The intention is that Division 26 furnish and install all wiring necessary to operate the magnetic starters with the selector switch in the Hand position and that Division 23 provide all additional automation required.

5. Relays, electropneumatic relays, and any other device required by Division 23 to operate in parallel with the starter coil shall be controlled through spare auxiliary contacts on the starter furnished by Division 26 and shall not be connected to the starter coil.

6. Single-phase motors generally are controlled by line voltage controllers furnished by the Temperature Control Contractor but installed by the Electrical Contractor. If the control sequence is more complicated than a single line voltage device such as a unit mounted thermostat, a relay or control device with a horsepower rated contact will be provided by the Temperature Control Contractor for installation by the Electrical Contractor adjacent to the motor disconnect device. The Electrical Contractor shall provide power-wiring connections to this control device. Temperature Control Contractor will provide control and interlock wiring to this control device.

26 29 13 MOTOR AND APPLIANCE CONTROL

A. Electrical Contractor shall furnish and install all electrical devices incident to the work except as otherwise stated herein. The Mechanical Contractor will furnish prewired control panels for equipment so indicated on the plans and will furnish EP switches, electrical thermostats, pressure switches and other temperature control devices as required by the specific sequence of operation for installation by the Electrical Contractor. Others will do testing and adjusting of mechanical system devices.

B. Enclosures shall be as follows, except noted otherwise:

1. Indoors – NEMA 1

2. Outdoors – NEMA 3R

3. Cooling Towers, Dishwashing Areas – NEMA 4X

C. The motor and appliance control devices shall be as follows:

1. Single Phase Magnetic Starters - Square D Class 8536 NEMA rated contactor with one standard NC overload, 120 volt coil, heavy duty 30 mm hand-off-automatic selector switch, heavy duty 30 mm pilot light, and two N.O. auxiliary contacts.

2. Three Phase Manual Starters - Square D Class 2510.

3. Three Phase Magnetic Starters - Square D Class 8536 NEMA rated contactor with solid state overloads, 120 volt control transformer with 2 primary and 1 secondary fuses, heavy duty 30 mm hand- off-automatic selector switch, heavy duty 30 mm pilot light, and two N.O. auxiliary contacts.

4. Three Phase Combination Starter and Fusible Disconnect Switch - Square D Class 8538 NEMA rated contactor including a three pole fusible switch and a starter with solid state overloads, Class R fuses, 120 volt control transformer with 2 primary and 1 secondary fuses, heavy duty 30 mm hand- off-automatic selector switch, heavy duty 30 mm pilot light, and two N.O. auxiliary contacts.

5. Two Speed Magnetic Starters - Square D Class 8810 NEMA rated contactors with two sets of solid state overloads, 120 volt control transformer with 2 primary and 1 secondary fuses, heavy duty 30 mm hand- off-automatic selector switch, heavy duty 30 mm pilot light, and two N.O. auxiliary contacts. Motors indicated to be 1750/850 rpm shall be single winding variable torque. Motors indicated to be 1750/1150 rpm shall be two winding variable torque.

6. Two Speed Combination Starter and Fusible Disconnect Switch - Square D Class 8810 NEMA rated contactors including a three pole fusible switch and a starter with two sets of solid state overloads, Class R fuses, 120 volt control transformer with 2 primary and 1 secondary fuses, heavy duty 30 mm hand-off-automatic selector switch, heavy duty 30 mm pilot light, and two N.O. auxiliary contacts. Motors indicated to be 1750/850 rpm shall be single winding variable torque. Motors indicated to be 1750/1150 rpm shall be two winding variable torque.

7. Single Phase Manual Starters - Square D Class 2510 open type. Furnish starters two speed, single speed with or without pilot lights as indicated by the motor connection diagrams. All surface mounted starters shall be mounted in a 'FS' conduit box.

8. Selector Switches and Pushbutton Stations - Square D Class 9001, 30 mm heavy duty.

9. Provide a 3”wide x 1½”high phenolic nameplate reading the following for each motor starter:

EQUIPMENT IDENTIFICATION	(3/8” Lettering)
Size ‘_’, __A Overload	(1/4” Lettering)
FED FROM _____	(1/4” Lettering)

10. Relays - Square D Class 8501. Furnish with coil voltage and number of poles indicated on the plans.

11. Devices of similar construction and design as manufactured by Cutler Hammer, Allen Bradley, Siemens, or General Electric are also acceptable.

26 29 23 VARIABLE FREQUENCY DRIVES

A. The Electrical Contractor shall provide variable frequency drives as shown on the drawings. The Electrical Contractor shall furnish and install the controller, control devices, and interconnection wiring as specified below.

B. The drives shall operate 460-volt motors from a 480-volt power source or 200 volt motors from a 208-volt motor as indicated on the drawings.

C. Drive General Description:

1. Furnish and install Toshiba Q9 variable frequency drives. The assembly shall include a circuit breaker, three contactor by-pass, motor overload relay(s), and operational options required by this specification.

2. The drive shall be designed for operation on standard Class B motors and shall have a diode bridge rectifier on the input to minimize the generation of electrical noise levels experienced when running the motor on Utility Company power.

3. A factory authorized trained technician shall make final adjustments and settings on the drives and shall submit a field report to the Engineer stating the setpoints and ramp time settings on each drive.

D. Drive Components:

1. The variable frequency drive system shall include a diode bridge rectifier, DC link reactor for reduction of harmonics, capacitor filter, and IGBT inverter section. The output shall be capable of a 12khz sine-coded pulse width modulated output for quiet operation. The drive ratings shall be based upon 8khz output.

2. The controller shall include the following devices:

Drive manual on-off-auto selector switch to manually energize or de-energize the drive control system.

Normal/by-pass selector switch.

This circuit shall have terminals to allow an auxiliary contact to be connected in series with the switch. In addition the switch shall allow selection of manual drive speed selector (manual position).

An isolated dry contact shall be provided which shall change state when then drive is indexed to the hand position and/or the manual speed control position.

Manual speed selector to allow a specified speed to be selected and maintained if the manual-off-automatic selector switch is in the manual position.

Integral line side disconnect switch or circuit breaker, contactors, and thermal overload relays for each motor on drives controlling two motors. The bypass contactors shall be mechanically and electrically interlocked.

4-20 milliamp output that is directly proportional to drive speed.

3. Provide a 3" wide x 1" high phenolic nameplate for each starter or disconnect as follows:

   EQUIPMENT IDENTIFICATION (3/8" Lettering)
   __AS/__AF (XX AMP SWITCH/XX AMP FUSE) (1/4" Lettering)

   or

   EQUIPMENT IDENTIFICATION (3/8" Lettering)
   Size '_', __A Overload (1/4" Lettering)

4. The system protection as a minimum will provide the following:

   a. Overcurrent protection of 100% continuous, 110% for 1 minute.
   b. Instantaneous overcurrent trip at 150%.
   c. Current limit stall prevention shall be adjustable 10 to 110%.
   d. Ground fault protection.
   e. Current limiting dc bus fuse.
   f. Overvoltage protection.
   g. Undervoltage protection.

5. When the drive faults, the drive shall activate a 1NO, 1NC-fault relay display for indication of type of trip.

   OC: Overcurrent trip at 150%
   OCA: Overcurrent on start-up
   OCL: Overcurrent on output
   OL: Overload
   OP: Overvoltage due to power surge
   OP2: Overvoltage while deceleration
   POFF: Undervoltage
   OH: Overheat
   EF: Ground faults

6. Auto restart shall be a standard feature of the drive as follows:

   Auto restart enabled or disabled by jumper or keypad selection.
   If auto restart is selected the microprocessor shall determine, in the event of a fault, if a restart should be attempted. A restart will be attempted under the following condition:

   Undervoltage (UP) - Every time as soon as voltage returns to a safe level. Fault relay is not activated.

   Input Overvoltage (OPS) and DC Bus Overvoltage (OP) - Every time if voltage returns to normal within 30 seconds, fault relay is not activated.

   Overcurrent (OC) - Drive delays 1 second and attempts a restart. If drive trips a second time it delays 2 seconds and attempts a second restart. Overall, five attempts are made after successive delays of 1, 2, 4, 8 and 16 seconds. If the

restart fails the drive locks out and sets the fault relay on. (Number of restarts and time delays to be adjustable via keypad or jumpers).

A restart will not be attempted for any other type of fault and the drive will trip out immediately, activate the fault relay and make the appropriate indication on the display.

7. In the event of a fault trip the microprocessor shall save the status of the drive at the time of the fault and make that information available on the display until the drive is reset or the control power is removed.

8. An undervoltage condition of less than 100 ms duration shall not affect drive operation. If main power falls below 85% of rated voltage for longer than 100 ms while control power is retained the drive shall forcibly decelerate the load in an attempt to force a higher bus voltage through regeneration. This feature, depending on the inertia of the load, shall allow the drive to "ride through" a longer condition.

9. A minimum of 3% DC link or line reactor.

10. Operation functions shall include the following:

Acceleration and deceleration time independently adjustable from .1 to 1200 seconds.

Signal follower 0-5VDC, 0-10VDC, 4-20ma, 0-20ma, 1- 5VDC, or 0-135 ohms selectable. An increasing input signal can command increasing or decreasing frequency as required by the application.

Ramp to stop or coast to stop for normal operation (coast to stop on fault).
Volts/Hertz patterns selectable by keypad.

Upper and lower frequency limit adjustments shall be available. When the drive reaches one of the limits it shall activate an open collector signal available to the user. A dry contact signal shall be available as an option.

11. Metal Enclosure

E. The following catalog data shall be submitted for the controller:

Dimensioned drawings.
Operation and installation manuals.

Maintenance, adjustment, part breakdown and troubleshooting manual.

Connection diagrams.

Schematic diagrams including printed circuit boards, wiring harnesses, and enclosure mounted controls.

F. Refer to Section 201074 for support of equipment and "housekeeping pad requirements".

26 30 00 FACILITY ELECTRICAL POWER GENERATING AND STORING EQUIPMENT

26 50 00 LIGHTING

26 51 00 INTERIOR LIGHTING

26 51 13 INTERIOR LIGHTING FIXTURES, LAMPS, AND BALLASTS

A. LIGHT FIXTURES

1. Furnish and install light fixtures as shown on the drawings and described herein. Fixtures shall be furnished complete with all auxiliaries, hardware, lenses, lamps, sockets, wiring, supports, etc.

2. Electronic fluorescent ballasts shall be high frequency type with no detectable flicker, UL Class P, FCC and NEMA compliance with regard to EMI and RFI, meet all applicable ANSI and IEEE standards regarding harmonic distortion and surge suppression, high power factor, lamp current crest factor not more than 1.6, sound rating “A”, and designed for specified lamp types. Ballasts shall be by Advance or equivalent as manufactured by Universal/Magnetek or Osram/Sylvania.

3. All fixtures installed in plaster or drywall ceilings shall be provided with metal plaster frames. All fixtures in acoustic tile ceilings shall be installed symmetrically in pattern, at center of tile or as noted on drawings. Fixture trim shall be installed to prevent cutting, denting, deforming, or otherwise damaging the ceiling tile.

4. Complete units and all electrical components for fluorescent and incandescent fixtures shall bear the Underwriters' Laboratories and Electrical Testing Laboratory labels.

5. All fixtures shall be rigidly supported. Fixtures installed in acoustic tile ceilings shall be rigidly mounted to ceiling frame or structure above in accordance with the NEC and ASTM E580. Fixtures mounted in plaster or gypsum board ceilings shall be secured to the ceiling structure. Fixture mountings to concrete slabs shall be with Phillips “Red Head” expansion anchors or equivalent.

6. All fixtures located in fire-rated ceilings shall be so installed as to protect the integrity of the fire-rated ceiling.

7. The actual locations of light fixtures in mechanical rooms shall be adjusted to avoid interference with mechanical equipment ductwork, and piping.

8. All emergency fixtures shall be labeled with an orange dot (sticker) on the outside frame of the fixture. Each fixtures shall also be labeled on the interior with an “E” (sharpie) adjacent to the lamp holders.

9. Any fixture noted to be relocated shall be re-identified/relabeled. Coordinate emergency and normal fixture locations to minimize re-identification.

B. LAMPS

1. All fluorescent lamps shall be of the wattage and type shown on the Lighting Fixture Schedule.

2. All Quartz lamps shall be of the wattage required for emergency operation.

3. All incandescent lamps shall be inside frosted unless noted and of the wattage shown on the light fixture schedule.

4. All metal halide lamps shall be clear unless noted and of the wattages and type shown on the light fixture schedule.

5. All lamps shall be as manufactured by Phillips, GTE Sylvania, or General Electric.

6. All lamps in existing fixtures that are reused/relocated shall have new lamps installed to match existing unless noted otherwise.

7. All burnt out lamps shall be replaced with new lamps to the satisfaction of the Engineer, prior to final acceptance.

26 56 00 EXTERIOR LIGHTING

A. General

1. Furnish and install an exterior lighting system including light fixtures, poles, wiring, conduit, and controls.

B. Light Fixtures

1. Light fixtures and poles shall be as specified in the Light Fixture Schedule.

C. Wiring Methods

1. Wire shall be THHN/THWN-2 as herein specified.

2. Junction boxes shall be waterproof, gasketed, threaded out let type, OZ Series YR, cast iron, sized as required. Boxes shall be provided with a neoprene gasket and installed as indicated on drawings.

3. Conduit shall be PVC Schedule 40**,** HDPE Schedule 40, manufactured by Carlon or equivalent with fittings to match, conforming to NEMA and UL listings. PVC conduit shall be installed in gravel encasement as specified in Section 260533. Connection to light fixture terminals shall be watertight.

26 60 00 MISCELLANEOUS ELECTRICAL COMPONENTS

26 90 10 TV BRACKET

A. Furnish and install ceiling mounted TV brackets where indicated on the drawings. Part numbers shall be as listed below or equivalent:

Ceiling Mount Arm Bracket with all accessories as manufactured by PDI Communications Systems.

Available through TVR Communications, Bill Bryant, Sales, Phone (909) 598-7035, FAX (909) 595-0505.

26 90 40 HEAT TRACING

A. Tyco Raychem 5XL, specifications to follow.

END OF SECTION

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DIVISION 27

27 00 00 COMMUNICATIONS

27 00 01 GENERAL

A. The Plans, the general provisions of the Contract including the General, Supplementary and/or Special Conditions and specification sections of Division 1 shall apply to Work of Division 27 of the Specifications.

B. Provisions and conditions cited in this Section shall apply to Work for other sections of Division 27 of these Specifications.

27 00 02 REFERENCES, REGULATORY REQUIREMENTS

A. Work for this Section of the Specifications shall be performed in accordance with the Codes, Standards, etc., as identified in Division 27.

27 00 03 REFERENCES, RELATED SECTIONS of the SPECIFICATIONS

Requirements of the following Sections of the Specifications apply to Work for this Section:

A. Division 20 – Basic Mechanical and Electrical Conditions
B. Division 26 – Electrical
C. Division 28 – Electronic Safety and Security

27 00 04 DEFINITIONS

(none)

27 00 05 WORK INCLUDED

A. Furnish material, labor and services necessary for, and incidental to, installing the following systems where shown on the Plans and as hereinafter specified. Include all necessary work in the related sections of the Specifications to provide for complete systems.

27 00 06 SUBMITTALS:

A. The Contractor shall submit the following for approval in accordance with Subsection 20 00 43, Duties of the Contractor - Submittals.

B. Provide manufacturer's technical product data of each material and accessory item with engineering support information, installation manual, operation and maintenance manual. Data shall be specific to product specified and clearly identified on all data sheets, which contains multiple models or sizes.

27 05 00 COMMON WORK RESULTS FOR COMMUNICATIONS

27 05 28 PATHWAYS FOR COMMUNICATIONS SYSTEMS

27 05 28.29 HANGERS AND SUPPORTS FOR COMMUNICATIONS SYSTEMS

A. All cabling shall be as shown on plans, and per specifications.

B. Cabling may be run as concealed open-type plenum rated cable unless specified otherwise.

C. Cables shall be supported with “J-Hooks” a minimum of every five feet. Bridal rings can be used when supporting (other than CAT 6) a maximum of six wires. Support devices are to be attached to existing permanent structure (not to drywall alone).

D. Cables shall be installed in cable tray where available.

E. Cables shall be continuous from outlet to termination equipment.

F. Cables shall be terminated using tools recommended by the termination manufacturer.

G. Cables and supports shall be installed at a readily accessible location above ceilings.

27 05 28.33 CONDUITS AND BACKBOXES FOR COMMUNICATIONS SYSTEMS

A. Furnish and install conduit rough-ins where shown on drawings. Rough-in shall consist of a two-gang outlet box, single gang trim ring, and a minimum 1” conduit stubbed above an accessible ceiling. Plastic bushings shall be installed on both ends of conduit. Install blank covers on all unused rough-ins.

B. Exposed or inaccessible cables shall be installed in conduit. Where possible cables/conduit shall be concealed.

C. Conduits for all cable runs shall be sized for 40% maximum fill, or as shown on the drawings.

D. Provide pull strings in all conduits.

E. Conduit bends shall accommodate radius requirements of fiber cable as necessary.

F. Provide sleeves in all walls which cable runs pass through.

G. Furnish and install a minimum of (1) one cable pathway device through fire rated partitions and floors, where indicated on the drawings. Device shall be Specified Technologies, Inc. EZDP33FWS.

H. Refer to 260529 for fire sealing of penetrations through fire rated walls.

I. Provide access panels as necessary for cable routing.

27 15 00 COMMUNICATIONS HORIZONTAL CABLING

27 15 13 COMMUNICATIONS COPPER HORIZONTAL CABLING

A. Description of Work

1. The Electrical Contractor shall furnish and install all materials, accessories, and labor required to install a new telephone and/or data cabling system or an operational extension of the existing telephone and/or data cabling system.

2. The Contractor shall be trained and certified by the equipment manufacturer.

3. The Contractor shall attend coordination meetings with the SIH IT Department and Engineer prior to installation.

B. Acceptable Manufacturers

1. Subject to compliance with requirements, provide telephone/data cabling system components from the following manufacturers:

   Hubbell
   Commscope/Systimax
   Homaco
   Belden
   Mohawk

C. Rough-Ins

1. Furnish and install rough-ins where shown on drawings. Rough-in shall consist of a two-gang outlet box, single gang trim ring, and a minimum 1" conduit stubbed above an accessible ceiling. Install blank covers on all unused rough-ins.

2. Maximum fill of conduit is not to exceed forty percent.

3. Furnish and install minimum 2" sleeve through fire rated partitions.

4. Refer to 260529 for fire sealing of penetrations through fire rated walls.

D. Cabling

1. One Four-pair category 6, 23 awg, plenum rated, 100 ohm UTP cable to be designated for each Voice outlet **(Mohawk M58285/Gray)**. Terminate at each wall outlet and at the closet using the T568B wiring scheme and per manufacturer's recommendations.

2. One Four-pair category 6, 23 awg, plenum rated, 100 ohm UTP cable to be designated for each Data outlet **Mohawk M58281/Blue)**. Terminate at each wall outlet and at the closet using the T568B wiring scheme per manufacturer's recommendations.

3. Communications cabling jacket color shall be in accordance with 260630 Schedule for Systems Cabling.

4. Cables shall not exceed 90 meters from termination location to wall outlet.

E. Telephone/Data Cabling Systems Equipment

1. Furnish and install faceplate and modular jacks at each **Voice/Data** outlet as described below:

   a. One Hubbell single gang Modular Flush-Mount Faceplate (part# IFP14EI/Ivory).

   b. One Hubbell Nextspeed CAT 6 jack to be designated as station Voice (part #HXJ6EI/Ivory).

   c. One Hubbell Nextspeed CAT 6 jack to be designated as Data (part #HXJ6OR/Orange).

   d. Furnish, install and terminate one **Voice**, and one **Data** cable for each tele/data outlet shown unless otherwise noted. (i.e. 2T2D symbol designates (2) voice and (2) data, where as TD designates (1) voice and (1) data)

2. Furnish and install 4' x 4' x ¾" "A-CINT-APA" grade fire retardant treated (FRT) plywood mounted on all walls in IT/Comm 1126. Mount plywood with worse face toward wall, horizontally, 24"AFF. The rating stamp shall be visible and not painted over.

5. Furnish and install terminal blocks at designated location for termination of voice cables.

6. Furnish and install 19" racks, patch panels and horizontal management for termination of data cables and fiber.

   a. Provide Hubbell (part #P6E48U) category six patch panels for network terminations.

   b. Provide and install Hubbell (part #CS1976H) equipment racks in quantity and locations as follows:

      IT/Comm 1126

   c. Each rack shall have Hubbell vertical cable management (Part #VS76) mounted on each side, and Hubbell horizontal cable management (Part #HC119ME3N) mounted between each switch or patch panel.

   d. Note: All cables routed from communications closet out to wall outlets shall be routed within communications closet to equipment

racks on ladder racking or cable runway. Junction Splices, Butt-splices, Radius drop kits, wall angles, rack to runway mounting plates, and corner support brackets shall be furnished in quantities required for proper installation.

6. Labeling and Standards

a. Cables at wall outlets and terminations at communication closet shall be identified and labeled with "Closet ID – Panel/Block ID – Jack Position (or cable pair)" indicating the Telcom/IS Closet source.

Examples
Data…**H4-A-12** (indicating Closet H4, Patch panel A, Jack 12)
Telephone…**H4-1-01** (indicating Closet H4, Block 1, Pair 1)

b. The cable at the source shall be labeled the same as at the outlet and shall also include the room number where the outlet jack is located.

c. Labels at wall outlet shall be TIA/EIA-606 Compliant.

d. All of work described above shall be ANSI/TIA/EIA-568B.1, B.2, B.3-1 & 569B compliant and follow NEC codes local or otherwise.
e. Coordinate nomenclature with SIH IT prior to labeling.

F. Testing and Labeling

1. Field test data cables after installation for acceptance as defined in TIA/EIA TSB67. Acceptance tests to include continuity, length, attenuation, crosstalk, and noise. The results of all tests for each cable will be documented in a printout from the test instrument and provided to the owner. Any cables which fail will be corrected and re-tested with the new test results provided to owner.

2. Label jacks at outlet faceplates and patch panels and label cables at the outlets and other termination location in accordance with the building standards.

3. Provide colored cables and jacks in accordance with the building standards. Reference 260630 for further detail.

G. As Built Drawings

1. Provide as-built drawings indicating cable routing and cable/jack/patch panel identification.

27 15 33 COMMUNICATIONS COAXIAL HORIZONTAL CABLING

A. Furnish and install cable television system rough-ins where shown on drawings. Rough-in shall consist of a two-gang outlet box, single gang trim ring, and a 1"

conduit stubbed above an accessible ceiling. Install blank covers on all unused rough-ins.

B. Install one RG-6/U plenum rated coaxial cable from each TV outlet to the telephone board in Elec 1125**.** Provide a minimum of 12" of slack at each outlet and five feet at the telephone boards.

C. Where not within a raceway, cable shall be installed in D-rings with five-foot spacing. D-rings shall be attached to the structure. Label all cables at each end.

D. TV outlets shall consist of a female type 'F' connector with an ivory faceplate.

E. Provide 8 port splitters at the telephone board(s) in sufficient quantity to terminate all cables or as shown on the drawings. EC shall coordinate with Clinical Engineering and Media-Com prior to cable installation.

F. Provide as-built drawings providing identification and routing of all cables.

END OF SECTION

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DIVISION 28

28 00 00 ELECTRONIC SAFETY AND SECURITY

28 00 01 GENERAL

A. The Plans, the general provisions of the Contract including the General, Supplementary and/or Special Conditions and specification sections of Division 1 shall apply to Work of Division 28 of the Specifications.

B. Provisions and conditions cited in this Section shall apply to Work for other sections of Division 28 of these Specifications.

28 00 02 REFERENCES, REGULATORY REQUIREMENTS

A. Work for this Section of the Specifications shall be performed in accordance with the Codes, Standards, etc., as identified in Division 28.

28 00 03 REFERENCES, RELATED SECTIONS of the SPECIFICATIONS

Requirements of the following Sections of the Specifications apply to Work for this Section:

A. Division 20 - Basic Mechanical and Electrical Conditions
B. Division 26 – Electrical
C. Division 27 – Communications

28 00 04 DEFINITIONS

(none)

28 00 05 WORK INCLUDED

A. Furnish material, labor and services necessary for, and incidental to, installing the following systems where shown on the Plans and as hereinafter specified. Include all necessary work in the related sections of the Specifications to provide for complete systems.

28 00 06 SUBMITTALS:

A. The Contractor shall submit the following for approval in accordance with Subsection 20 00 43, Duties of the Contractor - Submittals.

B. Provide manufacturer's technical product data of each material and accessory item with engineering support information, installation manual, operation and maintenance manual. Data shall be specific to product specified and clearly identified on all data sheets, which contains multiple models or sizes.

28 05 00 COMMON WORK RESULTS FOR ELECTRONIC SAFETY AND SECURITY

28 05 28.29 HANGERS AND SUPPORTS FOR COMMUNICATIONS SYSTEMS

A. All cabling shall be as shown on plans, and per specifications.

B. Cabling may be run as concealed open-type plenum rated cable unless specified otherwise.

C. Cables shall be supported with “J-Hooks” a minimum of every five feet. Bridal rings can be used when supporting a maximum of six wires (other than CAT 6). Support devices are to be attached to existing permanent structure (not drywall alone).

D. Cables shall be installed in cable tray where available.

E. Cables shall be continuous from outlet to termination equipment.

F. Cables shall be terminated using tools recommended by the termination manufacturer.

G. Cables and supports shall be installed at a readily accessible location above ceilings.

28 05 28.33 CONDUITS AND BACKBOXES FOR ELECTRONIC SAFETY AND SECURITY SYSTEMS

A. Furnish and install conduit rough-ins where shown on drawings. Rough-in shall consist of a two-gang outlet box, single gang trim ring, and a minimum 1” conduit stubbed above an accessible ceiling. Plastic bushings shall be installed on both ends of conduit. Install blank covers on all unused rough-ins.

B. Exposed or inaccessible cables shall be installed in conduit. Where possible cables/conduit shall be concealed.

C. Conduits for all cable runs shall be sized for 40% maximum fill, or as shown on the drawings.

D. Provide pull strings in all conduits.

E. Conduit bends shall accommodate radius requirements of fiber cable as necessary.

F. Provide sleeves in all walls which cable runs pass through.

G. Furnish and install a minimum of (1) one cable pathway device through fire rated partitions and floors, where indicated on the drawings. Device shall be Specified Technologies, Inc. EZDP33FWS.

H. Refer to 260529 for fire sealing of penetrations through fire rated walls.

I. Provide access panels as necessary for cable routing.

28 30 00 ELECTRONIC DETECTION AND ALARM

28 31 00 FIRE DETECTION AND ALARM

A. Description of Work

1. Install a complete and operational extension of the existing fire alarm system as indicated by drawings, schedules, and riser diagrams.

2. The equipment supplier must be the local factory authorized representative and must also be factory authorized, trained and certified to perform warranty service for the equipment being supplied.

3. Firm shall be regularly engaged in manufacturer of fire alarm systems of types, sizes, and electrical characteristics required, and whose products have been in satisfactory use in similar service for not less than 5 years.

4. Firm with at least 5 years of successful experience on projects with fire alarm systems work similar to that required for this project providing local factory authorized service and spare parts inventory.

5. After the one-year guarantee period, the supplier shall warrant that they are capable of providing service on a 24 hour, 7-day a week basis for at least five (5) additional years.

6. The Contractor and an approved representative of the system manufacturer shall perform conductor testing in accordance with NFPA 72, table 7-2.2, Items 11a-d, prior to installation of devices. Test results shall be submitted to the Engineer.

7. Provide shop drawings showing manufacturer's technical product data, including specifications and installation instruction, for each type of fire alarm system equipment. Project specific point-to-point wiring diagrams, device addresses and battery calculations shall be provided.

8. Programming and testing of devices shall be included. The test shall include the functional operation of all added and modified devices, circuits and equipment. Coordinate all system shutdowns and testing with the Owner.

B. Manufacturers

1. Provide fire alarm system components and devices compatible with existing Notifier AFP1010 control panel.

C. Devices

1. Manual Fire Alarm Stations: Notifier NBG-12LX addressable non-coded, red semi-flush, dual action manual station manufactured of Lexan and Stopper II covers with clearly visible operating instructions on the cover.

   a. Photoelectric Detectors: Notifier FSP-851 intelligent analog photoelectric smoke detectors shall use the photoelectric (light-scattering) principal to measure smoke density and shall, on command from the control panel, send

data to the panel representing the analog level of smoke density. Sensitivity of the detector shall have an adjustable nominal sensitivity range per UL. It shall be possible to perform a calibrated sensitivity and performance test on the detector without generating smoke. The test method shall test all detectors. The detector shall have a UL operating range of 0-4000 ft. per minute. Provide a detector at control panel and each annunciator and remote power supply. Provide standard bases model Notifier B710LP. Provide a detector at control panel and each annunciator and remote power supply.

2. Duct Detector: Notifier Model FSD-751PL duct smoke detector. Provide remote test switches where noted.

3. Beam Smoke Detector: System Sensor Beam 200S with multi mounting kit, surface mount kit, and remote test switches where noted.

4. Thermal Detector: Notifier FST-851 or FST-851H fixed temperature low profile type device with maximum protrusion of 2.1 inches and twist lock installation. Temperature rating to be 135 degrees or 190 degrees (H version). In elevator equipment rooms and shafts, heat detectors shall be located within two feet of each sprinkler head.

5. Relay Modules: Notifier Model FRM-1 addressable relay modules.

6. Control Modules: Notifier Model FCM-1 addressable control modules.

7. Monitor Modules: Notifier Model FMM-1 or FDM-1 addressable monitor modules.

8. Door Holders: ESL DHF-24120C or equivalent. Provide extension rods as necessary. Door Holders shall be 24V powered. Provide power supplies as necessary. Label power supplies “Door Holder Power Supply”.

9. Carbon Monoxide Detectors: Macurco CM-15 or equivalent flush mounted.

D. Signal Devices

1. Audible/Visual and Visual Signal Devices

Wall Mounted Selectable Candela Audible/Visual Signals: Horn shall have 84 dB output at 10 feet on the high setting. Strobes shall have 15, 15/75, 30, 75, 110, and 115 candela output. Notifier P2R.

Wall Mounted Selectable Candela Visual Signals: Strobe shall have 15, 15/75, 30, 75, 110 and 115 candela output. Notifier SR

Ceiling Mounted Selectable Candela Audible/Visual Signals: Horn shall have 84 dB output at 10 feet on the high setting. Strobes shall be multi-candela units with 15, 15/75, 30, 75, 110, and 115 candela outputs. Notifier PC2R

Ceiling Mounted Selectable Candela Visual Signals: Strobes shall be multi-candela units with 15, 15/75, 30, 75, 110, and 115 candela outputs. Notifier SCR

2. Signals shall meet the requirements of the Americans With Disabilities Act.

3. The visual section shall be polarized Xenon strobe in various candela ratings. The visual candela rating shall be as indicated on the drawings.

4. Audible signals and/or audible sections of combination signals shall be electronic multi-tone units and shall not require vibrating solenoids or contacts. The audible section shall provide for a high/medium/low setting providing different dB levels meeting the requirements of the particular room or space. Tone selection shall be continuous tones or the temporal pattern based on the ANSI S3.41 Standard shall be field selectable. Set audible signals to temporal pattern for this project and volume at high. Adjust volume for small rooms as required.

5. Visual and audible devices shall be synchronized.

6. The signals shall operate on 24 VDC polarized and meet UL 1971, UL464 and ADA. The signal shall be able to test circuit supervision without disconnecting wires.

7. There shall be FIRE lettering clearly visible from both sides.

8. Provide remote power supplies as necessary. Notifier FCPS-24S6.

E. System Wiring

1. All wiring will be as required by Notifier and the equipment supplier.

2. No conduit or raceway system will include Class I or nonpower limited fire protection signaling circuits with Class II or power limited fire protection signaling circuits in accordance with N.E.C. Article 725 or 760.

3. Wiring may be run as concealed open-type plenum rated cable. Exposed or inaccessible wiring shall be installed in conduit. Where possible wiring/conduit shall be concealed. Provide sleeves in all walls which cable runs pass through. Refer to 260529 for fire sealing of penetrations through fire rated walls. Provide access panels as necessary for cable routing. Support devices are to be attached to existing permanent structure.

F. Temporary Fire Alarm

1. Temporary but adequate fire alarm system coverage shall be provided for all construction areas. This requirement will be enforced as part of the SIH Interim Life Safety Program.

2. Mechanical type heat detectors shall be installed as needed to provide 100% coverage for all construction areas.

3. In areas where existing smoke detectors are currently installed, the contractor may utilize the existing fire alarm “bases” to install the required heat detection. Upon completion of the project the system must be brought back to the original state prior to construction or as shown otherwise.

4. The temporary fire alarm system shall be monitored be the facility (Notifer) fire alarm systems. Coordinate with Tech Electronics for any additional programming/devices necessary.

5. Verify program nomenclature with the owner prior to modifying the system program.

END OF SECTION

SECTION 00 31 21

GRADES, LINES & LEVELS

PART 1 GENERAL

1.1 REQUIREMENTS INCLUDE

A. Contractor layout of work under the contract.

1. Establish all working lines, levels, grades, elevations, and measurements.

1.2 RELATED REQUIREMENTS

A. Specified elsewhere:

Section 31 22 13 - Rough Grading
Section 31 22 16 - Finish Grading
Section 31 23 16 - Excavation, Backfill and Compaction for Pavement, Roads, Parking and Sidewalks
Section 32 12 00- QA/QC Bituminous Concrete Paving
Section 32 13 13 - Portland Cement Paving
Section 33 05 00 - Excavation, Backfill, and Compaction for Utilities
Section 33 11 16 - Site Water Distribution Systems
Section 33 31 00 - Sanitary Sewer Systems
Section 33 41 00 - Storm Sewage Systems

B. By others:

1. Architect will furnish:
   a. Locations, dimensions and data pertaining to proposed buildings.

2. Engineer will furnish:
   a. Dimensions as shown on Plans pertaining to proposed curbs, sidewalks & pavements.

1.3 QUALITY ASSURANCE

A. Qualifications of Engineer/Surveyor:

1. Experienced in layout work of similar complexity.

2. Illinois Licensed Professional Surveyor or Illinois Licensed Professional Engineer.

1.4 SUBMITTALS

A. Owner may at any time require written verification of grades, lines, and levels by a licensed surveyor as work progresses.

END 00 31 21

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SECTION 31 10 00

SITE CLEARING

PART 1 GENERAL

1.1 WORK INCLUDES

A. Base Bid and Alt 1:

1. General Contractor:

a. Clear site of plant life and grass.

b. Remove and dispose of:

(1) Root system of trees and shrubs.
(2) Surface debris.
(3) Trees, shrubs, etc.
(4) Other items as necessary for construction and earthwork

1.2 RELATED WORK

A. Specified elsewhere:

1. Section 31 22 13 - Rough Grading
2. Section 31 23 16 - Excavation, Backfilling and Compacting for Pavements, Roads, Parking Lots & Sidewalks
3. Section 31 25 13 - Erosion & Sediment Control
4. Section 33 05 00 - Excavation, Backfilling and Compacting for Utilities

1.3 REGULATORY REQUIREMENTS

A. Conform to IEPA, City of Murphysboro and State of Illinois laws and codes for disposal of debris.

B. Conform to IEPA requirements for site erosion and sediment control.

1.4 REFERENCES

Specified references, or cited portions thereof, current at date of bidding documents unless otherwise specified, govern the work.

A. Illinois Department of Transportation (IDOT): Standard Specifications for Road and Bridge Construction adopted January 1, 2012, including all addenda.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION

3.1 CLEARING

A. Clear designated areas for access to site and execution of work.

B. Remove trees and shrubs within marked areas. Grub out stumps, roots, surface rock, and other debris.

C. Clear undergrowth and deadwood, without disturbing subsoil.

3.2 PROTECTION

A. Protect plant growth and features remaining for final landscaping.
B. Protect bench marks and existing work from damage or displacement.
C. Maintain designated site access for vehicle and pedestrian traffic.

3.3 REMOVAL

A. Remove all debris from site.

END 31 10 00

SECTION 31 22 13

ROUGH GRADING

PART 1 GENERAL

1.1 WORK INCLUDES

A. Base Bid and Alt. 1:

1. General Contractor:

a. Remove topsoil and stockpile for later reuse.
b. Excavate subsoil and stockpile for later reuse.
c. Grade and rough contour site.
d. Provide off site soils as necessary.
e. Remove all excess soils from site.

1.2 RELATED WORK

A. Specified elsewhere:

1. Section 00 31 21 – Grades, Lines & Levels
2. Section 31 22 16 - Finish Grading
3. Section 31 25 13 - Erosion and Sediment Control
4. Section 31 23 16 - Excavating, Backfilling, & Compacting for Pavements, Roads, Parking Lots and Sidewalks.
5. Section 32 12 00 - QA/QC Bituminous Concrete Paving
6. Section 32 13 13 - Portland Cement Concrete Paving
7 Section 33 05 00 - Excavating, Backfilling and Compacting for Utilities
8. Section 33 11 16 - Site Water Distribution Systems
9. Section 33 31 00 - Sanitary Sewer System
10. Section 33 41 00 - Storm Sewage Systems

1.3 SUBMITTALS

A. Accurately record location of utilities remaining, rerouted utilities, new utilities by horizontal dimensions, elevations or inverts, and slope gradients.

1.4 PROTECTION

A. Protect trees, shrubs, lawns, and other features remaining as portion of final landscaping.

B. Protect benchmarks, existing structures, fences, and roads.

C. Protect above or below grade utilities which will remain.

D. Repair damage.

PART 2 PRODUCTS

2.1 MATERIALS

A. Topsoil: Excavated material, graded free of roots, rocks larger than 1 in., subsoil, debris and large weeds.

B. Subsoil: Excavated material, graded free of lumps larger than 6 in., rocks larger than 3 inches and debris.

PART 3 EXECUTION

3.1 PREPARATION

A. Identify specified lines, levels, contours and data.

B. Identify known below grade utilities. Stake and flag locations.

C. Identify and flag above grade utilities.

D. Maintain and protect existing utilities remaining which pass through work area.

E. Notify all utility companies to remove and/or to relocate utilities as necessary.

F. Upon discovery of unknown utility or concealed conditions, discontinue affected work; notify Architect/Engineer immediately. Confirm notification in writing.

3.2 TOPSOIL EXCAVATION

A. Excavate topsoil from areas to be further excavated, relandscaped or regraded and stockpile in area designated on site.

B. Do not excavate wet topsoil.

C. Stockpile topsoil to depth not exceeding 8 feet. Cover to protect from erosion. Provide environmental protection.

3.3 SUBSOIL EXCAVATION

A. Excavate subsoil from areas to be relandscaped or regraded and stockpile in area designated on site.

B. Do not excavate wet subsoil.

C. Stockpile to depth not exceeding 8 ft.

D. When excavating through roots, perform work by hand and cut roots with a sharp axe.

E. Provide off site soils as necessary to rough grade disturbed areas as necessary to provide proper drainage.

3.4 TOLERANCES

Top surface of subgrade: Plus or minus 1 in.

END 31 22 13

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SECTION 31 22 16

FINISH GRADING

PART 1 GENERAL

1.1 WORK INCLUDES:

A. Base Bidand Alt. 1:

1. General Contractor provide:

a. Finish grade subsoil.
b. Cut out areas to receive stabilizing base course materials for paving and sidewalks.
c. Place, finish grade and compact topsoil in all seeded areas and in planting beds.
d. Provide off site top soils as necessary.

1.2 RELATED WORK

A. Specified elsewhere:

1. Section 00 31 21 – Grades, Lines & Levels
2. Section 31 22 13 - Rough Grading
3. Section 31 23 16 - Excavating, Backfilling, and Compacting for Pavements, Roads, Parking Lots, and Sidewalks
4. Section 31 25 13 - Erosion And Sediment Control
5. Section 32 12 00 - QA/QC Bituminous Concrete Paving
6. Section 32 13 13 - Portland Cement Concrete Paving
7. Section 32 92 00 - Seeding, Fertilizing and Mulching
8. Section 33 05 00 - Excavating, Backfilling & Compacting for Utilities
9. Section 33 11 16 - Site Water Distribution Systems
10. Section 33 31 00 - Sanitary Sewer Systems
11. Section 33 41 00 - Storm Sewage Systems

1.3 PROTECTION.

A. Prevent damage to existing fencing, bench marks, and utility lines.

1.4 REFERENCES.

A. Specified references, or cited portions thereof, current at date of bidding documents unless otherwise specified, govern the work.

1. Illinois Department of Transportation (IDOT): Standard Specifications for Road and Bridge Construction, adopted January 1, 2012 including all addenda.

PART 2 PRODUCTS

2.1 MATERIALS

A. Topsoil: Friable loam free from subsoil, roots, grass, excessive amount of weeds, stones and foreign matter; acidity range (pH) of 5.5 to 7.5; containing a minimum of 4% and a maximum of 25% organic matter. Use topsoil on site conforming to these specifications.

PART 3 EXECUTION

3.1 SUBSOIL PREPARATION

A. Prepare subgrade in accord with IDOT Specification, Section 301, Articles 301.01 through 301.10.

B. Cut areas, to subgrade elevation, which are to receive stabilizing base for paving and sidewalks.

C. Bring subsoil to indicated levels, profiles and contours. Make changes in grade gradual. Blend slopes into level areas.

D. Slope grade away from building minimum 2.5 in. in 10 ft., unless indicated otherwise on the drawings.

E. Cultivate subgrade to a depth of 3 in., where topsoil will be placed. Repeat cultivation in areas where equipment, used for hauling and spreading topsoil, has compacted subsoil.

F. Compact subsoil:

1. 88% where topsoil will be placed.
2. 95% where stabilizing base for paving will be placed.
3. 95% where stabilizing base for concrete sidewalks will be placed.

3.2 PLACING TOPSOIL

A. Place topsoil in accord with IDOT Specification, Section 211, Articles 211.01 through 211.06.

B. Use topsoil in relatively dry state. Place during dry weather.

C. Place 6" uncompacted thickness in all seeded areas and 12" uncompacted thickness in all planted beds.

D. Fine grade topsoil in accordance with IDOT Specification Section 212, eliminating rough and low areas to ensure positive drainage. Maintain levels, profiles and contours of subgrades.

E. Remove stone, roots, grass, weeds, debris and other foreign material while spreading.

F. Manually spread topsoil around trees, plants and buildings and paved areas to prevent damage which may be caused by grading equipment.

G. Lightly compact placed topsoil.

3.3 SURPLUS MATERIAL

A. Remove surplus subsoil and topsoil from site.

B. Leave stockpile areas and entire job site clean and raked, ready to receive landscaping.

END 31 22 16

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SECTION 31 23 16

EXCAVATING, BACKFILLING & COMPACTING FOR PAVEMENTS, ROADS, PARKING LOTS & SIDEWALKS

PART 1 GENERAL

1.1 WORK INCLUDES

A. Base Bid and Alt. 1:

1. General Contractor provide:

a. Site clearing
b. Excavate for roadways, parking areas, parking lots, drives and sidewalks.
c. Shore and brace excavation.
d. Place and compact fills to rough grade elevations.
e. Dewater excavations.

1.2 RELATED WORK

A. Specified Elsewhere:

1. Section 00 31 21 – Grades, Lines & Levels
2. Section 31 22 13 - Rough Grading
3. Section 31 22 16 - Finish Grading
4. Section 31 25 13 - Erosion and Sediment Control
5. Section 32 12 00 - QA/QC Bituminous Concrete Paving
6. Section 32 13 13 - Portland Cement Concrete Paving
7 Section 33 05 00 - Excavating, Backfilling and Compacting for Utilities
8. Section 33 11 16 - Site Water Distribution Systems
9. Section 33 31 00 - Sanitary Sewer System
10. Section 33 41 00 - Storm Sewage Systems

1.3 REFERENCES

Specified references or cited portions thereof, current at date of bidding documents unless otherwise specified, govern the work.

A. American Society for Testing and Materials (ASTM):

1. ASTM D698: Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures using 5 lb. Rammer and 12 in. Drop.

B. Illinois Department of Transportation (IDOT): Standard Specifications for Road and Bridge Construction, adopted January 1, 2012 including all addenda.

1.4 SITE COMPACTION TESTING

A. Testing of compacted fill materials will be performed by an independent testing laboratory employed and paid for by the contractor. Testing will be performed in a manner to least encumber performance of work. Provide Architect/Engineer with copies of all test results as soon as they are available.

B. When work, or portions or work are completed, notify testing laboratory to perform density tests. Do not proceed with additional portions of work until satisfactory results have been verified in writing.

C. When, during progress of work, tests indicate that compacted materials do not meet specifications, remove defective work, replace and retest, as directed in writing by Architect/Engineer.

D. Ensure that all compacted fills are tested before proceeding with placement of surface materials.

1.5 SUBMITTALS

A. Submit 20 lb. sample of each type of fill to testing laboratory, in separate airtight containers. Submit samples a minimum of (2) days prior to first set of compaction tests.

1.6 PROTECTIONS

A. Protect trees, lawns, areas to receive planting and other features remaining as part of final landscaping.

B. Protect benchmarks and existing structures, roads, sidewalks, paving and curbs against damage from equipment and vehicular or foot traffic.

C. Protect excavations by shoring, bracing, sheet piling, underpinning or other methods to prevent cave-ins or loose dirt from falling into excavations.

D. Underpin adjacent structure which may be damaged by excavation work including service lines and pipe chases.

E. Notify Architect/Engineer immediately of unexpected subsurface conditions and discontinue work in area until Architect/Engineer issues written notification to resume work. Confirm notification in writing.

F. Protect bottom of excavations and soil around and beneath foundations from frost.

G. Grade around excavations to prevent surface water runoff into excavated areas.

PART 2 PRODUCTS

2.1 FILL MATERIALS

A. Type A Gravel: Angular pit run crushed natural stone; free from shale, clay, friable materials and debris; graded in conformance with Article 1004.01 IDOT Standard Specifications conforming to CA6 or CA10 gradation.

B. Type B Pea Gravel: Clean natural stone; free from clay, shale and organic matter; 1/4" to 1/2" size.

C. Type C Sand: Clean natural river or bank sand; free from silt, clay, loam, friable or soluble materials and organic matter; graded within the following limits:

	Sieve Size	% Passing
1.	No. 4	100
2.	No. 14	10 to 100
3.	No. 48	5 to 90
4.	No. 100	4 to 30
5.	No. 200	0

D. Type D: Select site excavated subsoil materials: Free from roots, rocks larger than three inches in size, and building debris. Use subsoil excavated from site only when conforming to specifications. All fill soils shall be subject to the approval of the geotechnical engineer prior to placement and compaction.

E. Type E: Select hauled in off site excavated subsoils materials. Free from roots, rocks larger than three inches in size and building debris or other organic debris. Use off site hauled in subsoil only when conforming to specifications. All fill subsoil shall be subject to the approval of the geotechnical engineer prior to placement and compaction.

2.2 FILL UNDER LANDSCAPED AREAS

Free from alkali, salt, petroleum products. Use subsoil excavated from site only when materials conform to specifications.

PART 3 EXECUTION

3.1 PREPARATION AND LAYOUT

A. Provide site clearing and obstruction removal in accordance with Section 31 10 00

B. Remove and stockpile on site topsoil in accordance with IDOT Standards for road and bridge construction, Section 211. Replace topsoil per Section 211. Seed disturbed areas.

C. Establish extent of excavated areas by area and elevation. Designate and identify data elevation.

D. Set specified lines and levels.

E. Maintain benchmarks, monuments and other reference points.

3.2 UTILITIES

A. Before starting excavation, establish location and extent of underground utilities occurring in work area. Contact Joint Utility Locating Information for Excavators (J.U.L.I.E.) 800/892-0123.

B. Maintain, reroute or extend existing utility lines to remain which pass through work area.

C. Protect utility services uncovered by excavation.

D. Remove abandoned utility service lines from areas of excavation; cap, plug, or seal such lines and identify at grade.

3.3 EXCAVATION

A. See site plan for building location and contract limit lines. Excavate subsoil in accord with lines and levels established for the work including space for forms, bracing and shoring to permit inspection.

B. Perform additional excavation only by Architect/Engineer written authorization.

C. Machine slope banks.

D. Hand trim excavations and leave free from loose or organic matter.

E. When complete, verify soil bearing capacities, depths and dimensions.

F. Correct unauthorized excavation in accord with Architect/Engineer written directions.

G. Fill over-excavated areas under structure bearing surfaces with concrete specified for foundations or pea gravel free from clay, shale and organic matter. Compact in accord with 3.5.

H. Excavations shall not interfere with normal 45 degree bearing splay of any foundation.

I. Stockpile excavated subsoil for reuse where directed. Remove excess or unsuitable excavated subsoil from site.

J. Do not disturb soil within branch spread of existing trees or shrubs that will remain.

K. When necessary to excavate through roots, perform work by hand and cut roots with a sharp axe. Employ a tree surgeon or an Illinois Registered Landscape Architect.

3.4 BACKFILLING

A. Stockpile fill materials in areas designated by Architect/Engineer.

B. Ensure areas to be backfilled are free from debris, snow, ice, water and that ground surfaces are not frozen.

C. Do not backfill over existing subgrade surfaces which are porous, wet or spongy.

D. Compact existing subgrade surfaces when densities determined by testing laboratory are not equal to that specified for backfill material.

E. Cut out soft areas of existing subgrade. Backfill with subsoil and compact to specified density.

F. Backfill areas to grades, contours, levels and elevations shown.

G. Backfill symmetrically and as early as possible to allow maximum time for natural settlement and compaction.

H. Place and compact fill materials in continuous layers not exceeding 12" loose depth.

I. Maintain optimum moisture content of backfill materials to attain specified compaction density.

J. Backfill simultaneously on each side of foundation walls to equalize soil pressures.

K. Where temporary unbalanced pressures are liable to develop on wall before floor slabs are placed, erect shoring to counteract imbalance. Leave in place until Architect/Engineer issues written authorization for their removal.

L. When necessary to excavate through roots, perform work by hand and cut roots with a sharp axe.

3.5 FILL TYPES AND COMPACTION

Compact all fill and backfill to specified values based on Standard Proctor Test.

A. Fill under all roads, roadways, parking areas, drives and sidewalks: Subsoil fill to underside of specified crushed stone paving or to underside of slab. Compact to 95% maximum dry density with Type D or E fill material with no more than 12" lifts.

B. Fill under landscaped areas: Subsoil to top of subgrade elevation. Compact to 90% maximum dry density, Standard Proctor.

C. Moisture content: Not less than 2% below or 3% above optimum moisture content determined in accord with:

1. Standard Proctor Test: ASTM D698 OR AASHTO T-99.

3.6 TESTING

A. Density tests shall be performed at the following interval:

1. For roads, roadways, drives, parking areas, parking lot: 1 test per 2500 sq.ft. per each lift of fill.

2. For sidewalks: 1 test for each 50 linear feet of sidewalk for each lift of fill.

3.7 SURPLUS MATERIALS

A. Remove surplus materials from site.

B. Leave stockpile areas completely free of all excess fill materials.

END 31 23 16

SECTION 31 25 13

EROSION & SEDIMENT CONTROL

PART 1 GENERAL

1.1 WORK INCLUDES:

A. Base Bid and Alt. 1:

1. Contractor Provide:

a. Soil erosion and sediment control.
b. Provide all material, equipment and labor for soil erosion and sediment control.
c. Remove temporary control structures after completion of construction stabilization of all distributed soils pursuant to successful establishment and growth of vegetative or other specified ground covers.

1.2 RELATED WORK

A. Specified elsewhere:

1. All sections under SITE WORK.

1.3 REFERENCES

Specified references or cited portions thereof, current at date of bidding documents unless otherwise specified, govern the work.

A. Illinois Environmental Protection Agency.

1. Standards and Specifications for Soil Erosion and Sediment Control

1.4 SUBMITTALS

A. Submit an itemized summary of soil erosion and sediment control procedures, materials and practices contractor intends to use at specific locations on this particular project. Make specific reference to the standard procedures and standard drawings included in the referenced IEPA specifications.

B. If contractor wishes to supplement the referenced IEPA procedures or standards, submit detailed description and drawings for proposed work to Architect/Engineer for approval.

PART 2 PRODUCTS

2.1 All Material used shall be new unless specifically approved by Architect/Engineer in writing.

2.2 Material shall be as specified and shown in the referenced specifications.

PART 3 EXECUTION

3.1 PREPARATION & PLANNING

A. Prior to initiation of any excavation, prepare a general soil erosion and sediment control strategy for each watershed on the construction site for review, discussion and approval by Architect/Engineer. This strategy shall be first discussed during the pre-construction meeting.

B. Subsequent to pre-construction meeting and based on proceedings of the meeting, formally prepare a submittal as instructed in submittals article above for review and approval by Architect/Engineer.

3.2 PLACING TOPSOIL

A. Implement and carry out the approved soil erosion and sediment control procedures as outlined in the approved submittals and in accordance with the provisions of the referenced specifications.

B. Remove temporary control structures and mechanisms after completion of construction and full stabilization of all disturbed soils pursuant to successful establishment and growth of vegetative or other specified ground covers.

END 31 25 13

SECTION 32 12 00

QA/QC BITUMINOUS CONCRETE PAVING

PART 1 GENERAL

1.1 WORK INCLUDES

A. Base Bid and Alt. 1:

1. General Contractor Provide:

a. Prepare sub-grade to receive base course.
b. Place stabilizing base course, grade, work and compact.
c. Prime base course, place bituminous concrete paving.
d. Testing coordination.
e. Provide Painted Pavement Markings & Lines.

1.2 RELATED WORK

A. Specified elsewhere:

1. Section 00 31 21 - Grades, Lines and Levels
2. Section 31 22 13 – Rough Grading
3. Section 31 22 16 – Finish Grading
4. Section 31 23 16 - Excavating, Backfilling, & Compacting for Pavements, Roads, Parking Lots and Sidewalks.
5. Section 33 05 00 - Excavating, Backfilling & Compacting for Utilities
6. Section 33 11 16 - Site Water Distribution Systems
7. Section 33 31 00 - Sanitary Sewer Systems
8. Section 33 41 00 - Storm Sewage Systems

1.3 REFERENCES

A. American Society of Testing Materials (ASTM):

1. ASTM D698-78 - Tests for Moisture-Density Relationship of Soils and Soil-Aggregate Mixtures, Using 5 lb. Rammer and 12 in. Drop.

2. All other ASTM standards as referenced by any other references listed in these specifications.

B. American Association of State Highway and Transportation Officials (AASHTO):

1. All AASHTO standards as referenced by any other references listed in these specifications.

C. Illinois Department of Transportation (IDOT):

1. Standard Specifications for Road and Bridge Construction, adopted January 1, 2012 or latest edition including all addenda.

2. Supplemental Specifications, adopted January 1, 2012 or latest edition.

3. Manual of Instructions for Bituminous Proportioning and Testing, September 1, 1983 or latest edition.

4. IDOT Check Sheets, Recurring Special Provisions, and Inserted Special Provisions as applicable for "Quality Control/Assurance of Bituminous Concrete Mixtures", Revised January 1, 2012, or latest editions.

5. IDOT Check Sheets, Recurring Special Provisions, and Inserted Special Provisions as applicable for "Segregation Control of Bituminous Concrete", Revised January 1, 2012 or latest edition.

6. The above IDOT reference materials are all subject to the following conditions:

   a. Change all references to "Engineer" or "Department" to "Owner", "Architect/Engineer", and or "Contractor Testing Laboratory" as appropriate and necessary.

   b. All references to "Measurement" and or "Payment" do not apply.

D. The Asphalt Institute (AI):

1. ES-11 Asphalt Surface Treatments - Specifications.
2. ES-12 Asphalt Surface Treatments - Construction Techniques.
3. MS-1 Thickness Design - Asphalt Pavements for Highways.
4. MS-2 Mix Design Methods for Asphalt Concrete and Other Hot-Mix types.
5. MS-5 Introduction to Asphalt
6. MS-8 Asphalt Paving Manual
7. MS-10 Soils Manual.
8. MS-15 Drainage of Asphalt Pavement Structures.
9. MS-22 Principles of Construction of Hot-Mix Asphalt Pavements.
10. All AI standards as referenced by any other references listed in these specifications.

1.4 TESTING AND INSPECTION

A. "Quality Control (QC)" testing and inspection of bituminous concrete mixes and testing of placed base and stabilizing base course(s) and bituminous concrete pavements shall be performed by the Contractor.

B. "Quality Assurance (QA)" testing and inspection of bituminous concrete mixes and testing of placed base and stabilizing base course(s) and bituminous concrete pavements will be performed by an independent testing laboratory employed and paid by the Contractor. Testing and inspection will be performed in manner to minimize disruption of work.

C. Contractor shall allow testing laboratory access to mixing plant for verification of weights or proportions, character of materials used and determination of temperatures used in preparation of bituminous concrete mix.

D. When requested by the contractor, the testing laboratory will perform tests on proposed bituminous pavement mixes to determine conformity with specifications.

E. Testing laboratory will perform one series of "QA" compaction tests for stabilizing base course and for each bituminous pavement course, as specified. Contractor shall pay for all costs of additional testing due to improper performance of work.

F. When stabilizing base course, or portion thereof, has been placed and compacted in accordance with the specifications, contractor shall notify testing laboratory to perform "QA" density tests. Do not place bituminous concrete pavement until satisfactory results have been verified and base course approved in writing by Architect/Engineer.

G. When placing bituminous courses contractor shall notify testing laboratory to perform "QA" density tests as specified during placement and rolling operations to insure conformance with specifications.

H. After completing paving operations contractor shall notify architect/engineer and owner that the surfaces are ready for surface variation and surface slope/grade testing.

I. When density/compaction, surface variation, and surface slope/grade test results indicate nonconforming work; the contractor shall remove, replace, and retest defective work at his own expense.

J. The Contractor shall perform all "QC" density and compaction testing as specified.

PART 2 PRODUCTS

2.1 MATERIALS

A. Geo-textile Fabric for Ground Stabilization: Comply with IDOT Standard Specifications, Section 210:

1. Woven or non-woven as specified on the plans.

B. Stabilizing Base Course: Comply with IDOT Standard Specifications, Section 351:

1. Aggregate Base Course, Type A, (CA-6 or CA-10). Thickness as shown on plans (10" minimum).

C. Bituminous Pavement Materials: Comply with IDOT Standard Specifications, Section 406:

1. Bituminous Concrete Binder Course, Mix B, N70, IL 12.5 (or IL 19.0 as applicable), thickness as shown on plans (1-1/2" minimum).

2. Bituminous Concrete Surface Course, Mix C, N70, thickness as shown on plans (1-1/2" minimum).

3. Bituminous Materials Prime Coat, MC-30. (applied at the rate of 0.35 gallons per square yard).

D. Painted Pavement Markings and Lines: Comply with IDOT Standard Specifications, Section 780

1. Beads are not required.

2. All pavement markings shall be in accordance with the "Manual on Uniform Traffic Control Devices", latest edition.

3. All parking lot stripes shall be 4" wide.

4. All symbols and lettering shall be as per IDOT Standard #780001-02, or latest revision, using the 6' legend height.

5. All striping and pavement markings except accessible parking spaces shall be white.

6. All accessible parking spaces, symbols and cross walks shall be high-visibility yellow.

PART 3 EXECUTION

3.1 INSTALLATION

A. Provide all items and perform all preparation and work in accordance with IDOT Standard Specifications, referenced Sections:

1. Subgrade: Section 301.
2. Geo-textile Fabric: Section 310.
3. Aggregate Base Course Type A: Section 351.
4. Bituminous Materials Prime Coat: Section 406.
5. Bituminous Concrete Binder and Surface Course, Class I: Section 406.
6. Bituminous Concrete Pavement (Full-Depth): Section 407.
7. Painted Pavement Markings & Lines: Section 780.

B. Contractor shall make every effort and take great care to provide a smooth uniform surface course free from the following:

1. Segregation of aggregates and bituminous materials.
2. Low areas causing ponding of waters.
3. Waves in pavement.
4. Bumps at joints between paving machine passes.
5. Other deficiencies or poor workmanship that contributes to or provides a substandard end product.

C. Contractor shall provide painted pavement markings and lines as shown on the drawings.

3.2 TESTING

A. "QC" Density tests shall be performed at the following interval:

1. For Drives and Parking areas: As per IDOT specifications and special provisions, except the following frequencies shall also apply.

a. A minimum of 2 tests per 10,000 square feet of pavement per mix.

b. A minimum of 2 tests per day of paving operations per mix.

c. A minimum of 1 test per paved area per mix. Separate paved areas shall be defined as areas that are non-contiguous in function and or location (parking areas are considered separate from drive areas).

B. "QA" Density testing shall be performed by the Contractor employed testing laboratory as per the specifications.

C. Surface Course Surface Variation Tests shall be performed by the Contractor to demonstrate conformance with the following requirements:

1. For Drives and Parking Areas: Surface shall not vary more than 3/16 inch in 16 feet in any direction when measured with a 16 foot straightedge.

D. Surface Course Slope/Grade Control Tests shall be performed by the Contractor to demonstrate conformance with the following requirements:

1. For Accessible Parking areas:

a. Inclination shall not exceed 1:50 in any direction.

2. For Walks and designated crossing areas:

a. Lateral inclination in the direction of travel shall not exceed 1:50.

b. Inclination in the direction of travel shall not exceed the grades as shown on the plans or 1:20, whichever is less.

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SECTION 32 13 13

PORTLAND CEMENT CONCRETE PAVING

PART 1 GENERAL

1.1 WORK INCLUDES

A. Base Bid and Alt. 1:

1. General Contractor Provide:

a. Concrete sidewalks, curbs, gutters, driveways, pavements, parking areas, equipment pads, ramps, stairs, MRI pad etc.
b. Prepare subgrade to receive base course for concrete pavements.
c. Place and compact base course materials for concrete pavements.
d. Formwork.
e. Reinforcement.
f. Expansion joints & dowel rods, etc.
g. Tooled joints (sidewalks, patios, etc.)
h. Surface finishes
i. Curing
j Saw cut joints (pavements, curbs, etc.)
k. Joint sealants.
l. Bollards
m. Finishing
n. Non Shrink Grout
o. Thrust blocks
p. Miscellaneous concrete as needed for construction

1.2 RELATED WORK

A. Specified elsewhere:

1. Section 00 31 21 - Grades, Lines and Levels
2. Section 31 22 16 - Finish Grading
3. Section 31 23 16 - Excavating, Backfilling, & Compacting for Pavements, Roads, Parking Lots and Sidewalks.
4. Section 33 11 16 - Site Water Distribution Systems
5. Section 33 31 00 - Sanitary Sewer Systems Section
6. Section 33 41 00 - Storm Sewage Systems

1.3 REFERENCES.

A. Specified references, or cited portions thereof, current at date of bidding documents unless otherwise specified, govern the work.

References to measurement and payment, engineer performed testing, engineer performed mix designs, or engineer performed material certifications do not apply.

1. Illinois Department of Transportation (IDOT): Standard Specifications for Road and Bridge Construction adopted January 1, 2012, including all addenda:
   a. Section 420 - "Portland Cement Concrete Pavement"
   b. Section 424 - "Portland Cement Concrete Sidewalk"
   c. Section 606 - "Concrete Gutter, Curb, Median and Paved Ditch"
   d. Other sections and articles as referenced and appropriate.

2. American Concrete Institute (ACI):
   a. ACI 305 - "Hot Weather Concreting"
   b. ACI 306 - "Cold Weather Concreting"
   c. ACI 308 - "Guide to Curing Concrete"
   d. ACI 347 - "Guide to Formwork for Concrete"
   e. Other Standards as referenced or applicable.

3. American Society for Testing Materials (ASTM):
   a. Various standards as referenced and applicable.

4. American Association of State Highway and Transportation Officials (AASHTO):
   a. Various standards as referenced and applicable.

1.4 QUALITY ASSURANCE

A. Perform all work in accordance with referenced IDOT Specifications, and other referenced ACI and ASTM standards.

B. Obtain all materials from respective same source throughout construction operations.

C. Ready-Mix Concrete Plant: IDOT certified concrete plant.

1.5 JOB CONDITIONS

Environmental Requirements: Protect concrete from physical damage or reduced strength due to weather extremes.

1. In cold weather comply with ACI 306-72.
2. In hot weather comply with ACI 305-72.

1.6 SUBMITTALS

A. Product Data:

1. Concrete Mix Designs.

2. Reinforcement & Welded Wire Fabric.

3. Expansion Joint Materials.

4. Joint Sealants and Appurtenances.

5. Other Pavement Appurtenances.

6. Tactile Warning

PART 2 PRODUCTS

2.1 MATERIALS.

Provide all materials in accord with referenced Sections, Articles of IDOT Specifications, and from IDOT approved material sources. References to Engineer performed tests do not apply.

A. Granular Sub-base: Comply with Article 311.02.

B. Base Course Aggregate: Comply with Article 351.02.

C. Portland Cement Concrete: Comply with Section 1020.

1. All concrete shall be class SI (min. 3500 psi @ 14 days, 2 to 4" slump, 4-8% air), unless otherwise noted.

2. Any and all proportioning and mix designs shall be performed by the contractor or concrete supplier.

3. Pavements and accessories: Comply with Article 420.02.

4. Sidewalks and accessories: Comply with Article 424.02.

5. Curbs, curbs & gutters, paved ditches, and accessories: Comply with Article 606.02

6. Calcium Chloride not permitted.

D. Portland Cement: Comply with Articles 1001.01 through 1001.04.

E. Water: Comply with Section 1002.

F. Fine Aggregate: Comply with Article 1003.01.

G. Coarse Aggregate: Comply with Article 1004.01.

H. Reinforcement Bars & Fabric: Comply with Article 1006.10.

I. Metal Joints, Dowel Bars, Etc.: Comply with Article 1006.11.

J. Concrete Admixtures: Comply with Section 1021.

K. Curing Materials: Comply with Section 1022: all membrane curing compounds shall be Type I (clear).

L. Protective Coat: Comply with Section 1023.

M. Nonshrink Grout: Comply with Section 1024

N. Epoxy Concrete Materials: Comply with Section 1025.

O. Preformed Expansion Joint Filler: Comply with Articles 1051.03

P. Joint Sealant: One component urethane, pour grade, self-leveling elastomeric sealant. Use in exterior and interior control/contraction and expansion joints in sidewalks and pavements.

1. Acceptable Products:
   a. MAMCO - Vulkem 45
   b. PECORA - Urexpan NR201
   c. SIKA - Sikaflex 12SL
   d. SONOBORN - Sonalastic SL1
   e. TREMCO - THC-900

PART 3 EXECUTION

3.1 SUBGRADE PREPARATION: Comply with Articles 301.01 through 301.10.

3.2 GRANULAR SUB-BASE: Comply with Articles 311.01 through 311.07.

3.3 PORTLAND CEMENT CONCRETE PAVEMENT: Comply with Articles 420.01 through 420.18.

3.4 PORTLAND CEMENT CONCRETE SIDEWALK: Comply with Articles 424.01 through 424.11.

3.5 CONCRETE CURBS, CURBS & GUTTERS, AND PAVED DITCHS: Comply with Articles 606.01 through 606.13.

3.6 FIELD QUALITY CONTROL: Comply with Section 106.

3.7 CLEAN UP: Upon completion of the work, remove all surplus materials, packaging, rubbish and debris resulting from the work and legally dispose of off site.

3.8 CONCRETE FINISHING:

A. Coordinate sidewalk and patio jointing patterns and locations with plans and Architect/Engineer prior to beginning concreting activities.

B. After striking-off and consolidating concrete, smooth surface by screeding and floating. Adjust floating to compact surface and produce uniform texture.

C. After floating, test surface for trueness with a 10' straightedge. Distribute concrete as required to remove surface irregularities, and re-float repaired areas to provide a continuous smooth finish.

D. Work edges of slabs and formed joints with an edging tool, and round to 1/2" radius, unless otherwise indicated. Eliminate tool marks on concrete surfaces.

E. Tool all joints in sidewalks, patios, etc. using a standard joint tool, eliminate tool marks on concrete surfaces.

F. Provide ADA and Local Agency compliant tactile warnings at locations as shown on the plans and as necessary, eliminate tool marks from concrete surfaces as appropriate.

G. After completion of floating and toweling when excess moisture or surface sheen has disappeared, complete surface finishing, as follows:

1. Provide Fine Line Broom finish, at all curbs and gutters, mechanical equipment slabs and sidewalks by drawing a fine-hair broom across the concrete surface, perpendicular to line of traffic. Repeat operation as necessary to provide a fine line texture.

2. Provide Broom Finish at all pavements by drawing a coarse broom across the concrete surfaces perpendicular to the direction of traffic. Repeat operation as necessary to provide a uniform lined texture.

3.9 EXPANSION JOINTS

A. Comply with IDOT Standards and project details.

3.10 CONTROL / CONTRACTION JOINTS

A. Comply with IDOT Standards and project details.

1. Sidewalks and patios, etc.: provide tooled joints as per plans and details and as directed by the Architect/Engineer.

2. Pavements, curbs, curbs & gutters, etc.: provide saw cut joints per plans and details and as directed by the Architect/Engineer.

3.11 TESTING

A. Contractor shall employ and pay for testing laboratory services for the following tests: Slump, Air Content and Compressive Strength. Testing shall be as per the IDOT Specifications subject to the following minimum frequencies:

1. A minimum of one set of tests per 25 cubic yards of concrete.

2. A minimum of one set of tests for each day’s concreting activities.

B. Straight Edge Testing and Surface Correction: As per Article 420.09

C. Surface Course Slope/Grade Control Tests shall be performed by the Contractor to insure conformance with the following ADA Code Requirements:

1. For Accessible Parking:

a. Inclination shall not exceed 1:50 (2.00%) in any direction.

2. For sidewalks and designated cross walk or crossing areas:

a. Lateral inclination shall not exceed 1:50 (2.00%).

b. Inclination in the direction of travel shall not exceed the grades as shown on the plans or 1:20 (5.00%), whichever is less.

3. For Curb Cuts & Curb Ramps (ADA Code Requirements):

a. Lateral inclination shall not exceed 1:50 (2.00%).

b. Inclination at curb ramps shall not exceed 1:12 (8.33%).

c. Gutter depressions shall not exceed one-half inch (1/2”).

Non conforming work shall be saw cut, removed and replaced, at the contractor’s expense, as necessary to conform to ADA Code Requirements.

END 32 13 13

SECTION 32 92 00

SEEDING, FERTILIZING AND MULCHING

PART 1 GENERAL

1.1 WORK INCLUDES

A. Base Bid and Alt. 1:

1. General Contractor:

a. Finish grade all disturbed excavated, and backfilled areas on the entire construction site in accordance with the project specifications.
b. Provide temporary & erosion and sediment control seeding as necessary and as specified.
c. General contractor to provide seeding as indicated on the drawings and specified herein.
d. Prepare subgrade to receive topsoil.
e. Spread topsoil.
f. Prepare seed beds, landscape beds, & seeded landscaped beds as shown on the plans.
g. Provide lime, fertilizer, seed and mulch as specified.
h. Maintain seeded areas.
i. Provide seed protection in areas specified.
j. Provide temporary & erosion and sediment control seeding as necessary and as specified.

1.2 RELATED WORK

A. Specified elsewhere:

1. Section 31 10 00 - Site Clearing
2. Section 31 22 13 - Rough Grading.
3. Section 31 22 16 – Finish Grading
4. Section 31 25 13 - Excavating, Backfilling and Compacting for Pavements, Roads, Parking Lots and Sidewalks.
5. Section 31 23 16 – Erosion and Sediment Control.
6. Section 33 05 00 – Excavating, Backfilling and Compacting for Utilities

1.3 REFERENCES

A. Illinois Department of Transportation (IDOT); Standard Specifications for Road and Bridge Construction, January 1, 2012, including all addenda.

B. Illinois Environmental Protection Agency (IEPA): Illinois Urban Manual, latest edition.

C. Illinois Seed Law (Ill.Rev. Stat.1987, ch.5, par.401 et seq.)

1.4 QUALITY ASSURANCE

A. Work shall be completed by a company specializing in the work specified with a minimum of 5 years documented full-time experience, and with workers skilled in the work to be performed.

1.5 PROTECTION

A. Only vehicles and equipment necessary to perform the work shall be allowed on areas to be seeded or sodded.

1.6 SUBMITTALS

A. Certificates of compliance.

1. Sod and seed tags and labels.

2. Fertilizer guaranteed analysis labels.

3. Herbicide labels

1.7 FINAL ACCEPTANCE AND WARRANTY

A. Seeded Areas: Final inspection and acceptance will be at the end of the turf establishment period which will follow the first mowing, to be performed by the installing contractor when grass has reached a height of 4”-5”.

B. Unacceptable areas of turf shall be reestablished to the above guidelines by the contractor.

C. Damage or poor stands resulting from erosion, disease or other causes shall be repaired at no additional compensation. Seeding shall be repeated until a satisfactory uniform stand of turf is achieved as determined by the A/E.

D. Sodded Areas: Contractor shall maintain sodded areas for 30 days following installation, including watering, weeding, resodding, mowing and edging. Mow the grass at regular intervals to maintain height at 2.5”. No more than 1/3 of the grass blade shall be removed at any one mowing.

E. At the end of the maintenance period, the A/E will inspect the site to determine final acceptance. Acceptance for both seeded and sodded areas will be based upon establishment of a weed-free healthy growing stand of turf comprising 95% of the specified species.

1.8 DELIVERY, STORAGE AND HANDLING

A. Provide seed in standard sealed containers with suppliers label indicating weight, variety or strain, percentage germination, purity and weed content. The date of packaging and analysis shall be no more than nine months prior to the delivery date. With the exception of specified turf-type fescue blends, seed should be unmixed in individual containers for each species.

B. Provide fertilizers in original water-resistant containers with label indicating chemical analysis.

C. Sod shall be provided fresh cut and installed within 24 hours of harvest.

PART 2 PRODUCTS

2.1 GROWING MEDIA

A. Mulching Material: Straw shall be air dried stalks of wheat, rye, or oats straw, reasonably free from weeds and foreign matter detrimental to plant life. Hay is not permissible or acceptable.

B. Special Erosion Control Materials: Comply with IDOT Specification; Article 1081.10.

1. Excelsior blanket: min. 0.63 lb/sq yd (+/- 10%).

2. Knitted straw mat: min. 0.50 lb/ sq yd.

3. Heavy duty erosion control blanket: min. 1.45 lb/sq yd (+/- 10%).

4. Appurtenances as necessary and required.

2.2 SOIL AMENDMENTS

A. Agricultural Ground Limestone: Comply with IDOT Specification; Article 1081.07.

B. Fertilizer: Comply with IDOT Specification; Article 1081.08.

2.3 SEEDS

A. Seed mixtures and varieties will vary; consult A/E for appropriate seeding mix. Typical blend shall be 95% 5-way turf-type fescue blend and 5% Kentucky Bluegrass by volume. Hydro seeding may be acceptable with certification of proper seed mix.

B. Provide mixtures as specified for the uses as indicated in article 3.2B of this specification.

2.4 FERTILIZERS

A. Fertilizer: ready-mixed granular complete formulation with a manufacturer's suggested application rate.

B. Lime: Agricultural ground limestone with a relatively uniform particle size of approximately 4.75 mm (no. 4 sieve, standard application rate shall be 4 tons/acre) or a bagged pelletized mixture may be substituted.

2.5 HERBICIDES

A. Pre and post emergence herbicides may be specified. The contractor shall provide any herbicides and apply as specified conforming to label directions, state certification requirements and safety standards.

2.6 TOPSOIL

A. Topsoil shall be a friable loamy soil from the A horizon of soil profiles of local soils. Topsoil shall be free of subsoil, roots, grass, weeds, and stones larger than 1" and other foreign matter, with a pH range of 5.5 to 7.5 and organic matter content from 3% to 20%. Stockpile existing topsoil from site on forming to these specifications for use in seeding and landscaping operations.

PART 3 EXECUTION

3.1 PREPARATION

A. All work shall be in accordance with sections 250, Seeding, and 251, Mulch, of the IDOT Standard Specifications.

B. Place and till topsoil in a relatively dry state. Do not work in a muddy or frozen condition.

C. If specified, apply limestone prior to tilling existing topsoil, or prior to final grading of placed topsoil.

D. Grade the area to be seeded flush with paved areas and to a level that will allow sod to be just below flush with paved areas.

E. Apply fertilizer evenly at a rate of 1.5 lb. actual nitrogen/1000 sq. ft. (approx. 600 lbs. 12-12-12 / acre), prior to finish grading operations.

F. Remove all foreign materials, plants, roots, stones, sticks, and debris greater than ½" from all areas to be seeded or landscaped. Remove all debris from site, do not bury foreign material.

G. Remove contaminated soil.

H. Cultivate area(s) to receive topsoil to depth of 6 in. Repeat cultivation in area(s) where equipment has compacted subgrade.

I. Grade to eliminate rough spots and provide proper drainage, eliminate low areas where ponding may occur. Maintain smooth, uniform grades. Finish grade with a cultipacker to a debris-free seedbed, eliminating rough spots, clods and low areas where ponding may occur. Maintain a smooth, uniform grade. Cultivate inaccessible areas by hand tiller, and rake smooth.

J. Provide erosion and sediment controls as necessary to prevent loss of soils.

K. Cultivate/scarify sub grade to a minimum depth of 6" prior to placement of topsoil. Till existing (undisplaced) topsoil to a minimum depth of 6".

L. If specified, apply limestone prior to tilling existing topsoil, or prior to final grading of placed topsoil.

M. Grade topsoil to eliminate uneven areas and low spots. Make gradual grade changes, blending slopes evenly into level areas. Slope grade away from building a minimum of 4" to 10' unless otherwise specified. Taper to existing turf areas in final 12" of grade.

3.2 SEEDING

A. All work shall be done in accordance with Section 250, Seeding, of the IDOT Standard Specifications except for the lawn areas shall be seeded at the rates and mixtures specified in this specification section.

B. Do not sow immediately following rain, when ground is too dry or during windy periods.

C. For uniform coverage, sow seed in two directions, with ½ of the total volume in a N/S and ½ in an E/W configuration (perpendicular application).

D. Roll seeded area with roller not exceeding 112 lbs.

E. Apply water with fine spray immediately after each area has been sown.

F. Provide temporary erosion control seeding as necessary and required.

G. Seeding shall be done only between April 15 and May 15 or (preferably) between August 15 and October 15.

H. Seeding mixtures shall be in accordance with Article 250.07 of the IDOT Standard Specifications and as follows:

1. Temporary Erosion Control:
   IDOT Seeding Mixture “CLASS 7 - TEMPORARY EROSION CONTROL MIXTURE”.

2. Landscaped Areas: Do not seed these areas.

I. Apply specified lawn seed blend at the recommended rate, typical blend of Fescue and Bluegrass will be at 10lbs./100 sq.ft.

3.3 MULCHING

A. All work shall be done in accordance with Section 251, Mulch, of the IDOT Standard Specifications.

B. Provide knitted straw mat or excelsior blanket at all areas where slopes are greater than 4:1 (H:V), in ditch & swale flow lines with slopes of 2% or less, and at other areas as shown on drawings. Install as per IDOT and manufacturers requirements.

C. Provide heavy duty erosion control blanket in ditch & swale flow lines with slopes greater than 2%, and other areas as shown on drawings. Install as per IDOT and manufacturers requirements.

D. Lay blankets and mats, in the direction of flow, as per IDOT standards: overlap end of strips a minimum 6" with upstream section on top. Fasten all matting with metal staples or wood stakes as per IDOT and the manufacturer’s requirements.

E. Apply straw mulch within 24 hours of seeding at a rate of 100 lbs./1000 sq.ft. (3 average bales). Apply evenly so there are no large bare areas, but at a thickness that allows proper growth of seedlings. The mulch shall be free of excessive lumps of matted or compacted material. Unless specifically waived, straw mulch shall be anchored into soil by means of a mechanical flat-blade crimper.

F. Water seeded area with overhead sprinklers until soil is uniformly wet and small puddles just begin to form. Continue appropriate watering schedule until project is accepted. Protect area from foot and vehicle traffic.

G. Mow first time to 2 ½" when grass has reached height of 4"

3.4 MAINTENANCE

A. The Using Agency will assume maintenance responsibility after final acceptance of the project. Prior to that, the Contractor shall be responsible for proper maintenance of all seeded areas.

B. Maintain surfaces; supply additional soil in low areas, including areas affected by erosion. Provide inter-seeding as necessary.

C. Water as necessary to ensure uniform seed germination and to keep surface of soil damp.

D. Mow first time to 2 ½" when grass has reached a height of 4".

END 32 92 19

SECTION 33 05 00

EXCAVATING, BACKFILLING & COMPACTING FOR UTILITIES

PART 1 GENERAL

1.1 WORK INCLUDES

A. Base Bid and Alt. 1:

1. General Contractor provide:

a. Excavate trenches for site utilities, including: electric lines, waterlines, sanitary sewers, storm sewers, and other public or private utility service extensions.
b. Compacted bed and compacted fill over site utilities to subgrade elevations.
c. Compaction.
d. Dewater excavations
e. Shore and brace excavations.
f. Provide trench backfill at areas located under or within 2’ of paved areas.

1.2 RELATED WORK

A. Specified elsewhere:

1. Section 00 31 21 - Grades, Lines & Levels
2. Section 31 25 13 - Erosion and Sediment Control
3. Section 32 92 00 - Seeding, Fertilizing and Mulching
4. Section 33 11 16 - Site Water Distribution Systems
5. Section 33 31 00 - Sanitary Sewer System
6. Section 33 41 00 - Storm Sewage Systems

1.3 TESTS

A. Tests and analysis of fill materials will be performed in accord with ANSI/ASTM (D698).

1. The contractor will employ and pay for an independent testing laboratory to perform specified trench backfill and earth compaction tests for excavations backfilled for respective utility work.

1.4 REFERENCES.

A. Specified references, or cited portions thereof, current at date of bidding documents unless otherwise specified, govern the work.

1. American National Standards Institute/American Society for Testing and Materials (ANSI/ASTM).

a. D698 - Test for Moisture-Density Relationship of Soils and Soil--Aggregate Mixtures Using 5.5 lb. Rammer and 12 in. Drop.

2. Illinois Department of Transportation (IDOT): Standard Specifications for Road and Bridge Construction adopted January 1, 2012, including all addenda.

1.5 PROTECTION

A. Protect excavations by shoring, bracing, sheet piling, underpinning or other methods to prevent cave-in or loose soil form falling into excavation.

B. Underpin adjacent structures which may be damaged by excavation work, including service utilities and pipe chases.

C. Notify Architect/Engineer immediately of unexpected subsurface conditions. Confirm notification in writing. Discontinue work until Architect/Engineer issues written notification to resume work.

D. Protect bottom of excavations and soil adjacent to and beneath foundations from frost.

E. Grade excavation top perimeter to prevent surface water runoff into excavation.

1.6 CONSTRUCTION SAFETY STANDARDS

A. Each Contractor shall comply with Occupational Safety and Health Administration (OSHA) Excavation and Trenching Safety Standards, 29 CFR, Part 1926.

PART 2 PRODUCTS

2.1 SELECT BED AND FILL MATERIALS

A. POROUS GRANULAR BACKFILL. Comply with IDOT Specification, Article 1003.04, Fine Aggregate, and Article 1004.05, Coarse aggregate.

2.2 COMMON FILL MATERIALS

A. Subsoil: Reused: free of gravel larger than 3 inch size, and debris.

PART 3 EXECUTION

3.1 INSPECTION

A. Verify stockpiled fill to be reused as approved in writing by Architect/Engineer.

3.2 PREPARATION

A. Identify specified lines, levels, contours and data. Coordinate with Section 00 31 21.

B. Compact subgrade surfaces to density specified for backfill materials.

3.3 UTILITIES

A. Before starting excavation, establish location and extent of underground utilities occurring in work area. Contact Joint Utility Locating Information for Excavators (J.U.L.I.E.) 800/892-0123.

B. Maintain, reroute or extend existing utility lines to remain which pass through work area.

C. Protect utility services uncovered by excavation.

D. Remove abandoned utility service lines from areas of excavation; cap, plug, or seal such lines and identify at grade.

E. Accurately locate and record abandoned and active utility lines rerouted or extended on Project Record documents.

3.4 EXCAVATION

A. Excavate subsoil: For conduit, water, sewer, gas lines, and installation of other underground work as shown on drawings.

B. Cut trenches wide enough to enable utility installation and allow inspection.

C. Hand trim excavation and leave free of loose matter. Hand trim for bell and spigot pipe joints.

D. Remove lumped subsoil, boulders and rocks.

E. Excavation shall not interfere with normal 45 degree bearing splay of foundations.

F. Correct unauthorized excavation.

G. Fill over-excavated areas under pipe or conduit bearing surfaces in accord with Architect/Engineer's directions.

H. Stockpile excavated material in area designated on site and remove excess subsoil not being reused, from site.

I. Verify locations of existing caissons to avoid conflicts with proposed utility routing.

3.5 BACKFILLING

A. Comply with IDOT Standards, Section 208 - Trench Backfill and Section 209 - Porous Granular Backfill; Disregarding any references to measurement and payment.

3.6 TOLERANCES. Top surface of backfilling: Plus or minus 1 in.

3.7 FILL TYPES AND COMPACTION. Compact all fill and backfill to specified values based on Standard Proctor Test.

A. Existing Ground in Place:

Area / Condition	Percent of Compaction
1. Overlot - landscaped areas.	85%
2. Footings and foundations.	95%
3. Pavements.	95%

B. Backfill Materials:

Area / Condition	Fill Type	Max. Lift	% of Compaction
1. Pavements, roads, parking lots, and sidewalks:			
a. Top 8 in. under slab	IDOT: CA-6	8 in.	95%
b. 8 in. & more below slab	IDOT: CA-6	8 in.	95%
2. Trenches:			
a. Under footings	IDOT: CA-6	8 in.	95%
b. Under pavements:			
(1) Top 8 in. under slab	IDOT: CA-6	8 in.	95%
(2) 8 in. & more below slab	IDOT: CA-6	12 in.	95%
c. Cross lot landscaping	Common Fill	12 in.	85%

C. Moisture Content: Not less than 2% below optimum moisture content determined in accord with:

1. Standard Proctor Test: ASTM D698 or AASHTO T-99.

3.8 COMPACTION TESTING.

A. Testing will be performed in accord with ANSI/ASTM D1556-64 and with IDOT Standard Specification requirements.

3.9 SURPLUS MATERIALS

A. Remove surplus materials from site.

B. Leave stockpile areas completely free of all excess fill materials.

END 33 05 00

SECTION 33 11 16

SITE WATER DISTRIBUTION SYSTEM

PART 1 GENERAL

1.1 WORK INCLUDES

A. Alt. 1:

1. General Contractor:

a. Provide, size as shown on plans, slip joint PVC C900, Class 150, SDR 18 water main piping and tracer wire as shown on the drawings.

b. Provide fire hydrants & auxiliary gate valves as shown on the plans

c. Provide ductile iron mechanical joint fittings where needed and as shown on plans.

d. Provide gate valves and cast iron adjustable valve boxes as shown on the plans.

e. Provide casing pipe as shown on the plans and as required by the IEPA.

f. Provide all required concrete thrust blocking.

g. Provide connections to existing water mains as shown on the plans.

h. Provide excavating, backfilling, and compaction; as specified in Section 33 05 00..

i. Provide pressure testing of pipe as required and as specified. Provide a test outlet at high point of line(s) and test new pipe as specified. Provide required pressurizing pump.

j. Provide required chlorine and disinfection of all piping (initial concentration of 50ppm with a residual concentration of 25ppm at 24 hours). Provide bacteriological testing of pipe as required and as specified (minimum one set of tests for each 1,200 feet of water line).

k. Coordinate all pressure testing with the hospital representative and the Engineer, all pressure testing must be witnessed by a hodpital representative or the Engineer.

1.2 RELATED WORK

A. Specified elsewhere:

1. Section 00 31 21 - Grades, Lines and Levels
2. Section 31 22 16 - Finish Grading
3. Section 31 25 13 - Erosion and Sediment Control
4. Section 32 12 00 - QA/QC Bituminous Concrete Paving
5. Section 32 13 13 - Portland Cement Concrete Paving
6. Section 33 05 00 - Excavating, Backfilling and Compacting for Utilities

1.3 QUALITY ASSURANCE

A. Comply with the requirements of the State of Illinois, Plumbing Code.

B. Installation shall also comply with the requirements and installation procedures of the Standard Specifications for Water and Sewer Main Construction in Illinois, July 2009. Except where otherwise specified:

1. References to "MEASUREMENT AND PAYMENT" do not apply.

1.4 SUBMITTALS

A. Submit material description and manufacturers' current literature indication conformance with AWWA requirements for all materials, gate valves, water pipe, meter and valve boxes, meter setters, valves, fire appurtenances and other materials.

1.5 CONSTRUCTION SAFETY STANDARDS

A. Contractor shall comply with Occupational Safety and Health Administration (OSHA), Excavation and Trenching Safety Standards, 29 CFR, Part 1926.

PART 2 PRODUCTS

2.1 MATERIAL AND EQUIPMENT

A. Pipe

1. All pipe sizes, material and specifications and pressure ratings are shown on the drawings. Pipe shall comply with AWWA requirements.
2. Joint material shall be elastomeric push on gaskets as per ASTM F477 for all water main piping.

B. Gate Valves and Check Valves

1. Valve size, specification, and pressure rating is shown on the drawings. Minimum acceptable pressure rating shall be 250 psi.
2. All valves shall be mechanical joint and shall be AWWA approved.
3. Gate valves shall have cast iron valve box and lid adjusted to grade.
4. All gate valves shall have resilient seats.

C. Fittings

1. All fittings shall be mechanical joint and AWWA approved.

PART 3 EXECUTION

3.1 INSTALLATION

A. All installation shall be in accordance with Illinois State Plumbing Code and the Standard Specifications for Water and Sewer Main Construction in Illinois, July 2009.

3.2 TESTING

A. The system must be disinfected and tested for bacteriological safety in accordance with IDPH and IEPA requirements prior to final acceptance. One set of tests shall be provided for each 1,200 lineal feet of water main. Provide repeat disinfection and testing as required until acceptable and satisfactory results are obtained.

B. The system must be pressure tested as per the requirements of the references in section 1.3 above in presence of the Engineer. The Engineer shall be given 48 hours advance notice of the test(s).

C. One set of State of Illinois Test Results showing satisfactory bacteriological results must be submitted to the Engineer.

END 33 11 16

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SECTION 33 31 00

SANITARY SEWER SYSTEM

PART 1 GENERAL

1.1 WORK INCLUDES

A. Base Bid and Alt. 1:

1. General Contractor:

a. Provide excavating, backfilling, and compaction; as specified in Section 33 05 00.

b. Provide ex-filtration testing as specified.

c. Provide deflection testing as specified.

d. Provide PVC SCH40 building sewers and clean outs, sizes as shown from buildings sanitary sewers as shown on the drawings.

1.2 RELATED WORK

A. Specified Elsewhere

1. Section 00 31 21 - Grades, Lines and Levels
2. Section 31 22 16 - Finish Grading
3. Section 31 25 13 - Erosion and Sediment Control
4. Section 32 92 00 - Seeding, Fertilizing and Mulching
5. Section 33 05 00 - Excavating, Backfilling and Compaction for Utilities

1.3 QUALITY ASSURANCE

A. Installation shall comply with the requirements and installation procedures of the Standard Specifications for Water and Sewer Main Construction in Illinois Sixth Edition, July 2009. Except where otherwise specified:

1. Change all references to "Engineer" to "Architect/Engineer".

2. References to "MEASUREMENT AND PAYMENT" do not apply.

1.4 CONSTRUCTION SAFETY STANDARDS

A. Contractor shall comply with Occupational Safety and Health Administration (OSHA) Excavation and Trenching Safety Standards, 29 CFR, Part 1926.

1.5 SUBMITTALS

A. Submit material description and manufacturers’ current literature indicating conformance with ASTM/AASHTO requirements for all materials, sanitary sewer pipe, pipe fittings and other materials. Provide shop drawings for all sanitary sewer manholes.

PART 2 PRODUCTS

2.1 MATERIAL AND EQUIPMENT

A. Sewer Pipe and Joint

1. SDR 26 PVC, ASTM D-3034.

2. Pipe jointing shall be elastomeric seal rubber gaskets ASTM D-3212.

B. Building Sewers

1. SCH 40 PVC ASTM 1785; Fittings: PVC; Joints: ASTM D-2855 solvent weld.

C. Bedding

1. Sewer pipe bedding shall be Class I, ASTM D-2321, graded granular crushed stone, IDOT, CA-10.

2. Haunching to springline of pipe shall be same material as bedding above.

3. The first 4" of cover over sewer pipe shall be same as bedding above.

4. See Typical Trench Cross Section for sewer pipe bedding in drawings.

D. Manholes

1. Pre-cast concrete ASTM C-478, minimum 4 ft. interior diameter with directed flow pre-cast channels in base section and self-sealing frame & lid with “sanitary” cast into the lid.

2. Steps shall be copolymer polypropylene coated grade 60 steel with load and pullout ratings meeting OSHA standards.

3. Joints between pre-cast sections shall be designed for and jointed with flexible butyl resin concrete sealant meetings AASHTO-M-198 requirements.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install sanitary sewer pipe, bedding, manholes and components in accordance with referenced standards in Article 1.3 and 1.4 above and as shown on drawings.

B. Contractor to verify exact location and routing of existing sewer before starting construction. Contractor shall verify the elevation at determined point of connection and verify proper slope can be maintained to building connection.

3.2 TESTING

A. Provide ex-filtration testing of sewer pipe and manholes in accordance with the referenced standard specifications. Ex-filtration leakage shall not exceed 240 gallons per inch diameter of pipe per mile per day, including manholes for section tested.

B. Provide deflection testing of the PVC sewer pipe as described in the referenced standard specification by pulling a "go - no go" mandrel through all the pipe installed from manhole to manhole.

C. Provide leakage testing for all proposed manholes in accordance to ASTM C969-94 and C1244-93.

D. All testing shall be performed in the presence of the Architect/Engineer. Provide at least 48 hours advance notice of planned testing to Architect/Engineer.

END 33 31 00

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SECTION 33 41 00

STORM SEWAGE SYSTEMS

PART 1 GENERAL

1.1 WORK INCLUDES:

A. Base Bid and Alt. 1:

1. General Contractor Provide:

a. Catch basins, grates, frames, manholes, inlets, storm sewers and appurtenances.

b. Building downspout collection system, piping, fittings, cleanouts, downspout transitions and piping outlets.

c. Subsurface & Foundation drainage piping and connections.

d. Connections to existing storm sewer systems.

e. Provide excavating, backfilling, and compaction; as specified in Section 33 05 00.

1.2 RELATED WORK

A. Specified Elsewhere:

1. Section 00 31 21 - Grades, Lines and levels
2. Section 31 22 16 - Finish Grading
3. Section 31 23 19 - Erosion Control
4. Section 32 12 00 - QA/QC Bituminous Concrete Paving
5. Section 32 13 13 - Portland Cement Concrete Paving
6. Section 32 92 00 - Seeding, Fertilizing and Mulching
7. Section 33 05 00 - Excavating, Backfilling and Compacting for Utilities

1.3 REFERENCES

Specified references, or cited portion thereof, current at date of bidding documents unless otherwise specified, govern the work.

A. Illinois Department of Transportation (IDOT): Standard Specifications for Road and Bridge Construction, adopted January 1, 2012 including all addenda, hereinafter referred to as "IDOT Specification" except any reference to measurement or payment does not apply.

1.4 SUBMITTALS

A. Submit material description and manufacturers' current literature indicating conformance with IDOT/ ASTM/AASHTO requirements for all materials, storm sewer pipe, frames and grates and other materials. Provide shop drawings for all storm sewer structures, catch basins, manholes and inlets.

1.5 CONSTRUCTION SAFETY STANDARDS

A. Contractor shall comply with Occupational Safety and Health Administration (OSHA) Excavation and Trenching Safety Standards, 29 CFR, Part 1926.

PART 2 PRODUCTS

2.1 CATCH BASIN, MANHOLES, INLETS & DRAINAGE, STRUCTURES:

A. Comply with IDOT Section 602, and as noted and detailed on the drawings.

2.2 GRATES/FRAMES: As noted on the drawings.

A. Comply with IDOT Specification Sections 602 & 604.

2.3 STORM SEWER PIPING: As noted on drawings subject to the following material specifications:

A. PVC SCH 40 plain end and belled end: ASTM D-1785, D-1784 cell class 12454-B, fittings PVC ASTM D-2665; solvent weld joints ASTM D-2855.

B. PVC SDR 26 gasket joint piping: ASTM D-3034, D-1784 cell class 13364, D-312 gasket bell; elastomeric gasket ASTM F-477.

C. Polyethylene (HDPE or PE) smooth wall & corrugated exterior piping: IDOT Articles 1040.04, AASHTO M-252-Type S (4"-10"), AASHTO M-294, Type S (12"-36") or AASHTO M-294, Type D (42"-48"), with a minimum cell classification of PE 335434 as defined in ASTM D-3350.

D. Reinforced Concrete Pipe (RCP): IDOT Article 1040.06.

E. Corrugated Steel Pipe (CMP): IDOT Article 1006.01.

2.4 SUBSURFACE DRAINAGE, PIPE DRAINS, UNDERDRAINS AND FRENCH DRAINS

A. Comply with IDOT Section 601 and as noted on drawings.

B. Perforated Polyethylene (PE) piping with a smoother interior: IDOT Article 1040.04.

C. Perforated Polyvinyl Chloride (PVC) piping: IDOT Article 1040.03.

D. Geotextile fabric sock: IDOT Article: 1080.

E. Geotextile fabric for French Drains: IDOT Article 1080.05.

F. Aggregate: gradations as shown on plans, IDOT Sections 1003 and 1004.

PART 3 EXECUTION

3.1 INSTALLATION

A. Catch basins, grates, frames and lids: IDOT Section 602 and in accordance with the elevations and details as shown on the plans.

B. Storm sewers and culverts: IDOT Sections 542 and 550 and in accordance with the details, slopes and grades as shown on the plans.

C. Install building downspout collection systems with slopes and grades as shown on drawings. Minimum pipe burial shall be 1'-0" to top of pipe at all areas except for outlets. Place pipes on undisturbed or compacted earth. Install cleanouts as shown on the drawings. Provide fittings and connections as necessary and as shown on the drawings.

D. Subsurface drainage systems, underdrains and French drains: IDOT Section 601, manufacturer's requirements and in accordance with the details, elevations, slopes and grades as shown on the plans.

END 33 41 00

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