



Healthcare

Architecture

Design

Planning

**Montefiore Health System
St. Luke's Cornwall Campus
19 Laurel Avenue
Cornwall, New York 12518**

***Cornwall Transformation Project Phase 3
Welcome Center & Nook Café - Ground Floor
Lab – Second Floor
19 Laurel Avenue – Ground Floor & Second Floor***

Specifications Manual

Manual 1 of 2

PDS Project No.: 20006d

**Issued for Construction and Pricing
September 10, 2021**

Pomarico Design Studio Architecture PLLC
Architect

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Montefiore St. Luke's Cornwall Hospital
70 Dubois Street, Newburgh, NY

Cornwall Transformation Project Phase 3
Welcome Center & Nook Café - Ground Floor
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19 Laurel Avenue, Cornwall, NY – Ground Floor & Second Floor

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**MONTEFIORE ST. LUKE'S CORNWALL HOSPITAL
CORNWALL TRANSFORMATION PROJECT PHASE 3
WELCOME CENTER, NOOK CAFÉ & LAB
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DRAFT AIA[®] Document G701[™] - 2001

Change Order

PROJECT (Name and address):	CHANGE ORDER NUMBER: 001 DATE:	OWNER: ☐
TO CONTRACTOR (Name and address):	ARCHITECT'S PROJECT NUMBER: CONTRACT DATE: CONTRACT FOR: General Construction	ARCHITECT: ☐ CONTRACTOR: ☐ FIELD: ☐ OTHER: ☐

THE CONTRACT IS CHANGED AS FOLLOWS:

(Include, where applicable, any undisputed amount attributable to previously executed Construction Change Directives)

The original Contract Sum was
The net change by previously authorized Change Orders
The Contract Sum prior to this Change Order was
The Contract Sum will be increased by this Change Order in the amount of
The new Contract Sum including this Change Order will be

\$	0.00
\$	0.00
\$	0.00
\$	0.00
\$	0.00

The Contract Time will be increased by Zero (0) days.
The date of Substantial Completion as of the date of this Change Order therefore is

NOTE: This Change Order does not include changes in the Contract Sum, Contract Time or Guaranteed Maximum Price which have been authorized by Construction Change Directive until the cost and time have been agreed upon by both the Owner and Contractor, in which case a Change Order is executed to supersede the Construction Change Directive.

NOT VALID UNTIL SIGNED BY THE ARCHITECT, CONTRACTOR AND OWNER.

ARCHITECT (Firm name)	CONTRACTOR (Firm name)	OWNER (Firm name)
ADDRESS	ADDRESS	ADDRESS
BY (Signature)	BY (Signature)	BY (Signature)
(Typed name)	(Typed name)	(Typed name)
DATE	DATE	DATE

AIA® Document G702™ – 1992

Application and Certificate for Payment

TO OWNER:	PROJECT:	APPLICATION NO:	Distribution to:
			OWNER: ☐
			ARCHITECT: ☐
FROM	VIA	PERIOD TO:	CONTRACTOR: ☐
CONTRACTOR:	ARCHITECT:	CONTRACT FOR: General Construction	FIELD: ☐
		CONTRACT DATE:	
		PROJECT NOS: / /	

CONTRACTOR'S APPLICATION FOR PAYMENT

Application is made for payment, as shown below, in connection with the Contract. Continuation Sheet, AIA Document G703, is attached.

1. ORIGINAL CONTRACT SUM.....	\$0.00
2. NET CHANGE BY CHANGE ORDERS.....	\$0.00
3. CONTRACT SUM TO DATE (Line 1 ± 2)	\$0.00
4. TOTAL COMPLETED & STORED TO DATE (Column G on G703).....	\$0.00
5. RETAINAGE:	
a. 0 % of Completed Work	
(Column D + E on G703: \$0.00)=	\$0.00
b. 0 % of Stored Material	
(Column F on G703: \$0.00)=	\$0.00
Total Retainage (Lines 5a + 5b or Total in Column I of G703).....	\$0.00
6. TOTAL EARNED LESS RETAINAGE.....	\$0.00
(Line 4 Less Line 5 Total)	
7. LESS PREVIOUS CERTIFICATES FOR PAYMENT.....	\$0.00
(Line 6 from prior Certificate)	
8. CURRENT PAYMENT DUE.....	\$0.00
9. BALANCE TO FINISH, INCLUDING RETAINAGE	
(Line 3 less Line 6)	\$0.00

CHANGE ORDER SUMMARY	ADDITIONS	DEDUCTIONS
Total changes approved in previous months by Owner	\$0.00	\$0.00
Total approved this Month	\$0.00	\$0.00
TOTALS	\$0.00	\$0.00
NET CHANGES by Change Order		\$0.00

The undersigned Contractor certifies that to the best of the Contractor's knowledge, information and belief the Work covered by this Application for Payment has been completed in accordance with the Contract Documents, that all amounts have been paid by the Contractor for Work for which previous Certificates for Payment were issued and payments received from the Owner, and that current payment shown herein is now due.

CONTRACTOR:

By:

Date:

State of:

County of:

Subscribed and sworn to before

me this

day of

Notary Public:

My Commission expires:

ARCHITECT'S CERTIFICATE FOR PAYMENT

In accordance with the Contract Documents, based on on-site observations and the data comprising this application, the Architect certifies to the Owner that to the best of the Architect's knowledge, information and belief the Work has progressed as indicated, the quality of the Work is in accordance with the Contract Documents, and the Contractor is entitled to payment of the AMOUNT CERTIFIED.

AMOUNT CERTIFIED..... \$0.00

(Attach explanation if amount certified differs from the amount applied. Initial all figures on this Application and on the Continuation Sheet that are changed to conform with the amount certified.)

ARCHITECT:

By:

Date:

This Certificate is not negotiable. The AMOUNT CERTIFIED is payable only to the Contractor named herein. Issuance, payment and acceptance of payment are without prejudice to any rights of the Owner or Contractor under this Contract.

DRAFT AIA[®] Document G704[™] - 2000

Certificate of Substantial Completion

PROJECT:
(Name and address)

PROJECT NUMBER: /
CONTRACT FOR: General Construction
CONTRACT DATE:

TO OWNER:
(Name and address)

TO CONTRACTOR:
(Name and address)

OWNER: ☐

ARCHITECT: ☐

CONTRACTOR: ☐

FIELD: ☐

OTHER: ☐

PROJECT OR PORTION OF THE PROJECT DESIGNATED FOR PARTIAL OCCUPANCY OR USE SHALL INCLUDE:

The Work performed under this Contract has been reviewed and found, to the Architect's best knowledge, information and belief, to be substantially complete. Substantial Completion is the stage in the progress of the Work when the Work or designated portion is sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work for its intended use. The date of Substantial Completion of the Project or portion designated above is the date of issuance established by this Certificate, which is also the date of commencement of applicable warranties required by the Contract Documents, except as stated below:

Warranty

Date of Commencement

ARCHITECT

BY

DATE OF ISSUANCE

A list of items to be completed or corrected is attached hereto. The failure to include any items on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents. Unless otherwise agreed to in writing, the date of commencement of warranties for items on the attached list will be the date of issuance of the final Certificate of Payment or the date of final payment.

Cost estimate of Work that is incomplete or defective: \$0.00

The Contractor will complete or correct the Work on the list of items attached hereto within Zero (0) days from the above date of Substantial Completion.

CONTRACTOR

BY

DATE

The Owner accepts the Work or designated portion as substantially complete and will assume full possession at _____ (time) on _____ (date).

OWNER

BY

DATE

The responsibilities of the Owner and Contractor for security, maintenance, heat, utilities, damage to the Work and insurance shall be as follows:

(Note: Owner's and Contractor's legal and insurance counsel should determine and review insurance requirements and coverage.)

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Statement of Beneficial Occupancy

Project Name: _____
Project No: _____
Architect/Engineer: _____
General Contractor: _____
Owner: _____

The below described portion of subject project is, to the best of my knowledge and belief,
complete to a point where the user desires to use in accordance with the Contract Documents.

Warranty items covered by Occupancy: _____

Architect/Engineer

Date: _____

General Contractor

Date: _____

Hospital Representative

Date: _____

☐ Open Punchlist

☐ No Punchlist

DRAFT AIA[®] Document G706A[™] – 1994

Contractor's Affidavit of Release of Liens

PROJECT: *(Name and address)*

ARCHITECT'S PROJECT
NUMBER:

CONTRACT FOR: General
Construction

TO OWNER: *(Name and address)*

CONTRACT DATED:

OWNER: ☐

ARCHITECT: ☐

CONTRACTOR: ☐

SURETY: ☐

OTHER: ☐

STATE OF:
COUNTY OF:

The undersigned hereby certifies that to the best of the undersigned's knowledge, information and belief, except as listed below, the Releases or Waivers of Lien attached hereto include the Contractor, all Subcontractors, all suppliers of materials and equipment, and all performers of Work, labor or services who have or may have liens or encumbrances or the right to assert liens or encumbrances against any property of the Owner arising in any manner out of the performance of the Contract referenced above.

EXCEPTIONS:

SUPPORTING DOCUMENTS ATTACHED HERETO:

1. Contractor's Release or Waiver of Liens, conditional upon receipt of final payment.
2. Separate Releases or Waivers of Liens from Subcontractors and material and equipment suppliers, to the extent required by the Owner, accompanied by a list thereof.

CONTRACTOR: *(Name and address)*

BY:

*(Signature of authorized
representative)*

(Printed name and title)

Subscribed and sworn to before me on this date:

Notary Public:

My Commission Expires:

DRAFT AIA® Document G712™ – 1972

Shop Drawing and Sample Record

PROJECT: ARCHITECT PROJECT NO.:

CONTRACTOR:

	DATE REC'D.	SPEC SECTION # SHOP DWG. OR SAMPLE #	TITLE	CONTRACTOR SUBCONTRACTOR TRADE	# REC'D.	REFERRED				ACTION				DATE RET'D.	COPIES TO			
						TO	DATE SENT	# COPIES	DATE RET'D.	APPROVED	APPROVED AS NOTED	REVISE & RESUBMIT	NOT APP'D		CONTRACTOR	OWNER	FIELD	FILE
1																		
2																		
3																		
1																		
2																		
3																		
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SECTION 01 11 00 - SUMMARY OF WORK

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

- A. General Contract Provisions and Sections of this Division 1 apply to Work of this Section.

1.02 DESCRIPTION:

- A. The Work of this Contract includes the Provision of all labor, materials, equipment and services necessary for the completion of the work as required by Contract Documents.
- B. Work includes all required cutting, patching and repairing of existing work scheduled to remain.

1.03 INTERPRETATION:

- A. All information relating to this Contract shall be obtained at the office of the Architect.

Pomarico Design Studio Architecture, PLLC
Michael A. Pomarico, Architect
19 Front Street
Newburgh, New York 12550
845-561-0448

- B. During the course of the work, should any ambiguities or discrepancies be found on the drawings and the Specifications, the Contractor shall apply to the Architect, in writing, with a copy to the Owner, for an interpretation and determination of the intent of the drawings and Specifications. No verbal answer will be given to any inquiries in regard to the meaning of the Drawings and Specifications. No verbal statement regarding the Contract by any person will be authoritative.
- C. Figures and dimensions on all drawings shall be checked by the Contractor, who shall note any discrepancies and shall bring them to the attention of the Architect. The Contractor shall not alter Specifications, Drawings or figures, nor make alterations in or additions to the quantity, character or arrangement of the materials or work whether same shall involve additional expense or not unless same shall be agreed upon first in writing, as provided for by the Contract; this provision, however, shall not abridge in any way the Architect's rights as to the interpretation of the Specifications, Drawings and figures thereon.

1.04 DRAWINGS:

- A. The Drawings included in this Contract are listed on cover or data sheet.
- B. Whenever the words "Drawings" or "Plans" are used in these Specifications, they shall be taken to include all of the Drawings listed. The word "Details" shall mean any details appearing on any Drawing listed.
- C. Any diagram, chart, plan or description or borings or other sub-soil data which may be submitted with the Drawings shall not, because of the well understood difficulties under which such borings and sub-soil exploration are made, be held to be final and conclusive.

1.05 WORK HOURS:

- A. The Work shall be performed during Contractor's normal working hours, except as otherwise approved by the Owner.
- B. No work shall be done on Saturdays, Sundays or legal holidays unless the Contractor shall have given the Owner and Architect at least 48-hours advance notice in writing.

1.06 CONTRACTOR USE OF THE PREMISES:

- A. Contractors shall have a limited use of the premises for storage and work operations, except as restricted by the Owner due to needs of daily operation of facility and habitation. Contractor shall assume all responsibility for the protection and safe-keeping of products stored on the Job Site. Do not load existing and new structures with weights that will endanger the structures.
 - 1. Each Contractor is cautioned that the extent of the proposed Work in relation to the area of the Job Site places strict limitations on the amounts of material and equipment that can be stored on the Job Site at any given time.
 - 2. Contractors are further cautioned that traffic on adjacent roads and drives may place strict limitations on the rates and means of delivery of materials, equipment and supplies, the removal of rubbish, and in some cases, the hours during which deliveries may be made.
 - 3. It shall be the responsibility of each Contractor to inform himself of the limitations on storage space and the limitations of times, rates and means of deliveries to and removals from the Job Site, whether such limitations are imposed by law, ordinances or physical conditions at the Job Site.
 - 4. All arrangements for delivery and storage of materials shall be coordinated by the Contractor. Contractor's material storage shall be confined to storage areas designated by Owner.
- B. Access to the areas of work shall be only via paths as designated by Owner. In the case of materials transport all necessary protection to the existing Hospital shall be provided to prevent any damage.
- C. Existing Operating Systems: It is the intent of the Contract Documents that all operating systems such as heating, ventilating, electric power and lighting shall be maintained in operating condition adequate to serve the needs of the existing building during construction of the altered work. Prior to the start of work on any of these systems, the Contractor shall consult with the Owner to establish a mutually satisfactory schedule for cutover, cut-off or other changes in operation of the systems. All schedules of disruption of services shall be strictly adhered to, except as mutually adjusted by the Contractor and Owner.

1.07 PARTIAL OCCUPANCY:

- A. The Owner reserves the right to place and install equipment and to occupy completed portions of the premises before final acceptance. Such placing of equipment and occupancy of any part or all of the buildings shall not evidence completion of the Work or any portion of it, nor signify Owner's acceptance of the Work or any part of it. Prior to occupancy, the owner will notify the Contractor and obtain approval of occupancy from all insurance companies having policies on the premises or the construction operations.
- B. In addition, the Architect shall make an "Occupancy Punch List" noting all incomplete or unsatisfactory Work at the time of any partial or complete occupancy, so that the Contractor will not be held responsible for Work damaged by Owner's occupancy.
- C. In the event of use and occupancy of the premises by the Owner, or a designated portion thereof, prior to Final Acceptance of the Work, the guarantee period shall commence upon Date of Beneficial Occupancy.

END OF SECTION 01 11 00

**SECTION 01 30 00
ADMINISTRATIVE REQUIREMENTS**

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Progress meetings.
- B. Construction progress schedule.
- C. Coordination drawings.
- D. Submittals for review, information, and project closeout.
- E. Number of copies of submittals.
- F. Submittal procedures.

1.2 RELATED REQUIREMENTS

- A. Document 00 7200 - General Conditions: Dates for applications for payment.
- B. Document 00 7200 - General Conditions: Duties of the Construction Manager.
- C. Document 00 7300 - Supplementary Conditions: Duties of the Construction Manager.
- D. Section 01 7000 - Execution and Closeout Requirements: Additional coordination requirements.
- E. Section 01 7800 - Closeout Submittals: Project record documents.

1.3 PROJECT COORDINATION

- A. Project Coordinators: Construction Manager and Hospital representative.
- B. Cooperate with the Project Coordinators in allocation of mobilization areas of site; for field offices and sheds, for access, traffic, and parking facilities.
- C. During construction, coordinate use of site and facilities through the Project Coordinators.
- D. Comply with Project Coordinator's procedures for intro-project communications; submittals, reports and records, schedules, coordination drawings, and recommendations; and resolution of ambiguities and conflicts.
- E. Comply with instructions of the Project Coordinators for use of temporary utilities and construction facilities.
- F. Coordinate field engineering and layout work under instructions of the Project Coordinators.
- G. Make the following types of submittals to Architect through the Project Coordinators:
 - 1. Requests for interpretation.
 - 2. Request for substitution.
 - 3. Shop drawings, product data, and samples.
 - 4. Test and inspection reports.
 - 5. Manufacturer's instructions and field reports.
 - 6. Applications for payment and change order requests.
 - 7. Progress schedules.
 - 8. Coordination drawings.
 - 9. Closeout submittals.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.1 PROGRESS MEETINGS

- A. Schedule and administer meetings throughout progress of the Work at maximum monthly intervals.

- B. Make arrangements for meetings, prepare agenda with copies for participants, preside at meetings.
- C. Attendance Required: Job superintendent, major Subcontractors and suppliers, Owner, Architect, as appropriate to agenda topics for each meeting.
- D. Agenda:
 - 1. Review minutes of previous meetings.
 - 2. Review of Work progress.
 - 3. Field observations, problems, and decisions.
 - 4. Identification of problems that impede, or will impede, planned progress.
 - 5. Review of submittals schedule and status of submittals.
 - 6. Maintenance of progress schedule.
 - 7. Corrective measures to regain projected schedules.
 - 8. Planned progress during succeeding work period.
 - 9. Maintenance of quality and work standards.
 - 10. Effect of proposed changes on progress schedule and coordination.
 - 11. Other business relating to Work.
- E. Construction Manager to record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.

3.2 CONSTRUCTION PROGRESS SCHEDULE

- A. Within 10 days after date of the Agreement, submit preliminary schedule defining planned operations for the first 60 days of Work, with a general outline for remainder of Work.
- B. If preliminary schedule requires revision after review, submit revised schedule within 10 days.
- C. Within 20 days after review of preliminary schedule, submit draft of proposed complete schedule for review.
 - 1. Include written certification that major contractors have reviewed and accepted proposed schedule.
- D. Within 10 days after joint review, submit complete schedule.
- E. Submit updated schedule with each Application for Payment.

3.3 COORDINATION DRAWINGS

- A. Review drawings prior to submission to Architect. Drawings must bear Construction Manager's stamp and comments.

3.4 SUBMITTALS FOR REVIEW

- A. When the following are specified in individual sections, submit them for review:
 - 1. Product data.
 - 2. Shop drawings.
 - 3. Samples for selection.
 - 4. Samples for verification.
- B. Submit to Architect for review for the limited purpose of checking for conformance with information given and the design concept expressed in the contract documents.
- C. Samples will be reviewed only for aesthetic, color, or finish selection.
- D. After review, provide copies and distribute in accordance with SUBMITTAL PROCEDURES article below and for record documents purposes described in Section 01 7800 - Closeout Submittals.

3.5 SUBMITTALS FOR INFORMATION

- A. When the following are specified in individual sections, submit them for information:
 - 1. Design data.
 - 2. Certificates.

3. Test reports.
 4. Inspection reports.
 5. Manufacturer's instructions.
 6. Manufacturer's field reports.
 7. Other types indicated.
- B. Submit for Architect's knowledge as contract administrator or for Owner. No action will be taken.

3.6 SUBMITTALS FOR PROJECT CLOSEOUT

- A. When the following are specified in individual sections, submit them at project closeout:
1. Project record documents.
 2. Operation and maintenance data.
 3. Warranties.
 4. Bonds.
 5. Other types as indicated.
- B. Submit for Owner's benefit during and after project completion.

3.7 NUMBER OF COPIES OF SUBMITTALS

- A. Documents for Review:
1. Small Size Sheets, Not Larger Than 8-1/2 x 11 inches: Submit the number of copies that Contractor requires, plus two copies that will be retained by Architect.
 2. Larger Sheets, Not Larger Than 36 x 48 inches: Submit the number of opaque reproductions that Contractor requires, plus two copies that will be retained by Architect.
 3. Digital submissions are an approved alternative.
- B. Documents for Information: Submit two copies.
- C. Samples: Submit the number specified in individual specification sections; one of which will be retained by Architect.
1. After review, produce duplicates.
 2. Retained samples will not be returned to Contractor unless specifically so stated.

3.8 SUBMITTAL PROCEDURES

- A. Transmit each submittal with approved form.
- B. Sequentially number the transmittal form. Revise submittals with original number and a sequential alphabetic suffix.
- C. Identify Project, Contractor, Subcontractor or supplier; pertinent drawing and detail number, and specification section number, as appropriate on each copy.
- D. Apply Contractor's stamp, signed or initialed certifying that review, approval, verification of Products required, field dimensions, adjacent construction Work, and coordination of information is in accordance with the requirements of the Work and Contract Documents.
- E. Deliver submittals to Architect at business address.
- F. Schedule submittals to expedite the Project, and coordinate submission of related items.
- G. For each submittal for review, allow 10 days excluding delivery time to and from the Contractor.
- H. Identify variations from Contract Documents and Product or system limitations that may be detrimental to successful performance of the completed Work.
- I. Provide space for Contractor and Architect review stamps.
- J. When revised for resubmission, identify all changes made since previous submission.
- K. Distribute reviewed submittals as appropriate. Instruct parties to promptly report any inability to comply with requirements.
- L. Submittals not requested will not be recognized or processed.

END OF SECTION 01 30 00.

SECTION 01 31 13 - PROJECT COORDINATION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

- A. The General Contract Provisions and Sections of Division 1 apply to Work of this Section.

1.02 DESCRIPTION:

- A. This section pertains to the coordination requirements of the various elements of the work and entities engaged to perform work.

1.03 DRAWINGS FOR MECHANICAL & ELECTRICAL WORK:

- A. Drawings are diagrammatic and indicate general arrangement of systems and other work.
- B. Prior to installation of material and equipment, review Architectural Drawings for exact locations and where not definitely indicated, request information from Architect.
- C. Check Drawings of other trades to verify spaces in which work will be installed.
- D. Maintain maximum headroom at all locations.
- E. Make reasonable modifications in layout needed to prevent conflict with work of other trades and to maintain architectural locations of exposed devices and equipment.

1.04 PRIORITY OF CONSTRUCTION SPACE:

- A. Following is the order of priority for construction space:
 - 1. First: Heating, Ventilating and Air Conditioning Work.
 - 2. Second: Plumbing, sprinkling and drainage work.
 - 3. Third: Electrical work.

1.05 COORDINATION DRAWINGS:

- A. The HVAC Contractor shall prepare a complete set of AutoCAD type background Drawings at scale of 1/4" equals 1'-0". Final drawings to be provided to Hospital at time of project commissioning.
- B. Each specialty trade listed below shall prepare a coordination overlay indicating his work, with appropriate elevations and grid dimensions.
- C. Each specialty trade shall sign and date the coordination drawing after the addition of his information.

- D. Where conflicts occur with placement of materials of various trades, the ductwork Contractor will be responsible to coordinate the available space to accommodate all trades. The Contractor will schedule and conduct meetings where this coordination will be reviewed; when required the ductwork contractor will prepare additional details and/or overlays of specific conflict areas.
- E. Fabrication shall not start until receipt of completed Coordination Drawings is acknowledged by the Contractor in writing to the Architect and copy of the drawings received by the Architect.
- F. Specialty Trades:
 - 1. Plumbing Systems.
 - 2. HVAC Piping Systems.
 - 3. Electrical.
 - 4. Sheet Metal Work.
 - 5. Sprinkling System.
 - 6. Ceiling Work.
- G. Coordination Drawings required for all corridors, horizontal exits from duct shafts, crossovers and any other areas where congestion of work may occur.
- H. Where conflicts occur with placement of materials of various trades, other than the ductwork Contractor, those Contractors involved will be responsible to coordinate the available space to accommodate the trades. When required, these Contractors will prepare additional details and/or overlays of specific conflict areas.

END OF SECTION 01 31 13

SECTION 01 32 00 - CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

- A. General Contract Provisions and Sections of this Division 1 apply to work of this Section.

1.02 DESCRIPTION:

- A. This Section pertains to the provisions for construction scheduling and phasing required for the complete duration of the Project.

1.03 BASIC REQUIREMENTS:

- A. Time is of the essence in the performance of this Contract in that the efficient and continuous operation of the Owner's facilities is mandatory.
- B. The Contractor shall perform actual construction work required by this Contract in accordance with the Construction Schedule in such a manner as to not interfere with or delay the Work required.

1.04 SUBMITTALS:

- A. The Contractor shall submit a bar graph schedule for the new construction work, showing the major elements of the Work, within fifteen (15) calendar days after the Notice to Proceed.
- B. Each month after initial approval of Construction Schedule, submit updated schedules as required, accurately depicting progress to first day of each month. Update schedules shall be submitted with monthly requests for payment as required.

1.05 CONSTRUCTION SCHEDULING:

- A. It is the intent that all operating systems such as heating, ventilating, electric power and lighting shall be maintained in operating condition adequate to serve the needs of the existing building during alterations and construction of the new work. Prior to the start of work on any of these systems, the Contractor shall consult with the Owner to establish a mutually satisfactory schedule for cutover, cutoff, and other changes in operation of the system. When established, such schedules shall be adhered to, except as mutually adjusted by the Contractor and the Owner.
- B. All shutdowns of utilities and drilling operations of all types shall be scheduled with Owner at least seven (7) days in advance.
- C. For any areas required to be vacated by Owner for the Work to be performed under this Contract, Contractor shall submit a notification no less than seven (7) days prior to the time such areas are required for construction operations. The notifications shall indicate the length of time the area will be unavailable for the Owner's use, and the work shall not proceed until the Owner approves the proposed length of time.

END OF SECTION 01 32 00

SECTION 01 33 00 – SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

General Contract Provisions and Sections of this Division 1 apply to work of this Section.

1.02 REQUIREMENTS:

A. Substitutions:

1. The materials, products and equipment described in the Contract Documents establish a standard of required function, dimension, appearance and quality to be met by any proposed substitution. Substitutions will be considered if a request is submitted to the Architect and Owner for approval.
2. Each such request shall include:
 - a) The name of the material or equipment for which it is to be substituted and a complete description of the proposed substitute, including Drawings, cuts, performance and test data and any other information necessary for an evaluation.
 - b) A statement setting forth any changes in other materials, equipment or other work that incorporation of the substitute would require shall be included. The burden of proof of the merit of the proposed substitute is upon the proposer.
3. The Architect's decision of approval or disapproval of a proposed substitution shall be final. If the Architect approves any proposed substitution, such approval will be set forth in writing. Redesign will be allowed only with Architect's written approval.
4. If any of the following conditions occur due to substitutions, the Contractor making the substitutions shall bear the cost of such conditions, including payment for services rendered by the Architect.

B. Schedule of Submittals:

1. Contractor shall make it a requirement of all subcontractors that within ten (10) days after notice from the Contractor to the subcontractor to proceed with work, subcontractor shall submit a complete schedule for submission of shop drawings and other submittals as stipulated on the Contractor Documents and as required for execution of all work.
2. Such schedule shall indicate dates when submittals will be given to Contractor for checking and forwarding to Architect and/or Engineers for their action.
3. Contractor shall be responsible for strict adherence to schedule unless written notice is given to Architect and Owner of request for variance from schedule and accepted.
4. Submittals shall be submitted by the Contractor each with a transmittal letter made out

in triplicate. Submittals shall make reference to the project name and applicable Drawing number and Project Specifications Section number to which it applies. The Contractor shall check submittals for accuracy, completeness, dimensions, clearances, connections, accessibility, servicing, maintenance and compliance with the Contract Document requirements, including all changes by Addenda, Change Orders, and/or other trades involved and the coordinated Drawings of related trades assembled into groups before submission. Verify all field measurements and conditions prior to submission. The Architect will not review submittals which do not comply with these requirements.

- C. Each Submittal shall be certified by the Contractor with the following rubber stamp (or similar technique) which shall be provided by the Contractor.

"I confirm that the Contract Document requirements have been met and all dimensions, conditions and quantities are verified as shown and/or corrected on this submittal; that the submittal is in sufficient detail to serve their intended purpose; that the submittal will not cause conflict with other trades; and that all previous applicable changes made in the Project by Change Orders or other directives have been properly shown on each submittal affected".

- D. Deviations from Contract Documents shall be clearly marked in a conspicuous manner, indicated component and system variations, additions and deletions, revised equipment locations, construction detail variations, substitutions and similar changes or deviations from the contract documents which are not brought to the attention of the Architect in this manner shall be the sole responsibility of the Contractor even though such submittal has been accepted.
- E. Timing: Submittals shall be in an orderly sequence in accordance with the schedule of submittals and shall be "sufficiently" in advance of construction requirements to allow "ample" time for checking, resubmitting and rechecking until accepted. The Architect will check submissions with reasonable promptness, but not less than ten (10) working days shall be allowed for review of any one submission from actual date submission is received at the Architect's office. Submittals which are not approved and are returned for resubmission shall be resubmitted within ten (10) days of receipt of disapproved Shop Drawings.
- F. Architect's review shall not be construed as a complete check, BUT WILL INDICATE ONLY THAT THE GENERAL METHOD OF CONSTRUCTION and detailing is satisfactory and that errors and discrepancies observed when reviewed have been noted.
- G. Acceptance of a separate item shall not be interpreted as acceptance of assembly in which the item functions. The right is reserved by the Architect to require submission of detail, shop erection or setting drawings and of any schedules for any part of the Work, whether or not specifically mentioned in Specifications Sections where substitutions or modifications are proposed by the Contractor or where such information is essential to proper assembly, coordination or execution of the Work under the Contract.

1.03 SHOP DRAWINGS:

- A. General: Shop drawings submissions for architectural structural, mechanical and electrical work shall consist of one (1) reproducible transparency and six (6) prints. After the architect's review, the transparency and one (1) print will be returned to the Contractor with the Architect's review comments and corrections. If, in the event the first submission is rejected, all resubmissions shall be repeated as above until the submission is acceptable. Additional reproducible transparencies and prints shall be submitted for ductwork and piping work and of the sprinkler, plumbing and steam fitting trades as the contractor may require for coordination of the work of these trades.
- B. The term "BY OTHERS" shall not be used on shop drawings. If referring to the Owner, or another Contractor is necessary for clarity, the name or function of individual, firm or organization that is to furnish or install related items shall be stated.
- C. Contractor's Responsibilities: The Architect's review and acceptance shall not relieve the Contractor from responsibility for error in shop drawings or for proper coordination and assembly of materials and equipment with other work; nor from the responsibility of furnishing materials and labor not indicated on the shop drawings, but required by the Contract Documents for completion of the Work.
- D. Shop drawings submittals for mechanical and electrical work shall show dimensions, operating and maintenance clearances and engineering data to indicate compliance with Contract Documents. Each piece of equipment shall be identified on Drawings. Shop drawings shall not be reproductions of Architect's and/or Engineer's Contract Drawings, but drawings prepared at a scale large enough to be clearly read and interpreted. Layout shall show clearances of piping, ducts, etc. in relation to elements of the projects.

1.04 TEST REPORTS, PRODUCT DATA AND SAMPLES:

- A. Catalog cuts, brochures, performance charts, test reports, diagrams, specifications, and other standard printed or published data, shall not be less than seven (7) copies each unless stated otherwise in these Specifications. Submittals shall show scaled details sizes, dimensions, performance characteristics, capacities, wiring diagrams and controls, and other pertinent information. Upon receipt, the Architect will mark corrections, stamp copies, and return those additional copies to the Contractor. If re-submittal is necessary, repeat process until acceptance has been obtained.
- B. Samples: Physical examples to illustrate actual materials, equipment or workmanship, ranges of color and pattern, and to establish standards, quality or grade by which completed Work is judged and shall be sufficient size to clearly illustrate the materials. Each example shall have a label indicating the materials. Each example shall have a label indicating the material is intended. The transmittal from may be submitted separately. Each transmittal shall list each sample by name, installer, and location in the Project.
 - 1. Submit samples in triplicate (3) unless otherwise indicated.
 - 2. Samples shall only be reviewed by the Architect for color design, grain, pattern, texture, or other similar visual factors. Compliance with other requirements is the exclusive responsibility of the Contractor.

3. The completed Work shall match, or be within the range of the samples in all respects.
- C. After a sample is accepted, no additional sample of the material will be considered and no change in brand or make will be permitted except in those cases where it can be proven that the delivery cannot be made of material previously accepted. The Contractor shall furnish such proof, as the Architect may require, to support requests for proposed substitutions. Failure of any material to pass testing will be sufficient cause for refusal to consider, under this Contract, any further samples of the same brand or make of that material.
- D. Test samples, as the architect may deem necessary, will be procured from the various materials or equipment delivered by the Contractor for use in the Work. If any of these samples fail to meet the Specification requirements, previous acceptance of the materials or equipment will be withdrawn and such materials or equipment shall be subject to the removal and replacement with material and equipment meeting these specifications. The costs of the test will be borne by the Owner except where specified otherwise in the Project Specifications.
- E. Manufacturer's Data for equipment shall include materials, type, performance characteristics, voltage, phase, capacity, and similar data. Provide wiring diagrams when applicable. Submittals indicating catalog, model, and serial numbers representing specified equipment will be assumed to comply with the contract Documents in all respects.

1.05 ARCHITECTS REVIEW REQUIREMENTS

- A. After Architect's review, each submission will be returned to the Contractor stamped:
 1. No exceptions taken.
 - a. No corrections or resubmission is required and fabrication may proceed.
 2. Exceptions as noted.
 - a. If contractor complies with noted corrections, fabrication may proceed. Submit corrected prints for final review.
 - b. If for any reason the contractor cannot comply with the noted corrections, fabrication shall not proceed and the contractor shall re-submit.
 3. Revise and resubmit.
 - a. Contractor shall review, correct and re-submit for review. Fabrication may not proceed.
 4. Rejected.
 - a. Contractor shall review comments and re-submit. Fabrication may not proceed.

END OF SECTION 01 33 00

SECTION 01 50 00 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

- A. General contract provisions and Sections of this Division 1 apply to work of this Section.

1.02 DESCRIPTION:

- A. This Section pertains to the provisions, maintaining, and removal of the temporary construction and facilities and similar related work.

1.03 TEMPORARY HOISTWAYS, SCAFFOLDS AND LADDERS:

- A. Furnish and securely set scaffolding required for all work. All scaffolding shall be good, sound materials, of adequate dimensions for its intended use and substantially braced and tied absolute safely for those required to use it.
- B. Provide all temporary ladders required for the Work. Ladders shall comply with all Labor Law requirements.

1.04 TEMPORARY PARTITIONS:

- A. Provide temporary dust-tight partitions or barricades as directed, to enclose portions of the building where existing work is to be removed. Enclosures shall be installed around all cutting operations such as floors, walls, or ceilings to prevent dust from spreading. Where holes are cut in ceiling or roof, the underside shall be dustproofed to catch and debris and dust which may result from these operations and to protect personnel from damage or injuries.
- B. Temporary dust-tight partitions shall be substantially constructed to Owner's satisfaction. Joints in the partitions, including joints at walls, floor and ceiling, shall be sealed dustproof with 1 1/2" wide pressure sensitive tape. Provide dust-tight doors of similar construction where necessary, including hinges and a first quality padlock and hasp on each door.
- C. Temporary partitions shall be relocated as necessitate by the Work and shall be removed only when directed by the Owner. Patch and repair any damage resulting from temporary work.

1.05 POSTERS AND SIGNS ON SHEDS OR BUILDINGS:

- A. No poster, advertising billboard or signs of any nature shall be placed on any part of any post, fence, bridge, railings, shed, existing and new building or structures of any kind about the premises, except such as may be necessary in connection with the Work under this Contract to identify the Contractor and his work, and approved by the hospital.

1.06 "NO-SMOKING" SIGNS:

- A. Signs with the words "No Smoking" painted or stenciled thereon, with letters 2 inches high, shall be furnished and hung in conspicuous places as directed, and kept in position until the completion of all work. No less than four (4) shall be provided.

1.07 EXITWAYS:

- A. Maintain all exits as required by prevailing codes throughout the construction period.

1.08 TEMPORARY IDENTIFICATION CARD AND USE OF HOSPITAL FACILITIES:

- A. Hospital will issue each workman a temporary identification card which is to be worn at all times. Workmen are to confine their presence to areas of construction and approved arteries to such areas only.
- B. On-site parking for use of the Contractor, his Contractors and subcontractors may be available but only where and as authorized by the Hospital. Use of other hospital facilities shall be fully coordinated with the hospital. Use of authorized facilities of any type or kind is strictly forbidden.

1.09 REMOVAL OF RUBBISH:

- A. The Contractor shall be responsible at all times to keep the building, premises and surroundings walks and streets clean and free from rubbish and discarded or surplus materials; and shall provide suitable receptacles of adequate size and number, in handy locations about the premises to receive his own rubbish and discarded or surplus materials and also that of his various Contractors, and shall direct his Contractors, to deposits their rubbish and surplus materials in the receptacles provided for this purposes, or in orderly piles of locations as he may designate; also he shall provide all labor required to remove said rubbish and discarded or surplus materials from the various floors and yards, and shall cart it from the premises. (1)
- B. Should the Contractor fail to keep the building, premises and surrounding roadways and walks shovel clean and free from rubbish at all times, then the Owner shall employ such parties as he pleases, in the open market, to remove the rubbish and shall withhold from any payment due the Contractor such sums as may be required to pay for the removal of the rubbish or materials, and such sums shall be deducted from the amount of the Contract.

END OF SECTION 01 50 00

**SECTION 01 51 01
TEMPORARY UTILITIES**

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Temporary Utilities: Electricity, lighting, heat, ventilation, and water.

1.2 TEMPORARY ELECTRICITY

- A. Cost: By Hospital.
- B. Provide power service required from utility source to be determined as provided by Hospital.
- C. Provide power outlets for construction operations, with branch wiring and distribution boxes located at each floor. Provide flexible power cords as required.
- D. Provide main service disconnect and over-current protection at convenient location and meter.
- E. Permanent convenience receptacles may be utilized during construction.
- F. Provide adequate distribution equipment, wiring, and outlets to provide single phase branch circuits for power and lighting.

1.3 TEMPORARY LIGHTING FOR CONSTRUCTION PURPOSES

- A. Provide and maintain lighting for construction operations to achieve a minimum lighting level of 2 watt/sq ft .
- B. Provide branch wiring from power source to distribution boxes with lighting conductors, pigtails, and lamps as required.
- C. Maintain lighting and provide routine repairs.

1.4 TEMPORARY HEATING

- A. Cost of Energy: By Hospital.
- B. Provide heating devices and heat as needed to maintain specified conditions for construction operations.
- C. Maintain minimum ambient temperature of 50 degrees F in areas where construction is in progress, unless indicated otherwise in specifications.

1.5 TEMPORARY COOLING

- A. Provide cooling devices and cooling as needed to maintain specified conditions for construction operations.
- B. Maintain maximum ambient temperature of 80 degrees F in areas where construction is in progress, unless indicated otherwise in specifications.

1.6 TEMPORARY VENTILATION

- A. Existing ventilation equipment may not be used, provide temporary fans & ventilation devices with pre-filters.

1.7 TEMPORARY WATER SERVICE

- A. Cost of Water Used: Provided by Hospital, point of connection to be determined.
- B. Provide and maintain suitable quality water service for construction operations at time of project mobilization.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION 01 51 01.

**SECTION 01 56 00 – CONSTRUCTION AND RENOVATION PLAN, INFECTION CONTROL, AND
INTERIM LIFE SAFETY MEASURES**

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

- A. General Contract Provisions and Sections of this Division 1 apply to work of this Section.

1.02 DESCRIPTION:

- A. This Section pertains to provisions related to the implementation of the Hospital Construction and Renovation Plan (CRP), including implementation of Infection Control and Interim Life Safety Measures. Continual health care facility upgrade through renovation and new construction involving existing facilities can create conditions that can be hazardous to patients. This specification addresses requirements specifically designed to protect the health, safety and welfare of patients during any renovations or new construction.
- B. Related items required for compliance include Hospital provided CRP, ILSM, and ICRA forms and requirements, Construction Phasing and Barrier Plan, and Code Conformance Plan.
- C. Common abbreviations:

CRP	Construction and Renovation Plan
ICRA	Infection Control Risk Assessment
ILSM	Interim Life Safety Measures
IC	Infection Control
OSHA	Occupational Safety and Health Administration
FAI	Fresh Air Intake
AHJ	Authority having jurisdiction
TBC	Total Building Commissioning
MSDS	Manufacturer Safety Data Sheet

1.03 GENERAL:

- A. Contractor shall upon award of the contract appoint a designated representative to act in conjunction with the design team, and designated Hospital personnel in the review of the CRP.
- B. Review shall include Risk Assessment and Interim Life Safety Measures. Contractor shall upon completion of review and approval of measures complete and sign the Infection Control Construction Permit.
- C. Contractor shall review and verify completion of ICRA Checklist and ILSM Prescriptive Requirements.
- D. Contractor shall coordinate the phasing and schedule of the work with the CRP, including submission of all proposed shut down/turn over dates.
- E. Contractor shall follow Division 1 requirements for submittals of all materials required for construction of temporary barriers, devices, alarms, etc.
- F. All CRP work shall conform to the basic materials and methods specified under Division 15 - MECHANICAL and Division 16 - ELECTRICAL, unless otherwise permitted by Code

- G. Contractor shall strictly adhere to the CRP specifications and plan.

2.01 DESIGN AND PRE-CONSTRUCTION PHASE:

- A. Perform thorough review of CPR requirements and advise Architect on proposed methods of compliance.
- B. Provide written conformation to architect and Hospital that Contractor and Sub-Contractors are aware of sensitive patient population locations.
- C. Mechanical Contractor shall review work scope with General Contractor to fully review the scope of the mechanical contract and determine prior to CRP acceptance, the ability for the HVAC system to conform to the infection control requirements.
- D. Submit a Bar-Chart schedule incorporating all proposed dates for shutdowns and start up of new equipment.
- E. Progression to the Demolition or Construction Phase by the General Contractor shall be interpreted as the Contractor to have reviewed and understood the CRP requirements and acceptance to abide by their requirements.
- F. Contractor shall review and complete the Short Form checklist for the risk assessment and submit a completed copy to the Architect in conjunction with completion of the Risk Assessment.

2.02 DEMOLITION AND REMOVALS PHASE:

- A. Review, comment on and implement pre-construction phase requirements.
- B. Establish, in conjunction with Hospital representative, flow routes for debris, staging area for dumpsters, and verify no conflict with FAI locations. Designate Elevator usage if required.
- C. Worksite garb shall conform to specified requirements of the ICRA. Utilize either HEPA vacuum, or jump suite procedures.
- D. Install construction safety signs, and patient detour signs if required for alternate route around construction area.
- E. Post the CRP at the entrance to the construction area. Contractor shall obtain copy of the completed ICRA/ILSM CRP from the Architect.
- F. Confirm that all transport carts are sealed for transport. Under no circumstances shall transport carts be overloaded or discharging dust or debris into the Hospital environment. If chutes are used, measures shall be taken to prevent cycling of dust and debris into the controlled environment.
- G. Properly secure the construction environment as prescribed by the ICRA/ILSM requirements. Install Barrier System prescribed, in accordance with these specifications.
- H. Install monitoring devices and negative air machines as may be required, perform visual monitoring for signs of non-compliance, in addition to electronic monitoring.
- I. Confirm that Hospital has and properly disposed of all Biohazard and Sharps containers.
- J. Bag all filters prior to removal.
- K. Determine airflow for construction area HVAC system, filter all re-circulation intakes and change filters regularly. Airflow must be maintained from clean to dirty areas.
- L. When required, maintain negative air pressure and monitor with alarm system. Refer to Risk Assessment for negative air determination. Furnish and install negative air machine(s), so as to meet the requirements of the Hospitals risk assessment, or as directed by the architect.
- M. Maintain exhaust air from construction environment with no re-circulation if possible. Re-circulated air shall pass through 95% HEPA filters.

- N. Mechanical Contractor shall shut down system prior to opening ductwork and interrupting normal system function.
- O. Seal all penetrations into adjacent areas and ceiling plenums prior to and during the duration of the phase.
- P. Monitor drilling and core bore activities and vacuum/flush disturbed areas or systems on completion. Under no circumstances shall core bore activities commence prior to pre-approval by Hospital.
- Q. Monitor relative humidity and maintain within specified tolerances, as specified by Mechanical Engineer or Hospital Engineering.
- R. Maintain cleaning procedures, including mopping, walk-off mats, etc. Coordinate Hospital and Contractor cleaning procedures.
- S. Schedule meetings as required with Hospital IC personnel, and design professional to ensure conformance with the CRP.

2.03 ROUGH-IN, FRAME AND ROUGH FINISH PHASE:

- A. Follow Demolition and Removal phase requirements.
- B. Provide continued maintenance construction environment as prescribed by the ICRA/ILSM requirements.
- C. Monitor airflow for construction area HVAC system, filter all re-circulation intakes and change filters regularly. Airflow must be maintained from clean to dirty areas.
- D. Test and Maintain monitoring devices.
- E. Monitor signage placement modify sign placement as may be required by phasing and project progression.

2.04 FINISH PHASE:

- A. Follow Rough in, Frame and Rough Finish Phase requirements.
- B. Monitor construction environment as prescribed by the ICRA/ILSM requirements as new HVAC systems are brought online.
- C. Monitor airflow for construction area HVAC system. Airflow must be maintained from clean to dirty areas. Check air balance of new systems as they are brought online, including potential impact to patient care areas outside the construction environment.
- D. Confirm that all penetrations into adjacent areas and ceiling plenums are sealed completely.
- E. Maintain cleaning procedures, including mopping, walk-off mats, etc. Coordinate Hospital and Contractor cleaning procedures. Coordinate final cleaning activities with Hospital environmental services.

2.05 COMMISSIONING PHASE:

- A. An independent agent, hired by the General Contractor, to monitor the work of the sub-contractors, shall perform commissioning testing.
- B. The design engineer of record shall review documents provided by the contractor concerning commissioning/quality control inspections. These inspections shall be that of a TBC (Total Building Commissioning) approach.
- C. TBC approach shall ensure that all components of the design (not just HVAC shall function according to the design intent, specifications, equipment manufacturers data sheets and operational criteria. Refer to MEP Plans and Specifications.

- D. Refer to Construction Contract Documents and Specifications for TBC requirements for each trade as follows:
 - a. HVAC
 - b. Plumbing
 - c. Electrical
 - d. Emergency Power
 - e. Fire Protection and Suppression Systems
 - f. Telecommunications and Networks
 - g. Nurse Call Systems
 - h. Medical Gas Systems
 - i. Intrusion and Alarm or Monitoring Systems
 - j. Specialty Equipment used to deliver Medical Gas, Power, Etc. including Central Processing Equipment, Diagnostic and Treatment Equipment, and other Patient Care Delivery Equipment.
 - k. HVAC commissioning shall conform to the requirements of ASHRAE Guideline 1-1996.
- E. Complete architects final inspection checklist items prior to scheduling final inspections with AHJ.
- F. Certification shall be provided to Hospital ensuring closure and seal of all penetrations through rated assemblies, smoke barriers, etc.
- G. Contractor shall complete final cleaning. Hospital to complete terminal cleaning and decontamination.
- H. Verify installation of and functionality of all paper towel and soap dispensers, functional sinks, etc. If partial occupancy, quantities of functional sinks shall number minimum standards, as directed by architect or Hospital staff. Confirm that alcohol rub dispensers are not located above or adjacent to electrical receptacles or devices.
- I. Hospital Medical, Nursing, and IC staff shall perform final walk-thru inspection and provide approval for occupancy by patients. This walk-thru shall be performed prior to acceptance of project by Hospital, and prior to final inspection by AHJ.

2.06 UTILITY SHUTDOWNS:

- A. Interruption of primary utilities may compromise infection control measures. Construction plans shall take into account utility shut downs, which must be coordinated with Hospital engineering.
- B. Additional precautions related to shut downs must be monitored to prevent the inadvertent release of air or water borne pathogens. In the event that it is determined that the shut down may compromise Hospital services, appropriate flushing of water systems or air change durations shall be performed as specified by the design engineer.
- C. Unscheduled and/or unapproved utility shut downs shall conform to the same control measures as those that are scheduled. In the event that utility services are contaminated, suspected contaminated, or Hospital IC determines precautionary measures be implemented, such precautions and rectification services shall be provided by the contractor, at the contractor's expense. The contractor must perform precautionary protective measures until such time that the Hospital IC team determines there is no negative impact potential to patients or hospital staff.

3.01 INTERIM LIFE SAFETY MEASURES:

- A. The attached “**DAILY ILSM SAFETY INSPECTION FORM**”, as provided by the Hospital, presents a typical model for interim life safety measures conformance.
- B. The design professional and authorized hospital staff shall perform review of the proposed alteration area during the pre-construction phase of the project. This review shall be performed in conjunction with and in follow up to the ICRA, thus allowing the ILSM to be responsive to the needs of the infection control precautions. Additionally, the ILSM will be reviewed in relation to the proposed construction-phasing plan.
- C. Integration of the ICRA, Construction Phasing plan methods will provide a coordinated assessment of the ILSM requirements for the proposed alteration area. The pre-construction prescriptive ILSM checklist will provide guidance for daily review of the ILSM measures, to be performed by not only hospital personnel, but also the design professionals and construction personnel.
- D. Throughout the course of the alteration project, the prescriptive checklist shall be periodically updated to allow for changes in the status of the work as it progresses. This shall be considered a living document that will evolve through the course of the project as various life safety systems and the construction process impacts components.
- E. Records of the checklist shall be maintained for review by authorities having jurisdiction over the project.
- F. Non-performance by the General or Sub-contractors in regard to the requirements of the ILSM shall be subject to the conditions of the Field Controls.

4.01 FIELD CONTROLS:

- A. Field controls are obviously an essential component of the CRP. The construction/renovation process is the logical point where planning related to the ICRA and CRP will breakdown. It is at this phase of the process where a multitude of predictable and unforeseen forces will be applied to the project, which will ultimately determine the success of the CRP. At this point in the process, the general and sub-contractors, material suppliers, hospital engineering staff and many other individuals will interface with the daily goings on of the project. Monitoring and control of the actions of these individuals will ensure appropriate protection to patients, staff and construction personnel themselves.
- B. Pre-construction meetings shall be held allowing key players in the control process to provide education to and identify requirements of the CRP to individuals responsible for management of construction forces. Periodic conformance checks, spot checks, etc, shall be logged to create a written documentation record.
- C. Enforcement measures shall also be utilized to ensure conformance. Non-compliance shall be assessed concerning violations of the CRP requirements. Contractor(s) shall be allowed a grace period concerning violations of the CRP. All violations logged after three warnings shall be assessed at the rate equivalent to costs incurred by the hospital to provide remediation to correct non-compliant conditions. These violation records shall be maintained by the Hospital and reviewed periodically to determine the necessity of disapproving a contractor or sub-contractor from performing work within the Hospital where that individual or organization consistently compromises the health, safety and welfare of patients and staff.
- D. Incorporation of the CRP Specifications, ICRA and ILSM into the Construction Contract Documents shall be considered a legal binding obligation upon the contractor through the Division One requirements of the Contract. This contractual obligation shall also allow the Hospital to obligate the General Contractor to include the ICRA provisions within their bonding umbrella for the project, ensuring conformance, in the event of lack of performance on the part of the contractor.

PART 2 - PRODUCTS

2.01 BARRIER CONSTRUCTION AND PROTECTIVE SYSTEMS:

- A. Temporary barriers and protective systems shall be constructed of membranes capable of rapid construction and removal. Systems shall allow enclosure of local work environments with minimal disruption to the occupied space.
 - a. Provide Products as manufactured by the following, or equal.
 - i. Zip Wall as manuf. by Abatement Technologies, Inc.
 - ii. Kontrol Kube, as manuf. by Fiberlock Technologies, Inc.
 - b. Provide field fabricated enclosure systems.

2.02 HEPA VACUUM CLEANERS:

- A. Provide HEPA filter units and air scrubbers, negative air machines as required by CRP.
 - a. Provide products as manufactured by the following, or equal.
 - i. Abatement Technologies, Inc.

2.03 HEPA FILTER UNITS:

- A. Provide HEPA filter units and air scrubbers, negative air machines as required by CRP.
 - a. Provide products as manufactured by the following, or equal.
 - i. Abatement Technologies, Inc.
 - ii. Grainger Equipment.
 - iii. American Air Filter

2.04 EXHAUST FANS:

- A. Provide exhaust fans as required by CRP.
 - a. Provide products as manufactured by the following, or equal.
 - i. International Decontamination Technology.
 - ii. Abatement Technologies, Inc.

2.05 PRESSURE ALARMS AND SENSORS:

- A. Provide pressure alarms and sensors as required by CRP.
 - a. Provide products as manufactured by the following, or equal.
 - i. Dwyer Instrument, Inc.
 - ii. Biological Controls.
 - iii. TSI Inc. industrial Test Instruments.

2.06 WORKSITE GARB:

- A. Provide all Precaution 3 and 4 areas with ample supply of white cover suits and booties as may be required by ICRA.

- a. Provide products as distributed by Grainger, or approved equal.

PART 3 - EXECUTION

3.01 BARRIER CONSTRUCTION AND PROTECTIVE SYSTEMS:

- A. Isolate area as required by construction and phasing plans.
- B. Small short duration projects generating minimal dust may use demountable barriers. Use either prefabricated enclosures or field construct using fire-rated plastic sheeting. Lap all entry points with full flaps overlapping a minimum of 2'-0".
- C. Projects that produce moderate to high levels of dust shall be protected with full height fire rated enclosures, constructed of metal stud and drywall. Protection shall extend from structural slab, to structural slab. Caulk all seams to create as airtight a seal as possible. Do not terminate at underside of ceiling assemblies.
- D. All Class 4 precaution areas shall be provided with an anteroom through which all personnel, materials, and equipment shall pass prior to entry into the construction enclosure. Entry vestibule shall have a gasket-sealed door and shall be self-closing and positive latching.
- E. Provide interim plastic barriers when constructing barrier walls and vestibules.
- F. Clean entire area on completion of protective barrier construction, and remove debris in approved manner.

3.02 HEPA VACUUM CLEANERS:

- A. When required by ICRA, provide HEPA vacuum in vestibule areas of Precaution 4 alteration projects. Provide HEPA vacuum in Precaution 3 areas as may be required by scope of work.
- B. All workmen, transport devices, etc. shall be HEPA vacuumed thoroughly to remove any loose dust or debris prior to leaving construction area.
- C. Change HEPA filters as required by manuf. recommendations. Bag all filters prior to removal from construction environment.

3.02 HEPA FILTRATION, EXHAUST FANS AND PRESSURE ALARMS/SENSORS:

- A. Consult with the Mechanical Design Engineer of record prior to performing demolition or modifications to existing HVAC systems.
- B. Install filters on existing systems as required by ICRA, and as directed by engineer.
- C. Air pressure within the construction area must be negative to surrounding areas. Install exhaust fans, or negative air machines or HEPA air scrubbers as required, based upon project specific requirements.
- D. Monitor the constant negative pressure within the construction environment with an alarmed device, which shall be maintained and monitored by the HVAC contractor. Provide testing of device as required by Hospital, to demonstrate operational status.
- E. Maintain ability to provide redundant equipment, should failure occur during critical construction or dust generating activities, or during off hours.
- F. Coordinate alarm monitoring process with Hospital Engineering representative to determine off-hours access to space and response arrangements.
- G. HVAC contractor shall locate exhaust points remote from operational windows and FAI's of the existing facility, and away from pedestrian traffic patterns.

3.03 WORKSITE GARB:

- A. Contractor personnel shall closely monitor the status of their clothing as they move between the clean environment and the construction area.
- B. When working within the construction environment, or within barriers, contractor personnel shall wear the specified protective apparel. When working in areas indicated in the ICRA to be highly sensitive, personnel shall be required to wear not only disposable jump suits, but also shoe and head covers.
- C. When working in Class 1 and 2 and possibly 3 Precaution areas, in lieu of wearing protective apparel, construction personnel may elect to construct a vestibule where they can HEPA vacuum their clothing prior to exit into the Hospital environment.
- D. Additional protective devices, including Hard Hats, Face Shields, Masks, Respirators, Gloves, etc. shall be provided as required by the work in progress, and as required by OSHA, or as directed by MSDS (which shall be posted in the construction environment).
- E. Protective Clothing shall be removed and discarded prior to leaving the construction environment. Provide waste receptacle at point of entry/exit to construction area.
- F. When construction personnel are required to pass through restricted corridors, sub-sterile areas, sterile areas, etc. they shall wear protective apparel, including jump suit, shoe covers, head cover. This apparel shall be removed upon entry into the construction environment vestibule. On leaving the construction environment post work, all clothing shall be vacuumed with a HEPA vacuum, protective apparel worn, and exit through the restricted area can then take place.

3.04 WORKSITE GENERAL PROCEEDURES:

- A. Contractor and sub-contractors shall be fully aware of the implications and requirements of the CRP. When in doubt, they shall contact the IC personnel, Hospital representative, or design professional with questions.
- B. Construction personnel shall always look for visual clues to breaches in the ICRA/ILSM requirements.
- C. Provide walk-off mats at the entry/exit to all construction environments. Change tack surface as required by level of traffic.
- D. Damp mop or HEPA vacuum corridors or areas immediately surrounding the area of disturbance as required by level of activity, dusting, etc. If damp mopping, follow hospital housekeeping requirements related to anti-bacterial agents to be used in the mop water. Change mop water as directed by hospital housekeeping department or IC personnel.
- E. Construction areas shall be swept and/or HEPA vacuumed daily.
- F. Construction personnel shall damp wipe all material and equipment prior to leaving the construction environment and passing through the hospital.
- G. Whenever possible, provide entrance/exit to construction area from an exterior wall, so as to minimize disruption within the hospital.
- H. Monitor doors to both the construction environment and to patient care areas. Doors shall remain closed whenever possible to minimize impact to patients and staff.
- I. Store materials in areas designated by the CRP only.
- J. Construction personnel shall be advised that appropriate precautions shall be followed and shall be alerted to the fact that they may be exposed to airborne dust that may contain spores of microorganisms, or moisture and fungal contamination. Wear appropriate protective garb based upon activities involved.

- K. Construction personnel shall consult with Hospital prior to start of work to determine if they will be working in proximity to a patient population that may harbor infectious disease. Provide special attention when working in vicinity of All rooms.

END OF SECTION 01 56 00

SECTION 01 60 00
PRODUCT REQUIREMENTS

PART 1 GENERAL

1.01 SUBMITTALS

- A. Product Data Submittals: Submit manufacturer's standard published data. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.
- B. Shop Drawing Submittals: Prepared specifically for this Project; indicate utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.
- C. Sample Submittals: Illustrate functional and aesthetic characteristics of the product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.
 - 1. For selection from standard finishes, submit samples of the full range of the manufacturer's standard colors, textures, and patterns.

PART 2 PRODUCTS

2.01 NEW PRODUCTS

- A. Provide new products unless specifically required or permitted by the Contract Documents.
- B. DO NOT USE products having any of the following characteristics:
- C. Where all other criteria are met, Contractor shall give preference to products that:
 - 1. If used on interior, have lower emissions, as defined in Section 01 6116.
 - 2. If wet-applied, have lower VOC content, as defined in Section 01 6116.
 - 3. Have a published GreenScreen Chemical Hazard Analysis.

2.02 PRODUCT OPTIONS

- A. Products Specified by Reference Standards or by Description Only: Use any product meeting those standards or description.
- B. Products Specified by Naming One or More Manufacturers: Use a product of one of the manufacturers named and meeting specifications, no options or substitutions allowed.
- C. Products Specified by Naming One or More Manufacturers with a Provision for Substitutions: Submit a request for substitution for any manufacturer not named.

PART 3 EXECUTION

3.01 SUBSTITUTION PROCEDURES

- A. Instructions to Bidders specify time restrictions for submitting requests for substitutions during the bidding period. Comply with requirements specified in this section.
- B. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents.
- C. A request for substitution constitutes a representation that the submitter:
 - 1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product.
 - 2. Will provide the same warranty for the substitution as for the specified product.
 - 3. Will coordinate installation and make changes to other Work that may be required for the Work to be complete with no additional cost to Owner.
 - 4. Waives claims for additional costs or time extension that may subsequently become apparent.
- D. Substitution Submittal Procedure:

1. Submit three copies of request for substitution for consideration. Limit each request to one proposed substitution.
2. Submit shop drawings, product data, and certified test results attesting to the proposed product equivalence. Burden of proof is on proposer.
3. The Architect will notify Contractor in writing of decision to accept or reject request.

3.02 TRANSPORTATION AND HANDLING

- A. Coordinate schedule of product delivery to designated prepared areas in order to minimize site storage time and potential damage to stored materials.
- B. Transport and handle products in accordance with manufacturer's instructions.
- C. Transport materials in covered trucks to prevent contamination of product and littering of surrounding areas.
- D. Promptly inspect shipments to ensure that products comply with requirements, quantities are correct, and products are undamaged.
- E. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage.
- F. Arrange for the return of packing materials, such as wood pallets, where economically feasible.

3.03 STORAGE AND PROTECTION

- A. Designate receiving/storage areas for incoming products so that they are delivered according to installation schedule and placed convenient to work area in order to minimize waste due to excessive materials handling and misapplication.
- B. Store and protect products in accordance with manufacturers' instructions.
- C. Store with seals and labels intact and legible.
- D. Store sensitive products in weather tight, climate controlled, enclosures in an environment favorable to product.
- E. For exterior storage of fabricated products, place on sloped supports above ground.
- F. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.
- G. Prevent contact with material that may cause corrosion, discoloration, or staining.
- H. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.
- I. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

END OF SECTION 01 60 00.

SECTION 01 73 29 - CUTTING AND PATCHING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

- A. General Contract Provisions and Sections of this Division 1 apply to Work of this Section.

1.02 WORK SUMMARY:

- A. This Section pertains to the provision of all cutting, removing, replacing, patching, repairing, restoration, refinishing, and similar type work as necessary to existing work scheduled to remain and to new work required to be cut or uncovered. All existing facilities damaged as a result of the construction activities shall be restored to a condition equivalent to that prior to the start of work, except where otherwise shown or specified.
- B. The extent of Work includes uncovering work to provide for installation of ill-timed work, removal and replacement of defective work or work that does not conform to the Contract Documents, installation of new work to be installed in existing construction, and as necessary to make the various parts fit.

1.03 RELATED WORK SPECIFIED ELSEWHERE:

- A. Section 01 32 00: Construction progress documentation.
- B. Section 01 50 00: Temporary facilities and controls.
- C. Section 02 41 00: Demolition.

PART 2 - PRODUCTS

2.01 MATERIALS:

- A. Materials for replacement, repairing, patching, restoration and similar type work shall conform to applicable Specification Sections for new materials or work. Where existing materials and/or installations are not covered by the Project Specifications, such materials shall match existing to the greatest extent possible. All excess materials resulting from cutting and removing work shall be removed from the premises in an approved manner.

PART 3 - EXECUTION

3.01 - INSPECTION AND PREPARATION:

- A. Inspect all existing conditions of work, for possible movement or damage during cutting or uncovering procedures. After uncovering work, inspect conditions affecting installation of new products. Do not proceed with any further removal or patching or repairing work if unsatisfactory conditions or defects are observed; or if any unsafe conditions exist.
- B. Submit a written request to Architect/Engineer well in advance of executing any cutting or alteration which affects:
 - 1. The work of the Owner or any separate Contractor.
 - 2. The structural value or integrity of any element of the project.
 - 3. The integrity or effectiveness of weather-exposed or moisture-resistant elements or systems.
 - 4. The efficiency, operational life, maintenance or safety of operational elements.
 - 5. The visual qualities of sight-exposed elements.
 - 6. The request shall include:
 - 7. Identification of the project.
 - 8. Description of the affected work.
 - 9. The necessity for cutting, alteration or excavation.
 - 10. The effect on the work of the Owner or any separate Contractor, or on the structural or weatherproof integrity of the project.
 - 11. Description of the proposed work;
 - 12. The scope of cutting, patching, alteration or excavation.
 - 13. The Trades who will execute the work.
 - 14. The products proposed to be used.
 - 15. The extent of refinishing to be done.
 - 16. Alternatives to cutting and patching.
 - 17. Cost proposal, when applicable.
 - 18. Written permission of any separate Contractor whose work will be affected.

- C. Should conditions of the work or the schedule indicate a change of products from the original installation, Contractor shall submit a request for substitution as specified in the General Conditions.
- D. Submit a written notice to Architect and Owner designating the date and the time the work will be uncovered.
- E. Preparation: Prior to cutting or uncovering work, provide all shoring, bracing, and supports as required to maintain the structural integrity of the Project. Prior to restoring work, properly prepare existing surfaces to receive new material such as to provide a proper bond or joining.

3.02 CUTTING AND DRILLING:

Contractor shall do all cutting and drilling of existing walls, partitions, ceiling, floors, etc., as necessary for installation of the new work, including cutting of holes and other openings for new plumbing, mechanical and electrical work. Cutting shall be performed by hand or small power tools; holes and slots cut neat and to size required, with minimum disturbance of adjacent existing work. Cut holes in existing concrete slabs for pipes and conduits with core drills of proper sizes. Openings shall be covered temporarily when not in use and patched as soon as work is installed.

3.03 PATCHING AND REPAIRS:

- A. Existing work shall be cut, altered, removed, temporarily removed and replaced, or relocated as required for the performance of the work indicated on the Drawings. Work remaining in place damaged or defaced by reason of alteration or cutting shall be restored equal to its condition before any work under this Contract is begun. The Contractor shall be responsible for coordinating all patching involving the various trades, whether or not specifically mentioned under the respective Sections. Coordinate all patching and repair work before beginning work.
- B. Where alterations or removals expose damaged surfaces or materials caused by such alterations or removals, such surfaces or materials shall be refinished or replaced as necessary to make continuous areas uniform. Where new work by any trade occurs in an existing finished area the entire wall or ceiling surface in which such work occurs shall be refinished. Where such new work occurs in an existing unfinished area, the work shall be done to render the new work inconspicuous.
- B. Alteration work will require repairing and rearrangement of existing work, such as piping, conduits, and their appurtenances. The materials and methods of application for new work for restoring or refinishing existing work shall comply with the applicable requirements of these specifications except that materials and workmanship not covered in the completed work, particularly on items exposed to view, shall conform to similar materials and workmanship existing in or adjacent to the space in which alterations are to be made.
- D. Where utilities are removed, relocated, or abandoned, they shall be capped, valved, plugged or bypassed to make a complete and working installation as required. Resulting holes and damaged surfaces shall be properly patched to match adjacent undisturbed surfaces or prepared to receive new finishes as applicable.

- E. Surfaces affected by patching and repairing work shall be restored to match existing adjacent surfaces. Repainting of affected areas or surfaces shall match color and shade of existing painted surfaces, unless otherwise indicated.

3.04 RE-EXAMINATION AND COVERING UP OF WORK:

- A. Re-examination of questioned work may be ordered by the Architect, and if so ordered, such part of the work must be uncovered, by the Contractor involved. If such part of the work is found in accordance with the Contract Documents, the Owner shall pay the cost of re-examination and replacement. If such part of the work is found not in accordance with the Contract Documents, the Contractor involved in the work shall pay such costs and also the cost of restoring the work of any other Contractor damaged or removed. If any part of the work of the Contractor is covered up by the Contractor without approval or consent of the Architect, such work must, upon request of the Architect, be uncovered at the expense of the Contractor.

END OF SECTION 01 73 29

SECTION 01 74 00 – CLEANING AND WASTE MANAGEMENT

PART 1 - CLEANING

1.01 RELATED DOCUMENTS:

- A. General Contract Provisions and Sections of this Division 1 apply to work of this Section.

1.02 DESCRIPTION:

- A. This Section pertains to keeping the Premises free from accumulation of waste materials, rubbish and other debris, and for final cleaning both during progress of work and a completion of the project.
- B. Specific cleaning and cleaning up requirements for particular trades or work is specified under respective Sections pertaining to that trade or work and should be executed under that Section. It is to be clearly understood that the entire project, inside and out, shall be thoroughly cleaned and polished, as required, prior to acceptance by Owner.

1.03 GENERAL:

- A. Inspections: Conduct daily inspections, and more often if necessary, to verify that cleanliness requirements are being met.
- B. Pollution Control: Clean-up and disposal operations shall comply with all local ordinances and anti-pollution laws and regulations. Burning or burying of rubbish and waste materials on the job site is not permitted.
- C. Fire Protection: Volatile (flammable and combustible) waste materials shall be stored in covered metal containers, and removed from premises daily.

PART 2 - PRODUCTS

2.01 CLEANING MATERIALS AND EQUIPMENT

- A. Provide all required personnel, equipment, and materials needed to maintain the specified standard of cleanliness.
- B. Only cleaning materials recommended by manufacturer of surface to be cleaned shall be used and shall be limited to those specific surfaces. Verify that cleaning materials and equipment are compatible with the surface to be cleaned.

PART 3 - EXECUTION

3.01 DURING CONSTRUCTION

- A. General: Perform or oversee cleaning operations and ensure that building and grounds are maintained free from accumulations of waste materials, rubbish and other debris resulting from construction operations at reasonable intervals. At no time shall accumulations be allowed to become an unsightly or hazardous condition. General cleaning operations shall be "broom clean" on an as-needed basis.

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- B. All materials accumulated as waste materials, rubbish, and debris shall become the property of the Contractor and shall be removed from the job site and legally disposed of by him.
- C. Handling of waste materials shall be in a controlled manner with as few handlings as possible. Do not drop or throw materials from heights without protective barricades, warning signs or devices, and sentries posted at strategic locations such as to forewarn workmen and other persons as to possible danger.
- D. Schedule cleaning operations so that dust and other contaminant resulting from the cleaning process will not fall on wet, newly painted surfaces or otherwise damage freshly placed materials.
- E. Preparatory cleaning prior to installation of succeeding materials shall be to the extent recommended by the manufacturer of the succeeding materials.
- F. Graffiti, including any evidence thereof, shall be promptly removed.

3.02 FINAL CLEANING:

- A. General: At completion of construction and just prior to acceptance or occupancy, all exposed interior and exterior surfaces shall be inspected and cleaned by approved methods by experienced workmen or professional cleaners. Cleaning shall consist of, but not be limited to, cleaning and polishing and replacement of any broken glass; removing stains, spots, marks, dirt, labels, grease, fingerprints, and other foreign materials from all finished surfaces; cleaning hardware; removing paint spots and smears from all surfaces; cleaning fixtures and equipment; washing all concrete, resilient tile, quarry tile and ceramic tile; and cleaning all metal windows, doors and trim. Avoid scratching metal and other similar finished surfaces by using approved solvents prepared for that purpose. Maintain cleaning until acceptance by Owner.

END OF SECTION 01 74 00

SECTION 01 77 00 – CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. General Contract Provisions and Sections of this Division 1 apply to work of this Section.

1.02 GENERAL:

- A. Prior to issuance of final payment the Contractor shall have submitted, in acceptable form, all items and documents specified by the Contract Documents including, but not limited to, construction photographs, project operating and maintenance manuals, as built (record) drawings, release of liens, completed punch lists.

1.03 PROJECT RECORD DOCUMENTS:

- A. As-built Drawings. See Section 01 30 00 - "Administrative Requirements".

1.04 OPERATING AND MAINTENANCE DATA:

- A. Project Operating and Maintenance Manual: 30-days prior to the request for the substantial Completion Inspection, Contractor shall submit to the Architect one review copy of the Project Operating and Maintenance Manual. Manual shall consist of plastic covered, 3-ring, loose-leaf binder with a project name lettered on the front. All sheets shall be 8-1/2" x 11"; where larger sheets must be used, sheets shall be neatly folded to 8-1/2" x 11", and used a pullout. Obtain the approval of the Mechanical and Electrical Engineers of Record prior to submission.
 - 1. Each copy of the manual shall include:
 - a. Name, address, and trade of all Contractors, subcontractors, manufacturers, and suppliers who participated in the construction of furnished materials and equipment.
 - b. Complete maintenance instructions, name, address, telephone number of installing Contractor and/or subcontractor and manufacturer's local representative for each piece of operative equipment.
 - c. Catalog data on all plumbing fixtures, valves, water heaters, heating equipment, temperature controls, fans, electrical panels, service entrance equipment, light fixtures, and similar equipment and systems. Manufacturer's advertising or promotional literature will not be acceptable.
 - d. Manufacturer's name, model number, service manual, spare parts lists, and descriptive literature for all components.
 - e. Preventive maintenance instructions and schedules for all major equipment.

- f. Listing of most likely breakdowns and repairs.
 - g. Instructions for starting and operating the actual system as installed.
 - h. Detailed and simplified type, one line, color coded flow and wiring diagram.
 - i. Field test reports.
- 2. After Architect's review, supply three (3) copies of manual to the Owner's Design and Engineer Department and Two (2) copies to the Architect. Supply two (2) sepia copies of all sheets larger than 8-1/2" x 11"; one (1) copy to be included in the Manual and one (1) copy to Owner for his future use. Manual shall include a detailed referenced index.
- 3. Manual shall be received by the Owner prior to final payment being rendered to the Contractor.

1.05 MECHANICAL AND ELECTRICAL SYSTEMS DEMONSTRATORS:

- A. Instructions of Owner's Personnel: Refer to Sections for Mechanical and Electrical Work.

END OF SECTION 01770

SECTION 01 91 13
GENERAL COMMISSIONING REQUIREMENTS

PART 1 - GENERAL

1.1 OVERVIEW

- A. This section of the specification describes the process for commissioning, defines the responsibilities of the contractors and design professionals, and outlines the duties of other members of the commissioning team.
- B. The commissioning process shall be applied to all equipment, components, and systems as listed in this section, including specific interfaces to and from equipment and systems provided under separate contracts.
- C. Building Commissioning work is a joint team effort to ensure that all systems function together properly to meet the design intent, and to document system performance parameters for fine-tuning of control sequences and operations procedures. The commissioning process shall encompass and coordinate the traditionally separate functions of system documentation, equipment start-up, control system calibration, testing and balancing, training, and performance testing. This section does not supersede other requirements of the specification though, it may, expand on some of them.

1.2 THE COMMISSIONING TEAM

- A. The commissioning team shall consist of:
 - 1. Design Engineer (DE)
 - 2. Mechanical Contractor (MC)
 - 3. Plumbing Contractor (PC)
 - 4. Electrical Contractor (EC)
 - 5. General Contractor (GC)
 - 6. Temperature Controls Contractor (TC)
 - 7. All appropriate Contractors and Sub-Contractors
 - 8. Approved Representatives of Mechanical, Electrical and Equipment Manufacturers
 - 9. Design Architect (ARCH)
 - 10. Facility Staff (FS)
 - 11. Owner's Representative (OR)

1.3 STANDARD AND CODE COMPLIANCE

- A. Commissioning will be accomplished to comply with, and in accordance with the requirements of the following:
 - 1. 2015 International Energy Conservation Code (IECC), Section C 408 System Commissioning.

1.4 COORDINATION

- A. Management - The Contractor(s) coordinates the commissioning activities through the Owner's Representative (OR). All members shall work together to fulfill their contracted responsibilities and meet the objectives of the contract documents.
- B. Scheduling - The Contractors, through the OR, will provide sufficient time for scheduling commissioning activities with respect to the Owner's participation. The Contractors will integrate all commissioning activities into the overall project schedule. All parties will address scheduling problems and make necessary notifications in a timely manner in order to expedite the commissioning process.

1.5 COMMISSIONING PLAN

- A. The Design Engineer will develop the Commissioning Plan which shall be followed by the installing contractors.
- B. The Commissioning Plan shall contain the information necessary to document the commissioning process.
- C. The Commissioning Plan will include the following:
 - 1. Narrative description of the activities that will be accomplished during the commissioning process.
 - 2. List of the specific equipment and systems which are scheduled to be commissioned.
 - 3. Functions to be tested.
 - 4. Conditions under which the testing will be performed.
 - 5. Measurable criteria of acceptable performance.

1.6 COMMISSIONING PROCESS

- A. The following narrative provides a brief overview of the commissioning tasks that shall be performed during construction and the general order in which they occur.
 - 1. The prefunctional checklists, developed by the Contractor(s), are to be completed before and during the startup process.
 - 2. Prefunctional checklists, TAB and startup must be completed before functional performance testing.
 - 3. Items of non-compliance in material, installation, or setup shall be corrected at no expense to the Owner.

4. The Contractor ensures that the Subcontractors' prefunctional checklists are executed and documented and that startup and initial checkout are performed. The DE verifies that the TAB has been completed.
5. The Contractor(s) develops equipment and system functional test procedures.
6. The performance tests are executed by the Contractor in cooperation with the OR with the assistance of the facility staff.
7. The Contractor provides the Commissioning Record.
8. Commissioning is to be completed before substantial completion.
9. Deferred testing and/or seasonal verifications are to be conducted as specified or required.
10. Design Engineer (DE) confirms that commissioning activities have been completed.

1.7 DESCRIPTION OF WORK

- A. Commissioning will be performed for the following equipment and systems, and as described in the 2015 IECC, Section C408 System Commissioning.
 1. HVAC Systems
 2. HVAC System Testing and Balancing
 3. Temperature Control Systems
 4. Lighting Controls, Occupancy Sensors, Time Switch Controls, Daylight Controls, Photo Sensor Controls, Programmable Controls, Vacancy Sensors
 5. Domestic Hot Water Equipment
- B. The Contractors shall review and verify the commissioning activities to meet the Owner's project schedule and requirements for the interface between all trades in order to prevent delays in the Commissioning Process.
- C. Seasonal commissioning is required under full load conditions during peak heating and peak cooling seasons, as well as part load conditions in the spring and fall. Simulations of peak load conditions may be implemented to allow for complete commissioning of the work.
- D. Systems that are not weather dependent shall be tested under full and partial load to the fullest extent possible.

1.8 ROLES AND RESPONSIBILITIES

- A. Design Engineer/Professional:
 1. Develops the Commissioning Plan.
 2. Include commissioning requirements in the project construction documents.

3. Confirm, upon project completion, that commissioning has been performed by the Contractor(s) or their authorized representative.

B. Contractor(s):

1. Follow the general commissioning process as outlined in the Commissioning Plan.
2. Develop and utilize Prefunctional Checklists and Functional Test Procedures for all equipment/systems to be commissioned.
3. Provide and document all air and water systems balancing required for the project.
4. Prepare a preliminary commissioning report. This report will minimally include the following:
 - a. List of deficiencies identified during functional performance testing.
 - b. Listing of deferred or seasonal testing that cannot be completed at this time.
 - c. Listing of climatic conditions that will be required to conduct deferred/seasonal tests.
 - d. Functional Performance Test reports completed to date.
5. Make available a copy of the preliminary commissioning report to the Code Office having jurisdiction.
6. Develop an operations and maintenance manual to be provided to the Owner that will minimally include the following (Some of these items may be addressed elsewhere in the project specifications):
 - a. Submittal data of equipment requiring maintenance.
 - b. Manufacturer's maintenance manual for all commissioned equipment.
 - c. Name, address, and contact information for all relevant service agencies.
 - d. Building direct digital control system information including wiring diagrams, schematics and sequences of operations.
 - e. Lighting and lighting control system submittals.
 - f. Schedule for inspection of lighting control systems.
 - g. General narrative of how each commissioned system is intended to operate.

7. Develop a final commissioning report to be delivered to the building Owner. The report will minimally include the following:
 - a. Functional Performance Testing results.
 - b. Final results of previously identified system deficiencies.
 - c. Functional testing procedure documentation.

C. Owner:

1. Participate in the contractor performed training sessions to the extent possible.
2. Provide any system operation schedules and set point information available to the contractor to allow for proper system start-up and operation.

1.9 REFERENCES

- A. Systems commissioning shall generally be accomplished in accordance with the latest version of commissioning publications from one the following industry associations:
 1. American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE) Guideline 1.1, HVAC&R Technical Requirements for the Commissioning Process.
 2. Associated Air Balancing Council, Commissioning Reference Manual.
 3. Building Commissioning Association - The Building Commissioning Handbook.

1.10 DOCUMENTATION

- A. Each Contractor shall provide to the OR three (3) copies of the following items as soon as they become available:
 1. Certified and approved start-up and testing report forms for all subsystem equipment that comprise the System. Commissioning documentation shall include control schematics of the total system and all subsystems.
 2. Records of required inspections for code compliance, and documentation of approved permits and licenses to operate components of the system.
 3. Operating data which shall include all necessary instructions to the Owner's operating staff in order to operate the system to specified performance standards.
 4. Maintenance data which shall include all necessary information required to maintain all equipment in continuous operating condition, such as the testing, balancing and adjusting report and the as-built drawings.

5. Written notice that building equipment and systems have been completed, tested and are fully operational.
6. Checklist of all submitted contract deliverables such as; operation and maintenance manuals, spare parts, warranties, training, documentation, etc.

PART 2 - PRODUCTS

2.1 TESTING

- A. The Contractor shall provide any equipment or device required for access such as platforms, scaffolds, and spare filters as may be necessary for all verification and testing.
- B. All standard testing equipment required to perform startup and initial checkout and required performance testing shall be provided by the Contractor for the equipment being tested.
- C. All testing equipment shall be of sufficient quality and accuracy to test and/or measure system performance within the tolerances specified in the specifications, calibration certification will be provided.

PART 3 - EXECUTION

3.1 DESIGN CRITERIA AND INTENT

- A. Design criteria and intent shall be as described in the technical specification sections and contract drawings. The basis of design developed by the DE will be also referenced.

3.2 MEETINGS

- A. Initial Meeting:
 1. The Contractor(s), through the OR, will schedule, plan and conduct an initial commissioning meeting. The Contractors and their responsible parties are required to attend.

3.3 STARTUP, CONSTRUCTION CHECKLISTS AND INITIAL CHECKOUT

- A. The following procedures apply to all equipment/systems to be commissioned.
- B. General: Prefunctional checklists are required to verify that the equipment and systems are fully connected and operational. The prefunctional checklists for a given system must be successfully completed and approved prior to startup and formal performance testing of equipment or subsystems of the given system.
- C. Startup and Checkout Plan: The Contractors shall develop prefunctional checklists and startup shall be identified in the commissioning scoping meeting and on the checklist forms.

1. The Contractor/Subcontractor responsible for the purchase of the equipment shall develop the full startup plan by combining the manufacturer's detailed startup and checkout procedures and the prefunctional checklists.
- D. Execution of Construction Checklists and Startup:
1. The Owner and facility personnel as necessary, shall observe procedures for primary equipment.
 2. For lower-level components of equipment, (e.g., sensors, controllers), the OR shall be offered the opportunity to observe a sampling of the startup procedures.
 3. The Contractors, Subcontractors and Vendors shall execute startup and provide the OR with a signed and dated copy of the completed startup and construction checklists.
 4. Only individuals employed by the Contractor (Technicians, Engineers, Tradesmen, Vendors, etc.) who have direct knowledge and witnessed that a line item task on the construction checklist was actually performed shall check off that item. It is not acceptable for non-witnessing onsite supervisors to fill out these forms.
- E. Deficiencies, Non-Conformance, and Approval of Checklists and Startup (Master Issues Log):
1. The Contractor shall ensure that the Subcontractors clearly list any outstanding items of the initial startup and construction checklist procedures that were not completed successfully, on an attached sheet. The form and any outstanding deficiencies shall be provided, to the OR within two (2) days of test completion.

3.4 FUNCTIONAL PERFORMANCE TESTING

- A. Requirements: The functional performance testing shall demonstrate that each system is operating according to the documented design intent and contract documents. Functional performance testing facilitates bringing the systems from a state of individual substantial completion to full dynamic operation. Additionally, during the testing process, areas of deficient performance are identified and corrected, improving the operation and functioning of the systems.

3.5 DOCUMENTATION, NON-CONFORMANCE, AND APPROVAL OF TESTS

- A. Documentation: The Contractors shall complete all documentation for performance testing.

3.6 DEFERRED TESTING

- A. Unforeseen Deferred Tests: If any check or test cannot be completed due to the project completion level, weather conditions, or time of season, execution of checklists and functional performance testing may be delayed upon approval of the OR. These tests will

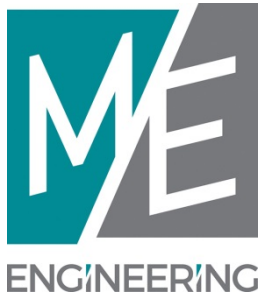
be conducted in the same manner as the seasonal tests as soon as possible. Contractors will not be due any additional compensation.

- B. Seasonal Testing: During the warranty period, seasonal testing (tests delayed until weather conditions are closer to the system's design) shall be completed as part of this contract. The Contractor shall coordinate this activity through the OR. Any final adjustments to the O&M manuals and as-built's due to the testing shall be made by the Contractor.

3.7 COMMISSIONING RECORD

- A. The Contractor is responsible to compile, organize and index the following commissioning data, for all commissioned equipment into labeled, indexed and tabbed, or in an electronic format, as preferred by the Owner.
 - 1. Commissioning Plan. (Design Engineer provided.)
 - 2. System reports including available design narratives and criteria including sequences. Each system shall contain the startup plan and report, approvals, corrections, construction checklists, completed performance tests, trending and analysis, training plan and recommended recommissioning schedule.
 - 3. Complete issues log inclusive of all items and resolutions.
 - 4. Final Commissioning Report including an executive summary and a list of participants and roles.
 - 5. All outstanding non-compliance items shall be specifically listed. Recommendations for improvement to equipment or operations, future actions, commissioning process changes, etc. shall also be listed. Each non-compliance issue shall be referenced to the specific performance test, inspection, trend log, etc. where the deficiency is documented.

END OF SECTION



Mechanical/Electrical Engineering Consultants

Buffalo • Rochester • Syracuse • Schenectady

Commissioning Plan Construction Phase

Project Title

Client Name

Address

Address

Date

M/E Reference 160000

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[DESIGNER NOTE: SECTION NUMBERS AND PAGE NUMBERS ABOVE ARE LINKED VIA CROSS-REFERENCE. IF ANY SECTIONS ARE REMOVED YOU MUST MANUALLY DELETE IT FROM THE TOC ABOVE. AFTER COMPLETE DOCUMENT EDIT IS FINISHED, HIGHLIGHT LINES ABOVE, RIGHT-CLICK AND SELECT "UPDATE FIELD". IF ANY SECTIONS ARE ADDED NEW CROSS-REFERENCE LINKS MUST BE CREATED.

TO CREATE NEW CROSS-REFERENCE:

- 1) HIGHLIGHT SECTION NUMBER OR PAGE NUMBER IN TOC ABOVE**
 - 2) GO TO INSERT TAB>CROSS-REFERENCE**
 - 3) HIGHLIGHT LINE TO ASSOCIATE UNDER "FOR WHICH NUMBERED ITEM:"**
 - 4) CHANGE "INSERT REFERENCE TO" TO THE FOLLOWING:**
 - "PARAGRAPH NUMBER" FOR REFERENCE TO SECTION**
- OR**
- "PAGE NUMBER FOR REFERENCE TO PAGE]**

COMMISSIONING PLAN

[PROJECT: _____]

[Date: _____]

1. Overview

A. Definitions:

1. Acceptance: A contractually defined action that permits an activity to commence or continue.
2. Basis of Design: A document that records the concepts, calculations, decisions, and product selections used to meet the Owner's Project Requirements and to satisfy applicable regulatory requirements, standards, and guidelines. The document includes both narrative descriptions and lists of individual items that support the design process.
3. Commissioning: See Commissioning Process.
4. Commissioning Activity: A component of the Commissioning Process.
5. Commissioning Field Report: A document that records the activities and results of the Commissioning Process.
6. Commissioning Plan: A document that outlines the organization, schedule, allocation of resources, and documentation requirements of the Commissioning Process.
7. Commissioning Process: A quality-focused process for enhancing the delivery of a project. The process focuses on verifying and documenting that the facility and all of its systems and assemblies are planned, designed, installed, tested, operated, and maintained to meet the Owner's Project Requirements.
8. Commissioning Process Progress and Approval Form: A document that indicates activities completed as part of the Commissioning Process, approval status of the activities, and significant findings from those activities; it is continuously updated during the course of a project.
9. Commissioning Team: The individuals who through coordinated actions, are responsible for implementing the Commissioning Process.
10. Construction Documents: This includes a wide range of documents, which will vary from project to project, Owner's needs, regulations, laws, and countries. Construction documents usually include the project manual (specifications), plans (drawings) and General terms of the contract, especially those required by subcontractors and manufacturer's representative, suppliers and manufacturers of equipment, assemblies and systems.
11. Continuous Commissioning Process: A continuation of the Commissioning Process well into the Occupancy and Operations Phase to verify that a project continues to meet current and evolving Owner's Project Requirements. The

12. **Contract Documents:** This includes a wide range of documents, which will vary from project to project, owner's needs, regulations, laws, and countries. It frequently includes price agreements, construction management process, subcontractor agreements or requirements, requirements and procedures for submittals, changes, and other construction requirements, timeline for completion, and the Construction Documents.
13. **Coordination Drawings:** Drawings showing the work of all trades to illustrate that equipment can be installed in the space allocated without compromising equipment function or access for maintenance and replacement. These drawings graphically illustrate and dimension manufacturers' recommended maintenance clearances.
14. **Functional Test Procedure:** A written protocol that defines methods, personnel, and expectations for tests conducted on components, equipment, assemblies, systems, and interfaces among systems.
15. **Verification:** The process by which specific documents, components, equipment, assemblies, systems, and interfaces among systems are confirmed to comply with the criteria described in the Owner's Project Requirements.

1. Commissioning is a systematic process of ensuring that selected systems perform interactively according to the design intent and the owner's operational needs. This is achieved by beginning in the design phase, documenting the design intent and continuing through construction, acceptance and the warranty period with actual verification of performance.

1. The following equipment and systems will be commissioned in this project by the respective contractors. Refer to Section 5 for additional details. All general references to equipment in this document refer only to equipment that is to be commissioned.

- a. **[HVAC Systems]**
- b. **[HVAC System Testing and Balancing]**
- c. **[Temperature Control Systems]**
- d. **[Lighting Controls,] [Occupancy Sensors,] [Time Switch Controls,]
[Daylight Controls,] [Photo Sensor Controls,] [Programmable
Controls,] [Vacancy Sensors]**
- e. **[Domestic Hot Water Equipment]**
- f. **[**

g. []
h. []]

2. General Building Information

Project: _____

Location: _____

Building Type: _____

3. Commissioning Team Members

Team Member	Co. & Contact Names	Office, Cell, Fax, Email
Owner		
Primary Contact		
Architect		
Project Architect		
Engineer		
Design Engineer		
Construction Contractors		

4. Contractors/Sub-Contractors

- A. [Mechanical]
- B. [Electrical]
- C. [Plumbing]
- D. [General]
- E. [Testing and Balancing]
- F. [Direct Digital Controls]
- G. [Other]

Note: Contractor(s) will be responsible for providing the project commissioning services in accordance with the requirements of the project Specification Section 019113, applicable code(s) and this Commissioning Plan.

5. Commissioning Process

- A. This section sequentially details the commissioning process by commissioning task or activity.

1. Commissioning Scoping Meeting:
 - a. A commissioning scoping meeting is planned and conducted by the Contractor. In attendance are the respective representatives of the Owner, Facility Staff, DE and the mechanical, electrical, controls, and TAB Contractor. At the meeting, commissioning parties are introduced and the commissioning process is reviewed, and management and reporting lines determined. The Cx Plan is reviewed, process questions are addressed, lines of reporting and communications determined and the work products list discussed.
2. Miscellaneous Management Protocols:
 - a. The following protocols will be used on this project:

<u>Issue</u>	<u>Protocol</u>
Scheduling of Commissioning Tasks	Contractor provides to Owner's Representative.
Question/Clarifications in regards to Commissioning Specification and/or Commissioning Plan	Contractor provides to Design Engineer.
Schedule of Training	Contractor provides to Owner's Representative who will notify Owner.
Turnover of Commissioning Documentation	Contractor delivers to Owner's Representative.
For Scheduling Commissioning Activities	Contractor to coordinate with Owner's Representative.
For Commissioning Deficiencies	Contractor notifies Owner's Representative and resolves deficiencies with Subcontractor and Equipment Manufacturer Representatives

3. Execution of Pre-functional Checklists and Startup:
 - a. The contractors and manufacturer's representatives execute and submit a signed copy of the completed start-up reports and/or Prefunctional checklists to the OR. Further details are found in the Contract Documents.
4. Deficiencies and Non-Conformance:
 - a. The Contractor works with the subcontractors and or manufacturer's representative to correct and retest deficiencies or uncompleted items, with involvement from the DE and others as required. The installing contractors or manufacturer's representatives correct all areas that are deficient or incomplete according to the start-up tests.
5. Execution of Functional Testing Procedures:
 - a. Overview and Process:

- 1) The Contractor schedules functional tests through the OR. The Contractor personnel oversees, witnesses and documents the functional testing of all equipment and systems according to the Contract Documents and the Cx Plan. The Contractors execute the tests. The control system is tested before it is used to verify performance of other components or systems. The air balancing and water balancing is completed and debugged before functional testing of air-related or water-related equipment or systems. Testing proceeds from components to subsystems to systems and finally to interlocks and connections between systems.
- b. Deficiencies and Retesting:
 - 1) The Contractor documents the results of the test. Corrections of minor deficiencies identified are made during the tests. The Contractor records the results of the test on the procedure or test form. Deficiencies or non-conformance issues are noted and reported to the OR. Contractors correct all deficiencies, notify the OR. Contractor will schedule re-testing with OR.
- c. Commissioning Record:
 - 1) The Contractor will compile, organize and index the following commissioning data by equipment/system into labeled, indexed and tabbed, three-ring binders or electronically, based on Owner preference.
 - 2) The Final Commissioning Record is provided to the Owner and Design Engineer for review.

END OF COMMISSIONING PLAN

SECTION 02 41 00 - DEMOLITION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

- A. General Contract Provisions and Sections of Division 1 apply to Work of this Section.

1.02 WORK SUMMARY:

- A. Work of this Section includes but is not limited to demolition and removal of certain existing drywall partitions including removal of doors, door frames, trim and hardware, windows, electrical switches and outlets occurring in walls and partitions to be demolished; certain plumbing fixtures and piping runouts; demolition and removal of existing ceilings, lighting fixtures, ceiling registers, removal of existing roof membrane and ballast; removal of certain exterior masonry veneer, etc; and preparing all areas left by removals for installation of new construction and all other items otherwise required for the alteration program. Consult Drawings for all work involved.
- B. Removing and legally disposing of all debris.

1.03 RELATED WORK SPECIFIED ELSEWHERE:

- A. Section 01 73 29: Cutting and patching.
- B. Section 01 50 00: Temporary facilities and controls
- C. Divisions 21, 22, 23, 26, 27, 28: Removal of mechanical and Electrical equipment, piping, etc.

1.04 SITE INVESTIGATION:

- A. Visit the site and carefully examine the work to be demolished so as to be familiar with existing conditions, the nature and scope of the work, and the difficulties that attend its execution.
- B. The submission of a proposal shall be construed as evidence that such an examination has been made and later claims for labor, equipment, materials required or for difficulties encountered, which could have been foreseen has such an examination been made, will not be recognized.

1.05 MISCELLANEOUS PROVISIONS:

- A. Conduct of demolition operations shall be in such a manner as to permit Owner to maintain full operations of all portions of the existing buildings not scheduled for demolition activities.
- B. Supplemental Code: Comply with provisions of the current edition of the ANSI "Safety Code for Building Construction."

1.06 LAWS, ORDINANCES & REGULATIONS:

- A. Secure and pay fees for all permits and licenses required for execution and completion of work of this section. Give notice and comply with laws, ordinances, rules, regulations and orders of any public authority bearing on the work. If Contractor performs any work knowing it to be contrary to such laws, ordinances, rules and regulations, and without notice to the Architect, he shall assume full responsibility therefore and shall bear all costs attributable thereto.

1.07 SUBMITTALS:

- A. Demolition Schedule:
- B. Prior to starting demolition work, submit proposed methods and operations of demolition for review. Include in the schedule the coordination for shut-off, capping, and continuation of mechanical and electrical services as required.
- C. Provide a detailed sequence of demolition and removal work to ensure the uninterrupted progress of Hospital operations. Demolition work shall be so conducted as to cause a minimum of disturbance or inconvenience to hospital operations in the existing buildings.
- D. Notify Architect when structural members are about to be cut or removed (if any), and where any cutting or removal are anticipated which may effect the structural safety of this project, to permit the Architect's review of measures to maintain stability of the structure and to leave remodeled work safe. Drawings indicate existing conditions to extent possible. The Contractor shall make such explorations and probes as are necessary to ascertain any required protective measures before proceeding with demolition and removal. Give particular attention to shoring and bracing requirements so as to prevent any damage to existing construction.

1.08 JOB CONDITIONS:

- A. Occupancy:
 - 1. Areas affected by demolition operations will be vacated and discontinued in use prior to the start of the work.
 - 2. All movable fixtures and equipment such as desks, tables, chairs, filing cabinets, etc. will remain the property of the Owner and will be removed by him before the Contractor starts his demolition work.
 - 3. Materials or items designated to become the property of the Owner shall be as shown on the drawings. Remove such items with care and store them in a location at the site to be designated by the Owner.
 - 4. Materials or items designated to be reinstalled shall be as shown on the Drawings and/or project manual. Remove such items with care under the supervision of the trade responsible for installation; protect and store until required. Replace material or items damaged in its removal with similar new material.

5. Materials or items demolished and not designated to become the property of the Owner or to be relocated shall become the property of the Contractor and shall be removed from the Owner's property.
 6. Condition of Premises: The Owner assumes no responsibility for the actual condition of improvements to be demolished.
 7. Conditions existing at the time of Notice to Proceed will be maintained by the Hospital in so far as practicable. However, variations within the premises may occur by Owner's removal and salvage operations prior to start of demolition work.
 8. Damage: Should any portion of the existing surfaces, which are scheduled to remain, be damaged due to removal work, the conditions and circumstances shall be reported to the Architect and necessary repairs and replacements to such damaged work shall be made, at no extra cost to the Owner, with new materials to match existing in every respect.
- B. Services:
1. Do not interrupt existing services indicated to remain, keep in service, and protect against damage during demolition operations.
 2. Shut off mechanical and electrical services areas proposed for demolition. Disconnect and seal indicated services before starting demolition operations.
 3. Cut Off, seal, cap, plug or remove if required existing mechanical and electrical items which are indicated or specified to be abandoned, or which obviously will be abandoned, or interrupted in the course of demolition work. Cutting off, sealing, capping, plugging, removal and rerouting shall be done according to approved accepted methods.
- C. As demolition operations proceed all noisy operations shall be brought to the attention of the Owner's representative, not less than 24 hours ahead of scheduled time. Contractor is cautioned that sudden and excessive noises may seriously endanger patients' lives and/or health conditions. This precaution is, therefore to be considered as one of urgent compliance. Take all precautions continuously to reduce noise.

PART 2 - PRODUCTS

2.01 MATERIALS:

- A. General: Furnish all materials and equipment necessary for demolition operations and protection of operations.
- B. All excess materials resulting from demolition operations and not scheduled to be salvaged or to be reused shall become the property of this Contractor and shall be disposed of off the Job Site using approved methods.

PART 3 - EXECUTION

3.01 PROTECTION:

- A. General: Existing portions of adjacent buildings and site shall be protected against damage. Extreme precaution shall be exercised, and protection shall be provided to prevent bodily injury and/or property damages to persons using public and private egress and spaces adjacent to the work to be demolished.
- B. Provide, erect, and maintain all necessary temporary enclosures warning signs, lights, guard rails, barricades, etc., to adequately protect all workmen and the public from possible injury. Provide all necessary temporary partitions, enclosures, coverings and the like of approved materials and construction for the exclusion of weather and for confining dust and debris in the room and spaces inside the building in which demolition and similar operations are being performed.
- C. It is essential that all hospital functions continue unimpeded while the demolition work is being proceeding. Corridors and stairways must remain clear at all times. Where this is not possible, contractor shall erect suitable signs directing traffic through alternate routes. Work shall be completed as quickly as possible.
- D. All return grilles in the areas in which demolition operations occur shall be covered air tight to prevent dirt and dust from entering the existing air systems.
- E. No wires, conduits or pipes shall be removed until applicable services have been properly disconnected and/or cut off and utilities shall not be left unattended while open or "hot." Wires, conduits, pipes, sprinklers, sewers, drains, etc., scheduled to remain shall be properly supported, protected and left in operating order, unless otherwise authorized. Preserve in operating condition all active utilities traversing the Job Site.
- F. Existing Finish Materials to Remain: Demolition operations shall be performed in such a manner as to minimize disturbance of existing finish materials, and to keep patch and repairing work to a minimum.

3.02 UTILITIES:

- A. Disrupted Utility Service: Before starting demolition, disconnected or arrange for the disconnection of utilities service connections, such as water, in accordance with the regulations of the Utilities Company concerned. Disconnect so as to not interrupt utility services to other portions of the building not scheduled to be disturbed by construction. Methods of capping or plugging shall be in accordance with the Utility Company having jurisdiction.

3.03 DEMOLITION OPERATIONS:

- A. Remove portions of existing slabs, and walls, cut new openings and in slabs and walls, do all demolition and removal of existing work otherwise required by the drawings and the specifications, or as they be required for the proper installation of the new work.
- B. Demolition and removals shall be carried out in a workmanlike, orderly and careful

manner without unnecessary noise, dust and other disturbances to the Owner's existing facilities, neighbors and public. All mechanical, electrical and related equipment, and utilities shall be completely removed within the limits of the Contract, unless otherwise shown or authorized to be abandoned.

END OF SECTION 02 41 00

SECTION 05 40 00 – COLD-FORM METAL FRAMING

PART 1 - GENERAL

1-01 DESCRIPTION

- A. Applicable requirements of Conditions of the Contract and of Sections listed under General Requirements apply to Work of this Section.
- B. Work Included: Steel stud wall-framing, metal suspension systems, enclosures and other framing applications including all hardware and accessories.
- C. Related Work Specified Within Other Sections:
 - 1. Rough Carpentry Section 06 10 00
 - 2. Gypsum Board Assemblies Section 09 20 00

1-02 QUALITY ASSURANCE

- A. Sequence of installation of materials is critical, confer with Architect and G.C. prior to installation to assure most efficient method to be used.
- B. In addition to this specification, this section shall provide any supplemental framing as required by jurisdiction codes.

1-03 SUBMITTALS

- A. Submit shop drawings for all items herein specified showing pertinent construction features, i.e. wall sections, corner framing, framing at doors and windows, blocking for cabinets or other wall hung accessories, planned method(s) of attachment, etc.

PART 2 - PRODUCTS

2-01 MANUFACTURERS

- A. Provide materials specified from one of the following manufacturers:
 - 1. Marino Industries Corporation; South Plainfield, NJ 07080
 - 2. Gold Bond Building Products; Charlotte, NC 28211
 - 3. Unimast Incorporated; Franklin Park, IL 60131

2-02 MATERIALS

- A. Interior Framing:
 - 1. Metal Partition - Studs - Standard 20 gauge, sizes as indicated. Where length of stud to deck exceeds maximum limit of 20 gauge, increase thickness to size indicated by stud manuf. Standard span chart.
 - 2. Metal Partition - Runners - Standard 20 gauge as indicated, sizes as indicated.
 - 3. Main Runner Ceiling Channels - 1-1/2" cold-rolled channels.

4. Fasteners, screws, supports and anchors of proper type.
- C. Supplementary Framing:
1. Provide supplementary framing, blocking and bracing wherever walls, partitions or ceilings are indicated to support fixtures, equipment, services, casework, heavy trim and furnishings and similar work requiring attachment and support. Where type of supplementary support is not otherwise indicated, comply with manufacturer's recommendations and industry standards, considering weight of or loading resulting from the item supported.
 2. Coordinate and provide additional framing at the closures to the existing building.

PART 3 - EXECUTION

3-01 INSTALLATION

- A. Wall Framing:
1. Steel stud work shall be erected by a mechanical attachment to the structure and runner track. Runner track shall be aligned accurately according to the layout and secured to the structure with power-driven fasteners of proper size, located one at every stud, 2 at every jamb and corner, and not more than 16" o.c. Provide double row of horizontal bracing, one row near top and second row centered between top brace and floor on full height walls. Use deep leg top track for deflection protection.
- B. Strap hangers shall be 1"x3/16" mild flat galvanized steel. Angles where required shall be 2" x 2" x 14" prime-coated steel unless otherwise specified, or #8 galvanized hangers.
- C. Accurately align metal track, studs and suspension. Anchor track-using power driven anchors at 24" o.c. Position studs with flanges all facing same direction. Secure all framing together and to runners with Type "S" screws as recommended by manuf. Frame openings as detailed using double studs. Cut to length for continuous span overhead of opening. Follow manufacturer's recommendations for setting, spacing and fastening of studs and related accessories.
- D. Install complete framing system in accordance with manufacturer's recommendations, and specifications for all loads implied upon from finishes and anchorage forces. Connections shall be rigid, secure and of proper type to allow for thermal expansion and movements related to the metal panel attachment. Coordinate with other Sections.
- F. Blocking and Reinforcing for Wall-Hung Items:
1. Provide cut sections or runner channel and others as indicated for the support of wall-hung fixtures. Cut ends of runner and backing plates to each stud. Fasten studs carrying the weight of wall-hung items to the bottom runner channel.
 2. 6" wide x 16 gauge galvanized sheet steel is an acceptable alternative method of wall reinforcement if sheet material is attached to a minimum of three (3) studs, spaced 16" O.C.
- H. Furring Structural Steel Columns for Attachment of Gypsum Wallboard: Install galvanized steel clips and support angles for erection of gypsum wallboard around structural steel columns in accordance with UL Fire Resistance requirements.

END SECTION 05 40 00

SECTION 05 50 00
METAL FABRICATIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

- A. General Contract Provisions and Sections of Division 1 apply to Work of this Section.

1.2 WORK SUMMARY:

- A. Work of this Section includes but is not necessarily limited to the following:
1. Steel lintels.
 2. Steel pipe railings and guard rails.
 3. Steel gratings.
 4. Mechanical Equipment dunnage and structural supports.
 5. Access ladders in mechanical rooms, elevator pits and roof's. Roof ladders shall be fitted with safety cages.
 6. All other miscellaneous steel for support of equipment, for stiffening construction assemblies, etc. (See Drawings for details and locations).

1.3 QUALITY ASSURANCE:

- A. Codes and Standards: Comply with the provisions of the following codes, standards and specifications, except as otherwise shown and specified:
1. AISC "Specifications for the Design, Fabrication, and Erection of Structural Steel for Building," including "Commentary of the AISC Specifications."
 2. AISC "Specification for the Design of Cold-Formed Steel Structural Members."
 3. AWS "Structural Welding Code."
- B. Qualifications for Welding Work: Qualify welding process and welding operators in accordance with AWS "Standard Qualification Procedure."

1.4 SUBMITTALS:

- A. Manufacturer's Data: Submit copies of manufacturer's specifications, load tables, dimension diagrams, anchor details and installation instructions for products to be used in miscellaneous metal work, including paint products.
- B. Shop Drawings: Submit shop drawings for the fabrication and erection of all assemblies of miscellaneous metal work, which are not completely shown by the Manufacturer's data sheets. Include plans, elevations, and details of sections and connections. Show anchorage and accessory items. Include setting drawings and templates for location and installation of miscellaneous metal items and anchorage devices.
- C. Samples: Submit 2 sets of representative samples of materials and finished products as may be requested by the Architect. Architect's review will be for color, texture, style, and finish only. All other requirements for the work are the Contractor's responsibility. Submit samples only when requested by the Architect.

1.5 COORDINATION AND MEASUREMENTS:

- A. Take all necessary measurements at the building to assure proper fitting and fabrication of all work. All variations of adjacent construction shall be taken into account and properly provided for. All work under this Section shall be closely coordinated with that of other trades whose work affects or is affected by the work included herein to assure complete assemblies and installations with clear separation and understanding of Contract responsibilities. Coordinate locations of all required embedded items.

1.6 PRODUCT HANDLING:

- A. Use all means necessary to protect Miscellaneous Metal materials before, during and after installation and to protect the installed work and materials of other trades. In the event of damage, immediately make all repairs and replacements necessary to the approval of the

Architect and at no additional cost to the Owner.

PART 2 - PRODUCTS:

2.1 FABRICATION MATERIALS:

- A. Materials for fabricated items of this Section shall be new and free from defects impairing strength, durability, or appearance, and of best commercial quality for purposes specified. Metals shall be made with structural properties to withstand safely the strains and stresses to which they will be normally subjected. Stock materials, patterns, products or fabricated items of manufacturers meeting the requirements of the Drawings and as herein specified will be acceptable if approved by the Architect.
 - 1. Steel Plates, Shapes, Bars: ASTM A 36.
 - 2. Cold-Formed Steel Tubing: ASTM A500 , Grade B.
 - 3. Steel-Pipe: ASTM A53, Type E or S, Grade B.
 - 4. Cold-Rolled Steel Sheets: ASTM A 366.
 - 5. Galvanized Steel Sheets: ASTM A 526, With ASTM A 525, Grade G 90 zinc coating.
 - 6. Shop Paint: FS TT-P-86, Type II; or, SSPC-Paint 14. Apply to cleaned and degreased steel surfaces at rate to provide a 2.0 mil. dry film thickness.
 - 7. Galvanizing: ASTM A 386 for assembled products: A 153 for iron and steel hardware.
 - 8. Aluminum:
 - a. Alloy and Temper: As specified or shown or required to produce finishes.
 - b. Extruded Shapes and Tubes: ASTM B 221 or B 308.
 - c. Extruded Pipe: ASTM B 429.
 - d. Plate and Sheet: ASTM B 209, alloy 30003-H16. Use alloy 5005-H16 for anodic finishes.
 - e. Bars, Rods, and Wires: ASTM B 211.
 - f. Castings: ASTM B 26 or B 108; alloy to suit type of finish.
 - 9. Welding Electrodes and Filler Metal: Type and alloy to match metal to be welded.
 - 10. Fasteners: Type and alloy to match metal to be fastened; use spanner head screws for exposed fasteners if not otherwise shown.
 - 11. Anchors and Inserts: Furnish as required for installation in other work. Use cadmium or galvanized.

2.2 ROUGH HARDWARE:

- A. Furnish bent or otherwise custom fabricated bolts, plates, anchors, hangers, dowels, and other miscellaneous steel and iron shapes as required for framing and supporting woodwork, and for anchoring or securing woodwork to concrete or other structures. Straight bolts and other stock rough hardware items are specified in Division 6 Sections.
- B. Manufacture or fabricate items of sizes, shapes, and dimensions required. Furnish steel washers for heads and nuts.

PART 3 – EXECUTION

3.1 SURFACE CONDITIONS:

- A. Prior to work of this Section, carefully inspect the installed work of other trades and verify that such work is complete to the point where this installation may properly commence. In the event of discrepancy do not proceed with installation until such discrepancies have been fully resolved.

3.2 FABRICATION, ERECTION AND INSTALLATION:

- A. All work shall be manufactured in ample time so as not to delay the progress of the work and shall be delivered at the building at such time as required for proper coordination. Fabrication and erection shall be in a thorough and workmanlike manner.
- B. Forming shall be true to detail, clean, straight, with sharply defined profiles. Metals shall have smooth finished surfaces excepting where otherwise particularly specified.
- C. All joints shall be of such character, and so assembled, that they will be as strong and rigid as adjoining sections. Joints required to be welded shall be continuously welded or spot welded

- as specified and face of welds dressed flush and smooth.
- D. Exposed joints shall be close fitting and jointing made where least conspicuous. Joints exposed to weather shall be formed to exclude water.
 - E. Weights of connections and accessories shall be adequate to safely sustain and withstand stresses and strains to which they will be normally subjected.
 - F. All rolled steel shapes be carefully straightened and free from twists before being assembled.
 - G. Metal work shall be properly countersunk to receive the required hardware and provided with proper bevels or clearances. Plates for mounting hardware shall be riveted or welded in place.
 - H. All work shall be fabricated to allow for expansion and contraction of materials.
 - I. Unless otherwise shown, rivet, bolt and screw heads shall be flat and countersunk in exposed faces of the work of a finish character.
 - J. All bolts, screws, etc., where exposed, shall be cut off flush with nuts or other adjacent metal.
 - K. Except as otherwise shown, specified or approved, all shop assembled connections shall be welded or riveted, or rivets, bolts or machine screws may be used for field connections.
 - L. Work to be built in with masonry or concrete work shall be of form required for anchorage or shall be provided with suitable inserts, anchors, expansion shields, etc., as indicated, specified, or necessary for proper anchorage.
 - M. Furnish and set all supporting members, fastenings, framing, hangers, bracing, brackets, strap bolts, angles, and the like required to set and connect the work rigidly and properly to other construction.
 - N. After erection, this Contractor shall fill all finish joints, screw heads, etc., with an approved mineral filler, making all surfaces smooth and uniform and ready for finishing coats of paints.
 - O. Except as otherwise noted, or where requirements of governing bodies are most stringent, miscellaneous metal shall conform to applicable requirements of the Specifications for Design, Fabrication and Erection of Structural Steel for Buildings, latest edition, as issued by the American Institute of Steel Construction. (AISC).
 - P. All work shall be installed so as not to impair the structural or moisture-resistive integrity of other work.

3.3 CUTTING, FITTING AND DRILLING:

- A. Cut, fit and drill as may be necessary in connection with the work herein specified, so that it may be properly set in place and so as to permit engaging work to be properly installed.
- B. Furnish screws, bolts and other fastening devices necessary for attachment of engaging materials to the work herein specified. Screws and bolts shall be standard, and proper washers shall be provided where necessary. Where hollow block masonry makes the use of expansion bolts unsuitable, provide toggle bolts or other suitable fastening devices as approved. Use no wood plugs in any material. Use non-ferrous attachments for non-ferrous metals.
- C. Build anchors and other connecting members which occur in concrete or masonry into the concrete or masonry as the work progresses, so as to avoid unnecessary cutting and drilling.

3.4 LOOSE STEEL LINTELS:

- A. Provide loose structural steel lintels for openings and recesses in masonry walls and partitions as shown. Weld adjoining members together to form a single unit where indicated. Provide not less than 8" bearing at each side of openings, unless otherwise indicated.
- B. Loose steel lintels shall be given one coat of shop paint to provide a minimum dry film thickness of 2.0 mils.
- C. Galvanize loose steel lintels to be installed in exterior walls.

3.5 HANDRAILS AND RAILINGS:

- A. General: Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges. Ease exposed edges to a radius of approximately 1/32", unless otherwise shown. Form bent metal corners to the smallest radius possible without causing

- grain separation or otherwise impairing the work.
- B. Non-welded Connections: Intermediate post to rail connections may be made using internal pipe sleeve locks and Allen screw fasteners. Locking devices which do not produce flush, smooth, rigid, hairline joints won't be acceptable. Weld other connections.
 - C. Welded Connections: Cope intersections of rails and posts, weld joints and grind smooth. Butt weld end to end joints of railings or use welding connectors, at fabricator's option.
 - 1. At connections to steel supports, weld post directly to steel supports, unless otherwise indicated.
 - 2. Other methods of welding may be used when acceptable to the Architect.
 - D. Weld corners and seams continuously and in accordance with the recommendations of AWS. Grind exposed welds smooth and flush, to match and blend with adjoining surfaces. Discoloration of finished surfaces will not be acceptable.
 - E. Form exposed connections with flush, smooth, hairline joints, using concealed fasteners wherever possible. Use exposed fasteners of the type shown, or if not shown, use Phillips flathead (countersunk) screws or bolts.
 - F. Brackets, Flanges, and Anchors: Provide brackets, flanges and anchors for railing ends. Furnish inserts and sleeves as required for anchorage to concrete or masonry work. Furnish cast metal brackets, flanges and exposed anchors of the same material and finish as supported rails, unless otherwise indicated.
 - G. Galvanize exterior steel railings that shall be located on roof's and in service areas, including pipe, fittings, brackets, fasteners and other ferrous metal components. Provide painted steel pipe for interior railings and exterior railings that are combined in whole or part with other structures and incorporated into the architecture as experienced in the public domain.
 - H. Provide anchorage devices and fasteners where necessary for securing handrails and railing items to in-place construction, including threaded fasteners for concrete and masonry inserts, toggle bolts, through-bolts, lag bolts and other connectors as required. Use railing manufacturer's standard methods of installation.
 - I. Perform cutting, drilling and fitting required for installation. Set the work accurately in location, alignment and elevation, plumb, level, true and free of rack, measured from established lines and levels.
 - J. Adjust railings prior to securing in place to ensure proper matching at butting joints and correct alignment throughout their length. Space posts not more than 8' on centers, unless otherwise shown. Plumb posts in each direction. Secure post and rail ends to building construction as follows:
 - 1. Anchor posts in concrete by means of pipe sleeves set and anchored into the concrete. Provide sleeves of galvanized steel pipe, not less than 6" long and having an inside diameter not less than 1/2" greater than the outside diameter of the inserted pipe post. Provide steel plate closure secured to the bottom of the sleeve and of width and length not less than 1" greater than the outside diameter of the sleeve. After the posts have been inserted into the sleeves, fill the annular space between posts and sleeve solid with non-shrink, non-ferrous grout. Cover anchorage joint with a round metal flange finished to match post.
 - 2. Anchor post to steel with oval flanges, angle type or floor type as required by conditions, welded to posts and bolted to the steel supporting members.
 - 3. Anchor rails ends into concrete and masonry with round flanges welded to rail ends and anchored into the wall construction with lead expansion shields and bolts.
 - 4. Anchor rail ends to steel with oval or round flanges welded to rail ends and bolted to the structural steel members, unless otherwise indicated.
 - 5. Provide removable railing sections as indicated. Furnish slip-fit metal socket or sleeve for casting into concrete. Accurately locate sleeves to match post spacing.
 - K. Secure handrails to walls with wall brackets and end fittings. Provide brackets with not less than 1½" clearance from inside face of handrail to the finish wall surface. Drill wall plate portion of the bracket to receive one bolt, unless otherwise indicated for concealed anchorage. Locate brackets as indicated or, if not indicated, at not more than 8'-0" o.c. Provide flush type wall return fittings with the same projection as that specified for wall brackets. Secure wall brackets and wall return fittings to building construction as follows:
 - 1. For concrete and solid masonry anchorage, use anchor bolt expansion shield and lag

- bolts. Use sleeve anchors embedded into masonry structures for guard rail installations.
2. For hollow masonry anchorage, use toggle bolts having square heads.
 3. For stud partitions use self-tapping screws set into continuous 6" 18 gauge steel backing plate secured to face of studs. Coordinate stud installation for accurate location of backing members.

3.6 MISCELLANEOUS FRAMING AND SUPPORTS:

- A. Provide miscellaneous steel framing and supports which are not a part of structural steel framework, as required to complete work. All miscellaneous steel framing and support structures shall be designed and submitted by a licensed Structural Engineer in the State of New York.
- B. Fabricate miscellaneous units to sizes, shapes and profiles indicated or, if not indicated, of required dimensions to receive adjacent other work to be retained by framing. Except as otherwise indicated, fabricate from structural steel shapes, plates and steel bars of welded construction using mitered joints for field connection. Cut, drill and tap units to receive hardware and similar items.
- C. Equip units with integrally welded anchors for castings into concrete or building into masonry. Furnish inserts if units must be installed after concrete is placed.
 1. Except as otherwise shown, space anchors 24" o.c. and provide minimum anchor units of 1-1/4" x 1/4" x 8" steel straps.
 2. Galvanize exterior miscellaneous frames and supports.

3.7 MISCELLANEOUS STEEL TRIM:

- A. Provide shapes and sized as required for the profiles shown. Except as otherwise noted, fabricate units from structural steel shapes and plates and steel bars, with continuously welded joints and smooth exposed edges. Use concealed field splices wherever possible. Provide cut-outs, fittings, and anchorages as required for coordination of assembly and installation with other work.
- B. Galvanize exterior miscellaneous steel trim.

3.8 EXTERIOR METAL SADDLES

- A. Provide all metal door thresholds except those provided at aluminum entrances, automatic doors and elevators.
- B. Saddles shall be abrasive cast aluminum similar to style 815 S, 4" wide with a plain surface design as manufactured by American Safety Tread Co. Inc., or approved equal.
- C. Saddles shall be notched and fitted at jambs, secured with flat head counter sunk stainless steel bolts and set in a full bed of sealant compound neatly finished.

3.9 ACCESS LADDERS

- A. Provide all metal access ladders required as shown on the drawings, including but not limited to ladders in elevator pits, at elevator bulkheads, at mechanical and electrical equipment rooms and on roof's to provide access to elevated roof surfaces.
- B. Design and fabricate in accordance with OSHA and NFPA standards for width, rung spacing, rung size and depth.
- C. Provide safety cages at all exterior roof ladders that rise to an elevation higher than 6'-0".

END OF SECTION 05 50 00

SECTION 06 10 00
ROUGH CARPENTRY

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Roof-mounted curbs.
- B. Roofing nailers.
- C. Preservative treated wood materials.
- D. Communications and electrical room mounting boards.
- E. Concealed wood blocking, nailers, and supports.
- F. Miscellaneous wood nailers, furring, and grounds.

1.02 REFERENCE STANDARDS

- A. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2009.
- B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.
- C. AWPA U1 - Use Category System: User Specification for Treated Wood; American Wood Protection Association; 2012.
- D. PS 1 - Structural Plywood; 2009.
- E. PS 20 - American Softwood Lumber Standard; National Institute of Standards and Technology, Department of Commerce; 2010.
- F. SPIB (GR) - Grading Rules; Southern Pine Inspection Bureau, Inc.; 2014.

1.03 DELIVERY, STORAGE, AND HANDLING

- A. General: Cover wood products to protect against moisture. Support stacked products to prevent deformation and to allow air circulation.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

- A. Dimension Lumber: Comply with PS 20 and requirements of specified grading agencies.
 - 1. Species: Douglas Fir-Larch, unless otherwise indicated.
 - 2. Grading Agency: Any grading agency whose rules are approved by the Board of Review, American Lumber Standard Committee (www.alsc.org) and who provides grading service for the species and grade specified; provide lumber stamped with grade mark unless otherwise indicated.
- B. Lumber fabricated from old growth timber is not permitted.

2.02 DIMENSION LUMBER FOR CONCEALED APPLICATIONS

- A. Grading Agency: Southern Pine Inspection Bureau, Inc. (SPIB).
- B. Sizes: Nominal sizes as indicated on drawings, S4S.
- C. Moisture Content: S-dry or MC19.
- D. Miscellaneous Framing, Blocking, Nailers, Grounds, and Furring:
 - 1. Lumber: S4S, No. 2 or Standard Grade.
 - 2. Boards: Standard or No. 3.

2.03 CONSTRUCTION PANELS

- A. Communications and Electrical Room Mounting Boards: PS 1 A-D plywood, or medium density fiberboard; 3/4 inch thick; flame spread index of 25 or less, smoke developed index of 450 or less, when tested in accordance with ASTM E84.

2.04 ACCESSORIES

- A. Fasteners and Anchors:
 - 1. Metal and Finish: Hot-dipped galvanized steel per ASTM A 153/A 153M for high humidity and preservative-treated wood locations, unfinished steel elsewhere.

2.05 FACTORY WOOD TREATMENT

- A. Treated Lumber and Plywood: Comply with requirements of AWP A U1 - Use Category System for wood treatments determined by use categories, expected service conditions, and specific applications.
 - 1. Preservative-Treated Wood: Provide lumber and plywood marked or stamped by an ALSC-accredited testing agency, certifying level and type of treatment in accordance with AWP A standards.
- B. Preservative Treatment:
 - 1. Preservative Pressure Treatment of Lumber Above Grade: AWP A U1, Use Category UC3B, Commodity Specification A using waterborne preservative to 0.25 lb/cu ft retention.
 - a. Kiln dry lumber after treatment to maximum moisture content of 19 percent.
 - b. Treat lumber in contact with roofing or flashing.
 - c. Treat lumber in contact with masonry or concrete.

PART 3 EXECUTION

3.01 PREPARATION

- A. Coordinate installation of rough carpentry members specified in other sections.

3.02 INSTALLATION - GENERAL

- A. Select material sizes to minimize waste.
- B. Reuse scrap to the greatest extent possible; clearly separate scrap for use on site as accessory components, including: shims, bracing, and blocking.
- C. Where treated wood is used on interior, provide temporary ventilation during and immediately after installation sufficient to remove indoor air contaminants.

3.03 BLOCKING, NAILERS, AND SUPPORTS

- A. Provide framing and blocking members as indicated or as required to support finishes, fixtures, specialty items, and trim.
- B. In framed assemblies that have concealed spaces, provide solid wood fireblocking as required by applicable local code, to close concealed draft openings between floors and between top story and roof/attic space; other material acceptable to code authorities may be used in lieu of solid wood blocking.
- C. In metal stud walls, provide continuous blocking around door and window openings for anchorage of frames, securely attached to stud framing.
- D. In walls, provide blocking attached to studs as backing and support for wall-mounted items, unless item can be securely fastened to two or more studs or other method of support is explicitly indicated.
- E. Where ceiling-mounting is indicated, provide blocking and supplementary supports above ceiling, unless other method of support is explicitly indicated.
- F. Provide the following specific non-structural framing and blocking:
 - 1. Base cabinets
 - 2. Chalkboards and marker boards.

3.04 ROOF-RELATED CARPENTRY

- A. Coordinate installation of roofing carpentry with deck construction, framing of roof openings, and roofing assembly installation.
- B. Provide wood curb at all roof openings and expansion joints except where specifically indicated otherwise. Form corners by alternating lapping side members.

3.05 INSTALLATION OF CONSTRUCTION PANELS

- A. Communications and Electrical Room Mounting Boards: Secure with screws to studs with edges over firm bearing; space fasteners at maximum 24 inches on center on all edges and into studs in field of board.
1. At fire-rated walls, install board over wall board indicated as part of the fire-rated assembly.
 2. Where boards are indicated as full floor-to-ceiling height, install with long edge of board parallel to studs.
 3. Install adjacent boards without gaps.
 4. Size: 48 by 96 inches, installed horizontally at ceiling height.
 5. Locate as indicated on drawings.

END OF SECTION 06 10 00.

SECTION 06 20 00 - FINISH CARPENTRY

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

- A. General Contract Provisions and Sections of Division 1 apply to Work of this Section.

1.02 WORK SUMMARY:

- A. Work of this Section includes the following items of Work. See Drawings for scope and extent and types of work required.
 - 1. Casework and millwork with plastic laminate finish including Nurse's Station/Reception Desks, units with integral counters, worktops, counter tops, desk areas, form file and form holder units, base and wall cabinets and related drawers, doors, shelves, and solid wood trim.
 - 2. Plastic laminate vanity tops.
 - 3. Shelving.
 - 4. Base and wall cabinets.
 - 5. Cabinet hardware and adjustable shelf hardware.
 - 6. Fire treated or 16 ga. steel blocking
 - 7. Miscellaneous accessories and hardware.
 - 8. Shop finish as hereinafter specified.
 - 9. All other items of finish carpentry work as required.

1.03 RELATED WORK SPECIFIED ELSEWHERE:

- A. Section 08 11 13: Hollow Metal Doors and Frames.
- B. Section 08 14 00: Flush Wood doors.
- C. Section 09 90 00: Painting and coating.
- D. Section 09 91 23: High Performance Paintings and coating.

1.04 QUALITY ASSURANCE:

- A. Codes and Standards:
 - 1. Comply with all applicable requirements of the prevailing Building Code, latest edition.
 - 2. Standards: Comply with the applicable provision for premium grade workmanship of the "Architectural Woodwork Quality Standards and Guide

Specifications", of the Architectural Woodwork Institute (herein referred to as Standards), except as otherwise indicated.

3. Contract the fabrication and installation of finish carpentry (millwork) to a firm which has successfully produced millwork similar to the quality specified and in the quantity shown for a period of not less than 5 years.

1.05 SUBMITTALS:

- A. Manufacturer's Data: For information only, submit copies of manufacturer's specifications and installation instructions for hardware, Plastic laminates, plywood and other materials used in the fabrication of millwork, as required to show compliance with these Specifications.
- B. Shop Drawings: Submit shop drawings for millwork showing location of each item, dimensioned plans and elevations, large scale details, hardware, anchors and other components. Indicate compliance with specified standards and other specified requirements for materials and workmanship.
- C. Samples: Submit fully finished samples of the following items required in the millwork.
 1. Solid wood with finish to be specified by Interior Designer, 1 finished sample, 3/4" x 6" x 6", for each species.
 2. Plastic laminate, 1 sample, 12" square, for each type, color and surface finish.

1.06 PRODUCT DELIVERY, STORAGE AND HANDLING:

- A. Store finish carpentry materials and completed woodwork only in a dry ventilated place, protected from the weather and complying with temperature and humidity conditions specified by Standards and as required for installation areas.
- B. Protect sanded and finished surfaces from soiling and damage during handling and installation. Keep covered with polyethylene film or other protective covering.

1.07 JOB CONDITIONS:

- A. Humidity and Temperature Controls: Advise the General Contractor of requirements for maintaining heating, cooling and ventilation in installation areas as required to reach relative humidity necessary to maintain optimum moisture content specified for millwork.
- B. Determine equilibrium moisture content and maintain required temperature and relative humidity as required for a tolerance of plus or minus 1% of the specified optimum moisture content until woodwork receives specified finishes. Refer to Table 38 in Wood Handbook No. 72 of the Forest Products Laboratory or Table II in the "Guide to Wood Species Selection", AWI, for method of determining equilibrium moisture content values.
- C. Examination of Substrate and Conditions: The Contractor must examine the substrate and the conditions under which the work under this Section is to be performed, and notify the General Contractor in writing, of unsatisfactory conditions.

Do not proceed with work under this Section until unsatisfactory conditions have been corrected in an acceptable manner.

PART 2 - PRODUCTS

2.01 GENERAL MILLWORK FINISHES

- A. All exposed portions of millwork including surfaces visible when doors and drawers are closed, bottom of cases more than 4'0" above the floor and all visible members in exposed cases or behind glass doors and interior of wardrobe units, shall have a plastic laminate or wood finish (see plans for types and locations), unless otherwise indicated to receive another type of finish. In addition, all edges of doors exposed to normal view top edges and the face of the face plate or the edges of case body members exposed by open doors must be finished to match.
- B. All semi-exposed portions of millwork including those members behind opaque doors, such as shelves, divisions, interior faces of ends, case backs, drawer sides, backs and bottoms and tops of cases 6'6" or more above the floor shall be laminated with a beige high pressure plastic cabinet liner 0.030" thick, unless otherwise indicated.
- C. All concealed portions including sleeps, web frames, dust panels and other surfaces not usually visible after installation, shall not be finished & shall be of material suitable for intended use at manufacturers option.

2.02 MATERIALS AND FABRICATION - GENERAL:

- A. Optimum Moisture Content: Kiln dry millwork to an average moisture content with the 6% to 11% range, as recommended by Standards for the regional Climatic conditions involved.
- B. Plastic Laminate as manufactured by Nevamar, Formica or Wilson Art, 0.062" General Purpose Type. Color, Pattern and Texture as selected from manufacturers standard range.
- C. Measurements: Before proceeding with millwork required to be fitted to other construction, obtain measurements and verify dimensions of shop drawing details as required for accurate fit.
- D. Assemble in mill in as large units as practicable to minimize field cutting and jointing. Where necessary to fit at site, provide ample allowance for cutting and fitting.
- E. Miter joints, where shown or where required by Standards to be shop-mitered, by jointing, splicing and gluing to comply with the requirements for the specified grade.
- F. Provide scribe strips for all millwork where adjoining building walls and to accommodate varying room dimensions.
- G. Provide wood species as indicated on drawings and details.
- H. All millwork shall be constructed of fire-retardant plywood.

2.03 SHELVING:

- A. Open shelving with plastic laminate finish shall comply with the following:
 - 1. Grade: AWI Premium Grade, Section 400 as applicable.
 - 2. Plastic laminate: As manufactured by Nevamar, Formica or Wilson Art; 0.062" general purpose type.
 - 3. Color, Pattern and Texture: As selected by Architect from manufacturer's standard range.
 - 4. Core Construction: 3/4" plywood.
 - 5. All Edges: Plastic laminate matching surface. Ease exposed edges of overlap sheet.

2.04 WOOD MILLWORK:

- A. Wood and millwork with plastic laminate finish including Nurse's Station and Reception Desks, units with integral counters, worktops, countertops, desk areas, form file and form holder units, base and wall cabinets and related drawers, doors, shelves, etc., shall comply with the following:
 - 1. Grade: AWI Premium Grade, Section 400 as applicable.
 - 2. Plastic Laminate: As manufactured by Nevamar, Formica or Wilson Art; 0.062" general purpose type.
 - 3. Color, Pattern and Texture: As selected by Architect from manufacturer's standard range.
 - 4. Face Construction: "Flush overlay" type, except as otherwise indicated in which drawer fronts, doors, and fixed and removable panels conceal casework which is behind. Wood trim shall be finished as specified by Interior Designer.
 - 5. Thickness and Style: Provide 3/4" thick doors, drawer fronts and fixed panels (including thickness of plastic) except where required to be thicker by Standards; and provide flush units.
 - 6. Exposed Edges: Plastic laminate over hardwood edges matching exposed panel surfaces. Ease exposed edge of overlap sheet.
 - 7. Cut openings for equipment to be installed. Comply with equipment manufacturer's requirements. Smooth saw cut and ease edges.
 - 8. Provide tackboards where part of millwork. Tackboards shall comply with the following:

- a) Homosote board 1/2" thickness, wrapped with fabric material as specified and provided by Owner/Interior Designer.

2.05 COUNTERTOPS

- A. Plastic laminate faced countertops shall comply with the following:
 - 1. Grade: Same AWI grade as required for casework (Section 400) plastic laminate covered.
 - 2. Plastic Laminate: As manufactured by Nevamar, Formica or Wilson Art; same type as specified for casework.
 - 3. Color, Pattern and Texture: As selected by the Architect from manufacturer's standard range.
 - 4. Counter Construction: Provide back-splash and end-splash against vertical surfaces, top mounted square butt joint 4" height at counters without sinks and 6" height at counters with sinks.
 - 5. Exposed Counter Edges: Plastic laminate matching surface. Ease exposed edges of overlap sheet.
 - 6. Cut openings for equipment to be installed. Comply with equipment manufacturer's requirements, but provide internal corners of 1/8" minimum radius. Smooth saw cut and ease edges.

2.06 CABINET HARDWARE:

- A. Hardware, Cabinet and Miscellaneous: Provide hardware as required (exclusive of builders hardware) for millwork, including cabinet hardware and miscellaneous items.
 - 1. Drawer slides for standard drawers and file drawers, Grant No. 329, full extension type.
 - 2. Cabinet Door and Drawer Pulls: 5" satin chrome wire pulls; through bolted to back face.
 - 3. Hinges: Concealed hinge similar to Blum Model Series #90. All metal and open 176 degrees.

<u>Door Height</u>	<u>No. Hinges per Door</u>
0" - 36"	2
37" - 60"	3
61" - 80"	4
81" - 94"	5
 - 4. Cabinet and Door Locks: Drawers and hinged doors shall have disc tubular locks; National lock No. 68-054 with dull chrome finish; locks keyed alike and master keyed.

5. Heavy-Duty Magnetic Catches: BHMA B43172, aluminum case, Commercial grade, 11.0 lbs. minimum test pull.
6. Adjustable Shelf Supports: Provide flush-mounted pilaster-type slotted steel standards where indicated, comply with BHMA B84072. Provide matching shelf rests, BHMA B84082.

No. 255 and 256; Knappe & Vogt Manufacturing Co.
No. 798 and 799; Stanley Works.
7. Adjustable Shelf Standards: Provide standard-weight slotted aluminum standards where shown, comply with BHMA B34102.

No. 82; Knappe & Vogt Manufacturing Co.
No. 6783; Stanley Works.
8. Caps: Provide manufacturer's standard caps at top and bottom of surface-mounted standards which do not abut other surfaces.
9. Shelf Brackets: Provide standard-weight double-hook aluminum brackets of the sizes shown, complying with BHMA B34112, equal to Knappe & Vogt No. 182 or Stanley No. 6785.
10. Finish for Exposed Cabinet Hardware: US 26D or US 32D except as otherwise indicated. For items not available in required finish, provide finish selected by Architect from those available. If more than one finish is indicated, match finish of hardware items on each "Set" of casework as indicated.
11. Specialties:
 - a. See millwork elevations and details for special hardware specifications and requirements.

2.07 COAT RODS AND SUPPORTS:

- A. Hanging poles for coat closets shall be 1-1/4" dia. round steel rod Bright nickel plated with end flange. For poles 5'-0" or longer furnish clothes pole hangers of manufacturer's standard.

2.08 MISCELLANEOUS ACCESSORIES:

- A. Wood Screws: Select the material type, size and finish required for each use. Comply with FS FF-S-111 for applicable requirements. Provide stainless steel screws and grommets where indicated on the drawings.
- B. Nails: Select the material, type, and finish required for each use. Comply with FS FF-N-105 for applicable requirements.
- C. Anchors: Select the material, type, size and finish required by each substrate for secure anchorage. Provide non-ferrous metal or hot-dip galvanized anchors and inserts for exterior installations and elsewhere as required for corrosion-resistance. Provide toothed steel or lead expansion bolt devices for drilled in place anchors. Furnish inserts and anchors as required, to be set in concrete or masonry work for subsequent woodwork anchorage.

2.09 FIRE-RETARDANT TREATED WOOD:

- A. Where fire-retardant wood is shown or scheduled, provide lumber and plywood which complies with AWPAs Standards for pressure impregnation with fire-retardant chemicals to achieve a flame spread rating of not more than 25 when tested in accordance with UL Test 723, ASTM E84 or NFPA Test 355, except solid red oak members shall not be more than 30.
- B. Fire-Retardant treatment for solid oak members shall be Koppers NCX treatment. Wood shall be treated over-sized, kiln dried and milled following treatment to the required sizes. Milling operations shall be performed by Koppers or by a millwork company certified by UL. The wood shall be suitable for natural finish as determined by the Architect. Stains, sticker marks, uneven, dark, blotchy appearance will not be acceptable. Treated wood shall be guaranteed not to bleed through or adversely affect bond of finish.
- C. Kiln-dry treated woodwork to a maximum moisture content of 15% after treatment.
- D. Inspect each piece of lumber and plywood or each unit of woodwork after drying; do not use twisted, warped, bowed or otherwise damaged or defective wood.
- E. Provide UL label on each piece of fire-retardant lumber and plywood, or on each unit of woodwork.

PART 3 - EXECUTION

3.01 PREPARATION:

- A. Condition woodwork to average prevailing humidity conditions in installation areas prior to installing.

3.02 INSTALLATION:

- A. Install plumb, level, true and straight with no distortions. Shim as required using concealed shims.
- B. Cut to fit unless specified to be shop-fabricated or shop-cut to exact size. Where millwork abuts other finish work, scribe and cut for accurate fit. Before making cutouts, drill pilot holes at corners.
- C. Adjust casework and cabinet hardware so that doors and drawers operate smoothly and with tolerances as established by Standards. Lubricate operating hardware as recommended by manufacturer.
- D. Sinks
 - 1. Underside Installation: Use manufacturer's recommended adjustable support system for cabinet-type installation.
 - 2. Set top edge of sink unit firmly pressed to countertop, set in manufacturer's

recommended chemical resistant sealing compound to produce a tight and fully leak proof joint. Adjust sink and securely support to prevent movement.

3. Semi flush Installation: Use stainless sink frame, complete with clamping lugs and pads. Before setting, apply a full coat of manufacturer's recommended sealant under rim lip and along top. Omit sink frame if sink is fabricated with integral rim seal.

E. Recessed Computer Consoles.

1. Install recessed computer consoles (N.I.C.) as provided by Owner. Installation shall be in accordance with manufacturer's requirements, templates, etc. See plans for quantities and locations.

3.03 CLEANING AND PROTECTION:

- A. Repair or remove and replace defective work as directed upon completion of installation.
- B. Clean shop-finished millwork, touch-up finish as required and remove and refinish damaged or soiled areas of finish.
- C. Protection: Advise the General Contractor of procedures and precautions for protection of materials and installed millwork from damage by the work of other trades until acceptance of the work by the Owner. Advise the General Contractor of the required temperature/humidity conditions which must be maintained during the remainder of the construction period in areas of millwork installations.
 1. Protect all millwork during delivery.
 2. Cover casework with 4-mil. polyethylene film, for protection against soiling and deterioration during remainder of construction period.

END OF SECTION 06 20 00

SECTION 06 80 00 – ARCHITECTURAL WOOD CASEWORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

- A. General Contract Provisions and Sections of Division 1 apply to Work of this Section.

1.2 WORK SUMMARY:

- A. Work of this Section includes the following items of Work. See Drawings for scope and extent and types of work required.
 - 1. Fabrication of new custom millwork, casework cabinetry, base pedestals, work counters, and shelving.
 - 2. Cabinet hardware.
 - 3. Miscellaneous accessories and hardware.
- B. Hardware typically furnished by the Millworker or Finish Carpenter:
 - 1. Cabinet door hinges.
 - 2. Cabinet door and drawer pulls.
 - 3. Drawer glides.
 - 4. Door and drawer silencers.
 - 5. Tack panels associated with millwork sections.
 - 6. Cabinet door and drawer locks, when specified.
 - 7. Adjustable shelf standards, shelving brackets and/or pins.
 - 8. Coat rods, hooks, grommets or other millwork accessories required to finish scope of work.

1.3 RELATED WORK SPECIFIED ELSEWHERE:

- A. Section 09 21 16: Gypsum Board Assemblies
- B. Section 09 91 23: High Performance Paintings and Coatings.
- C. Section 09 65 00: Resilient Flooring.
- D. Section 09 90 00: Painting and coating.

1.4 QUALITY ASSURANCE:

- A. Codes and Standards:
 - 1. The Architectural Woodwork Institute's (AWI) "Quality Standards" shall apply and by reference is hereby made a part of this specification; any reference to Premium, Custom or Economy Grade shall be as defined in the latest edition thereof.
 - 2. ANSI/BHMA A156.9 – Cabinet Hardware
 - 3. Comply with all applicable requirements of the prevailing Building Code, latest edition.

4. Standards: Comply with the applicable provision for premium grade workmanship of the "Architectural Woodwork Quality Standards and Guide Specifications", of the Architectural Woodwork Institute (herein referred to as Standards), except as otherwise indicated.
5. Contract the fabrication and installation of finish carpentry (millwork) to a firm which has successfully produced millwork similar to the quality specified and, in the quantity, shown for a period of not less than 5 years.

1.5 SUBMITTALS:

- A. Manufacturer's Data: For information only, submit copies of manufacturer's specifications and installation instructions for hardware, Plastic laminates, plywood and other materials used in the fabrication of millwork, as required to show compliance with these Specifications.
- B. Shop Drawings: Submit **Field Verified** shop drawings for millwork showing location of each item, dimensioned plans and elevations, large scale details, hardware, anchors and other components. Indicate compliance with specified standards and other specified requirements for materials and workmanship.
- C. Samples: Submit fully finished samples of the following items required in the millwork.
 1. Solid wood with finish to be specified by Architect, 2 finished sample, 3/4" x 6" x 6", for each species.
 2. Plastic laminate, 2 samples, 12" square, for each type, color and surface finish.

1.6 PRODUCT DELIVERY, STORAGE AND HANDLING:

- A. Store finish carpentry materials and completed woodwork only in a dry ventilated place, protected from the weather and complying with temperature and humidity conditions specified by Standards and as required for installation areas.
- B. Protect sanded and finished surfaces from soiling and damage during handling and installation. Keep covered with polyethylene film or other protective covering.

1.7 JOB CONDITIONS:

- A. Humidity and Temperature Controls: Advise the General Contractor of requirements for maintaining heating, cooling and ventilation in installation areas as required to reach relative humidity necessary to maintain optimum moisture content specified for millwork.
- B. Determine equilibrium moisture content and maintain required temperature and relative humidity as required for a tolerance of plus or minus 1% of the specified optimum moisture content until woodwork receives specified finishes. Refer to Table 38 in Wood Handbook No. 72 of the Forest Products Laboratory or Table II in the "Guide to Wood Species Selection", AWI, for method of determining equilibrium moisture content values.

- C.** Examination of Substrate and Conditions: The Contractor must examine the substrate and the conditions under which the work under this Section is to be performed, and notify the General Contractor in writing, of unsatisfactory conditions. Do not proceed with work under this Section until unsatisfactory conditions have been corrected in an acceptable manner.

PART 2 - MATERIALS

2.1 GENERAL MILLWORK FINISHES

- A.** All finish carpentry shall be Premium Grade. Cabinetwork shall have 3/4" flush overlay doors, 3/4" 45# density particleboard. All surfaces shall be laminated with either Plastic Laminate, Clear Birch Veneer color, finish to match control sample to be provided by Architect, or Corian (or equal) Solid Surface Material. See drawings for types, configurations and locations of fabrications.
- B.** Countertops and cabinets not specified to be Solid Surface shall be of plastic laminate covered at all exposed portions. Plastic laminate as manufactured by Formica, Wilson Art, or other manuf. As selected by the Architect. Comply with NEMA Standards LD3.
- a. General purpose type GP50; nominal 0.050" thickness on horizontal and vertical surfaces.
 - b. Post forming type PF42; nominal 0.042" thickness for coved top surfaces.
 - c. Plastic Laminate Backing: High-pressure paper base laminate without a decorative finish; nominal 0.030" thick.
 - d. Adhesive: Type recommended by millwork manufacturer to suit application.
- C.** Cabinet components shall be finished in plastic laminate, covering areas exposed to view including when doors and drawers are open as determined by Architect. An acceptable finish for cabinet interiors is particleboard manufactured with a "Kortron" finish or equal.
- 1. Cut openings in plastic laminate finished tops for equipment which is installed under other Sections. Verify with the required trade exact size of opening required prior to making openings.
- D.** All counter tops in contact with wet surfaces or which are to receive a sink shall be Corian Solid Surface. Transaction tops at Nurse Stations and Reception Desks shall be Corian Solid Surface. Color to be selected by Architect.
- E.** Finish hardware and accessories required for the complete cabinet installation shall be furnished by this Section.

2.2 MATERIALS AND FABRICATION - GENERAL

- A.** Wood Treatment:
 - a. Optimum Moisture Content: Kiln dry millwork to an average moisture content with the 6% to 11% range, as recommended by Standards for the regional Climatic conditions involved.
 - b. Fire Retardant: Provide lumber and plywood which is fire retardant treated and pressure-treated to comply with the requirements of flame spread rating not greater than 25 when tested for a period of not less than 30 minutes without evidence of significant progressive combustion in accordance with the standard test method for surface-burning characteristics of building materials (ASTM E84, NFPA 255, UL 723, AWWA C-20 and C-27). Each piece of wood shall be UL-labeled showing compliance with the flame spread classification. Following treatment, fire retardant treated wood shall be kiln dried to a moisture content of 19% or less for lumber and 15% or less for plywood. Surfaces cut after treatment shall receive a heavy brush coating of the same fire retardant material.
 - c. Use marine-grade plywood as substrate when counter has or is adjacent to a sink or wet location.
- B.** Plastic Laminate: Manufactured by Formica or Wilson Art, or Nevamar 0.062" General Purpose Type. Color, Pattern and Texture as selected from manufacturers standard or premium range. Refer to Architectural drawings for additional information. Assume no custom color/textures will be used. Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Corners and joints: hairline.
- C.** Measurements: Before proceeding with millwork required to be fitted to other construction, obtain measurements and verify dimensions of shop drawing details as required for accurate fit.
- D.** Assemble in mill in as large units as practicable to minimize field cutting and jointing. Where necessary to fit at site, provide ample allowance for cutting and fitting.
- E.** Miter joints, where shown or where required by Standards to be shop-mitered, by jointing, splicing and gluing to comply with the requirements for the specified grade.
- F.** Provide scribe strips for all millwork where adjoining building walls and to accommodate varying room dimensions.
- G.** All exposed portions of millwork including surfaces visible when doors and drawers are closed, bottom of cases more than 4'0" above the floor and all visible members in exposed cases or behind glass doors and interior of wardrobe units, shall have a plastic laminate or melamine finish (see drawings for types and locations), unless otherwise indicated to receive another type of finish. In addition, all edges of doors exposed to normal view top edges and the face of the face plate or the edges of case body members exposed by open doors must be finished to match in a vinyl edge banding.

2.3 SHELVING

- A. Open shelving with plastic laminate finish shall comply with the following:
 - 1. Grade: AWI Premium Grade, Section 400 as applicable.
 - 2. Core Construction: 3/4" fire-retardant plywood.
 - 3. Provide Knappe and Vogt Co., KV 255 standards with KV 256 support, and KV 87 standard with KV 186 or KV 187 support as required, including center supports.
 - 4. Exposed Edges: 3mm vinyl edge-banding around all perimeter edges. Color and texture to match adjacent laminate.

2.4 MILLWORK

- A. Custom architectural millwork shall comply with the following:
 - 1. Grade: AWI Premium Grade, Section 400 as applicable.
 - 2. Face Construction: "Flush overlay" type, except as otherwise indicated in which drawer fronts, doors, and fixed and removable panels conceal casework which is behind. Wood trim shall be finished as specified by Interior Designer.
 - 3. Thickness and Style: Provide 3/4" thick doors, drawer fronts and fixed panels (including thickness of plastic) except where required to be thicker by Standards; and provide flush units.
 - 4. Exposed Edges: Vinyl edge-banding around all perimeter edges. Color and texture to match shelf.
 - 5. Cut openings for equipment to be installed. Comply with equipment manufacturer's requirements. Smooth saw cut and ease edges.
 - 6. Provide tackboards where part of millwork. Tackboards shall comply with the following:

2.5 PLASTIC LAMINATE COUNTERTOPS

- A. Plastic laminate faced countertops shall comply with the following:
 - 1. Grade: Same AWI grade as required for casework (Section 400) plastic laminate covered.
 - 2. Counter Construction: Plastic Laminate bonded to fire retardant plywood using the manufacture's recommended adhesive and installation instructions. Refer to millwork detail drawings for specific edge conditions.

3. Provide 4" backsplash and sidesplash against all vertical surfaces. Bond to finished gypsum wallboard using manufactures recommended adhesive and installation instructions. Calk top and side edges with paintable calking.
4. Exposed Counter Edges: Provide cut-in vinyl edge moulding at counter egdes. Finial profile and color to be selected by Architect.
5. Cut openings for equipment to be installed. Comply with equipment manufacturer's requirements, but provide internal corners of 1/8" minimum radius. Smooth saw cut and ease edges.
6. Millwork contractor to coordinate grommet locations with Architect and Owner at time of installation. Refer to the Architectural drawings enlarged plans for equipment locations.

2.6 SOLID SURFACE COUNTERTOPS

A. Solid Surface faced countertops shall comply with the following:

1. Solid Surface: As manufactured by Dupont Corian or Avonite.
2. Color, Pattern and Texture: As selected by the Architect from the manufacture's standard or premium color range.
3. Counter Construction: 1/2" Solid Surface material bonded to fire retardant plywood using the manufacture's recommended adhesive and installation instructions. Edges shall have built up edge of 1-1/2" solid surface material. Refer to millwork detail for edge conditions.
4. Provide 4" backsplash and sidesplash against all vertical surfaces. Bond to finished gypsum wallboard using manufactures recommended adhesive and installation instructions. Calk top and side edges with paintable calking.
5. Openings: Openings in the counter for "trash drop-through units" shall be lined with 1/2" solid surface material. This is typical unless a grommet is identified in the drawings.
6. Millwork contractor to coordinate grommet locations with Architect and Owner at time of installation.
7. Cut openings for equipment to be installed. Comply with equipment manufacturer's requirements, but provide internal corners of 1/8" minimum radius. Smooth saw cut and ease edges.

2.6 CABINET HARDWARE:

- A.** Hardware, Cabinet and Miscellaneous: Provide hardware as required (exclusive of builders hardware) for millwork, including cabinet hardware and miscellaneous items.

1. Drawer slides for standard drawers and file drawers, Grant No. 329, full extension type.
2. Cabinet Door and Drawer Pulls: 5" satin chrome wire pulls; through bolted to back face.
3. Hinges: Concealed hinge similar to Blum Model Series #90. All metal and open 176 degrees.

<u>Door Height</u>	<u>No. Hinges per Door</u>
0" - 36"	2
37" - 60"	3
61" - 80"	4
81" - 94"	5

4. Cabinet and Door Locks: Drawers and hinged doors shall have disc tubular locks; National lock No. 68-054 with dull chrome finish; locks keyed alike and master keyed.
5. Heavy-Duty Magnetic Catches: BHMA B43172, aluminum case, Commercial grade, 11.0 lbs. minimum test pull.
6. Adjustable Shelf Supports: Provide flush-mounted pilaster-type slotted steel standards where indicated, comply with BHMA B84072. Provide matching shelf rests, BHMA B84082.

No. 255 and 256; Knappe & Vogt Manufacturing Co.
No. 798 and 799; Stanley Works.

7. Adjustable Shelf Standards: Provide standard-weight slotted aluminum standards where shown, comply with BHMA B34102.

No. 82; Knappe & Vogt Manufacturing Co.
No. 6783; Stanley Works.

8. Caps: Provide manufacturer's standard caps at top and bottom of surface-mounted standards which do not abut other surfaces.
9. Shelf Brackets: Provide standard-weight double-hook aluminum brackets of the sizes shown, complying with BHMA B34112, equal to Knappe & Vogt No. 182 or Stanley No. 6785.
10. Finish for Exposed Cabinet Hardware: US 26D or US 32D except as otherwise indicated. For items not available in required finish, provide finish selected by Architect from those available. If more than one finish is indicated, match finish of hardware items on each "Set" of casework as indicated.

11. Specialties:

- a. See millwork elevations and details for special hardware specifications and requirements.

2.7 COAT RODS AND SUPPORTS:

- A. Hanging poles for coat closets shall be 1-1/4" dia. round steel rod Bright nickel plated with end flange. For poles 5'-0" or longer furnish clothes pole hangers of manufacturer's standard.

2.8 MISCELLANEOUS ACCESSORIES:

- A. Wood Screws: Select the material type, size and finish required for each use. Comply with FS FF-S-111 for applicable requirements. Provide stainless steel screws and grommets where indicated on the drawings.
- B. Fasteners & Anchorages: Hardened steel for nails, expansion screws, toggle bolts, self-clinching nails, metal plugs, inserts and other anchorages. Size and type best suited to conditions. Fastening to wooden plugs in masonry or concrete will not be permitted.
- C. Nails: Select the material, type, and finish required for each use. Comply with FS FF-N-105 for applicable requirements.
- D. Anchors: Select the material, type, size and finish required by each substrate for secure anchorage. Provide non-ferrous metal or hot-dip galvanized anchors and inserts for exterior installations and elsewhere as required for corrosion-resistance. Provide toothed steel or lead expansion bolt devices for drilled in place anchors. Furnish inserts and anchors as required, to be set in concrete or masonry work for subsequent woodwork anchorage.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Condition woodwork to average prevailing humidity conditions in installation areas prior to installing.
- B. Verify adequacy of backing and support framing.
- C. Verify mechanical, electrical, and building items affecting work of this section.

3.2 INSTALLATION

- A. Install work in accordance with AWI Premium Quality Standards.

- B.** Scribe work abutting other components with maximum gap of 1/32 inch.
- C.** Set and secure materials and components in place, plumb and level.
- D.** Install plumb, level, true and straight with no distortions. Shim as required using concealed shims.
- E.** Cut to fit unless specified to be shop-fabricated or shop-cut to exact size. Where millwork abuts other finish work, scribe and cut for accurate fit. Before making cutouts, drill pilot holes at corners.
- F.** Adjust casework and cabinet hardware so that doors and drawers operate smoothly and with tolerances as established by Standards. Lubricate operating hardware as recommended by manufacturer.
- G.** Adjust all doors hinges, drawer glides, door/drawer silencers so that all moving parts are functioning as per manufactures recommendations.
- H.** Metal Sinks
 - 1.** Underside Installation: Use manufacturer's recommended adjustable support system for cabinet-type installation.
 - a.** Set top edge of sink unit firmly pressed to countertop, set in manufacturer's recommended chemical resistant sealing compound to produce a tight and fully leak proof joint. Adjust sink and securely support to prevent movement.
 - 2.** Semi flush Installation: Use stainless sink frame, complete with clamping lugs and pads. Before setting, apply a full coat of manufacturer's recommended sealant under rim lip and along top. Omit sink frame if sink is fabricated with integral rim seal.
- I.** Integral Solid Surface Sinks
 - 1.** Adhere sink/bowl to countertops using manufacturer recommended adhesives and color coordinate silicone sealant. Secure seam mount bowls and sinks to counter tops using color matched joint adhesive.
- J.** Wood Grounds, Nailers and Blocking:
 - 1.** Provide wherever shown and where required for attachment of other work. Form to shapes as shown and cut as required for true line and level of work to be attached. Coordinate location with other work involved.
 - 2.** Attach to substrates as required supporting applied loading. Countersink bolts and nuts flush with surfaces, unless otherwise shown.

3.3 CLEANING AND PROTECTION

- A.** Repair or remove and replace defective work as directed upon completion of installation.

- B.** Clean shop-finished millwork, touch-up finish as required and remove and refinish damaged or soiled areas of finish.
- C.** Protection: Advise the General Contractor of procedures and precautions for protection of materials and installed millwork from damage by the work of other trades until acceptance of the work by the Owner. Advise the General Contractor of the required temperature/humidity conditions which must be maintained during the remainder of the construction period in areas of millwork installations.
 - 1. Protect all millwork during delivery.
 - 2. Cover casework with 4-mil. polyethylene film, for protection against soiling and deterioration during remainder of construction period.

END OF SECTION 06 41 00

SECTION 07 1410
UNDER-TILE FLUID-APPLIED
WATERPROOFING

PART1 GENERAL

1.01 SECTION INCLUDES

- A. Fluid applied membrane waterproofing.

1.02 RELATED REQUIREMENTS

- A. Section 03 3000 - Cast-in-Place Concrete: Concrete substrate.
- B. Section 04 2001 - Masonry Veneer: Backer Rod
- C. Section 09 2116 - Gypsum Board Assemblies: Cementitious Backer Board for Tile Installations
- D. Section 22 1006 - Plumbing Piping Specialties: Roof drain and plumbing vent flashing flanges.

1.03 REFERENCE STANDARDS

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data for membrane and joint and crack sealants.
- C. Manufacturer's Installation Instructions: Indicates special procedures, perimeter conditions requiring special attention, and acceptable installation temperatures.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacture of fluid-applied waterproofing membranes with three years experience.
- B. Installer Qualifications: Company specializing in installation of fluid-applied waterproofing with minimum 10 years experience.

1.06 FIELD CONDITIONS

- A. Maintain ambient temperatures above 40 degrees F for 24 hours before and during application and until cured.

1.07 WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Contractor shall correct defective Work within a five year period after Date of Substantial Completion; remove and replace materials concealing waterproofing at no cost to Owner.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Cold-Applied, single component, self-curing liquid rubber polymer
 - 1. Manufacturer:
 - a. Laticrete International, Inc.
 - b. One Laticrete Park North, Bethany, CT 06524-3423
 - c. 1-800-243-4788
 - 2. Substitutions: See Section 01 6000 - Product Requirements

2.02 MEMBRANE AND FLASHING MATERIALS

- A. Under-Tile Waterproofing and Anti-Fracture Membrane: Specifically designed for bonding to concrete, backer boards, and plywood under ceramic tile; complying with ANSI A118.10.
 - 1. Basis of Design: Hydro Ban manufactured by Laticrete International, Inc..
 - 2. Material: Fluid-applied rubber polymer membrane, 20-30 mils thick (dried)
 - 3. ICC-ES approved.
 - 4. IAPMO approved.
 - 5. Products:
 - a. Hydro Ban; as manufactured by Laticrete International, Inc..

2.03 ACCESSORIES

- A. Substrate Crack Filler: Latex-Modified Thin Set mortar, as specified in Section 09 3000 - Tiling
- B. Backer Rod: closed-cell foam as specified in Section 04 2001 - Masonry Veneer
- C. Sealant: High performance, one component, neutral cure, 100% silicone sealant for ceramic tile and stone applications.
 - 1. Latasil, as manufactured by Laticrete International, Inc.
 - 2. Substitutions: See Section 01 6000 - Product Requirements

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify substrate surfaces are free of frozen matter, dampness, loose particles, cracks, pits, projections, penetrations, or foreign matter detrimental to adhesion or application of waterproofing system.
- C. Verify that substrate surfaces are smooth, free of honeycomb or pitting, and not detrimental to full contact bond of waterproofing materials.
- D. Verify that items that penetrate surfaces to receive waterproofing are securely installed.

3.02 PREPARATION

- A. Protect adjacent surfaces not designated to receive waterproofing.
- B. Clean and prepare surfaces to receive waterproofing in accordance with manufacturer's instructions. Vacuum substrate clean.
- C. Do not apply waterproofing to surfaces unacceptable to manufacturer.
- D. Fill substrate cracks using methods recommended by waterproofing manufacturer.

3.03 INSTALLATION

- A. Pre-treat cracks, joints, corners, coves, drains, and penetration surfaces in accordance with manufacturer's instructions.
- B. Apply waterproofing in accordance with manufacturer's instructions to specified minimum thickness.
- C. Unless otherwise indicated, all floors and walls within the shower area shall be waterproofed.
- D. Apply extra thickness of waterproofing material at corners, intersections, and angles.
- E. Extend waterproofing material into drain clamp flange, apply adequate coating of liquid membrane to assure clamp ring seal. Coordinate with drain installation in Division 15 - Plumbing.
- F. Seal membrane and flashings to adjoining surfaces.

END OF SECTION

SECTION 07 21 00
THERMAL INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Board insulation and integral vapor retarder None - N/A at cavity wall construction, perimeter foundation wall, underside of floor slabs, over roof deck, and exterior wall behind metal panel wall finish.
- B. Batt insulation and vapor retarder in exterior wall, ceiling, and roof construction.
- C. Batt insulation for filling perimeter window and door shim spaces and crevices in exterior wall and roof.

1.02 RELATED REQUIREMENTS

- A. Section 03 30 00 - Cast-in-Place Concrete: Under-slab and foundation wall insulation installation. Field-applied termiticide for concrete slabs and foundation.
- B. Section 05 40 00 - Cold-Formed Metal Framing: Board insulation as wall sheathing.
- C. Section 06 05 73 - Wood Treatment: Field-applied termiticide for wood.
- C. Section 07 25 00 - Weather Barriers: Separate air barrier and vapor retarder materials.
- D. Section 07 84 00 - Firestopping: Insulation as part of fire-rated through-penetration assemblies.
- E. Section 09 21 16 - Gypsum Board Assemblies: Acoustic insulation inside walls and partitions.
- F. Section 09 51 00 - Acoustical Ceilings: Acoustic insulation above acoustical ceilings

1.03 REFERENCE STANDARDS

- A. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation; 2015a.
- B. ASTM C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board; 2014.
- C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.
- D. ASTM E136 - Standard Test Method for Behavior of Materials in a Vertical Tube Furnace At 750 Degrees C; 2012.
- E. ASTM E2357 - Standard Test Method for Determining Air Leakage of Air Barrier Assemblies; 2011.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on product characteristics, performance criteria, and product limitations.

1.05 FIELD CONDITIONS

- A. Do not install insulation adhesives when temperature or weather conditions are detrimental to successful installation.

PART 2 PRODUCTS

2.01 APPLICATIONS

- A. Insulation Under Concrete Slabs: Extruded polystyrene board.
- B. Insulation at Perimeter of Foundation: Extruded polystyrene board.
- C. Insulation Inside Prefabricated Wall Panels: Extruded polystyrene board.
- D. Insulation Over Metal Stud Framed Walls, Continuous: Extruded polystyrene board.

- E. Insulation in Metal Framed Walls: Batt insulation with no vapor retarder.
- F. Insulation Over Roof Deck: Polyisocyanurate board.
- G. Insulation in Metal Roof Trusses and Roof Joist Framing: Batt insulation and netting system with no vapor retarder

2.02 FOAM BOARD INSULATION MATERIALS

- A. Termite-resistant Extruded Polystyrene Board Insulation: Extruded polystyrene board; ASTM C578; with either natural skin or cut cell surfaces, and the following characteristics:
 - 1. Flame Spread Index: 25 or less, when tested in accordance with ASTM E84.
 - 2. Smoke Developed Index: 450 or less, when tested in accordance with ASTM E84.
 - 3. Board Thickness: 2 inches.
 - 4. R-value; 2 inch of material at 72 degrees F: 10, minimum.
 - 5. Board Edges: Square.
 - 6. Manufacturers:
 - a. Nisus Corporation; Bora Foam: www.nisuscorp.com.
 - 7. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Polyisocyanurate Board Insulation with Facers Both Sides: Rigid cellular foam, complying with ASTM C1289; Type I, aluminum foil both faces; Class 1, non-reinforced foam core.
 - 1. Flame Spread Index: 25 or less, when tested in accordance with ASTM E84.
 - 2. Smoke Developed Index: 450 or less, when tested in accordance with ASTM E84.
 - 3. Board Size: 48 by 96 inch.
 - 4. Total Roof Thermal Resistance: Refer to construction drawings & energy ComCheck.
 - 5. Board Edges: Square.
 - 6. Manufacturers:
 - a. Dow Chemical Co: www.dow.com.
 - 7. Substitutions: See Section 01 60 00 - Product Requirements.

2.03 BATT INSULATION MATERIALS

- A. Where batt insulation is indicated, either glass fiber or mineral fiber batt insulation may be used, at Contractor's option.
- B. Glass Fiber Batt Insulation: Flexible preformed batt or blanket, complying with ASTM C665; friction fit.
 - 1. Combustibility: Non-combustible, when tested in accordance with ASTM E136.
 - 2. Thermal Resistance: Refer to construction drawings & energy ComCheck.
 - 3. Manufacturers:
 - a. CertainTeed Corporation: www.certainteed.com.
 - 4. Substitutions: See Section 01 60 00 - Product Requirements.
- C. Mineral Fiber Batt Insulation: Flexible preformed batt or blanket, complying with ASTM C665; friction fit; unfaced flame spread index of 0 (zero) when tested in accordance with ASTM E84.
 - 1. Smoke Developed Index: 0 (zero), when tested in accordance with ASTM E84.
 - 2. Thermal Resistance: Refer to construction drawings & energy ComCheck.
 - 3. Manufacturers:
 - a. Thermafiber, Inc.; SAFB: www.thermafiber.com.

2.04 ACCESSORIES

- A. Tape: Bright aluminum self-adhering type, mesh reinforced, 2 inch wide.
- B. Tape joints of rigid insulation in accordance with roofing and insulation manufacturers' instructions.
- C. Insulation Fasteners: Impaling clip of unfinished steel with washer retainer and clips, to be adhered to surface to receive insulation, length to suit insulation thickness and substrate, capable of securely and rigidly fastening insulation in place.
- D. Wire Mesh: Galvanized steel, hexagonal wire mesh.
- E. Adhesive: Type recommended by insulation manufacturer for application.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that substrate, adjacent materials, and insulation materials are dry and that substrates are ready to receive insulation.
- B. Verify substrate surfaces are flat, free of honeycomb, fins, irregularities, or materials or substances that may impede adhesive bond.

3.02 BOARD INSTALLATION AT FOUNDATION PERIMETER

- A. Adhere a 6 inch wide strip of polyethylene sheet over construction, control, and expansion joints with double beads of ____ adhesive each side of joint.
- B. Apply adhesive to back of boards:
 - 1. Three continuous beads per board length.
- C. Install boards horizontally on foundation perimeter.
 - 1. Place boards to maximize adhesive contact.
 - 2. Install in running bond pattern.
 - 3. Butt edges and ends tightly to adjacent boards and to protrusions.
- D. Extend boards over expansion joints, unbonded to foundation on one side of joint.
- E. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

3.03 BOARD INSTALLATION AT EXTERIOR WALLS

- A. Adhere a 6 inch wide strip of polyethylene sheet over expansion joints with double beads of adhesive each side of joint.
- B. Apply adhesive to back of boards:
 - 1. Three continuous beads per board length.
- C. Install rigid insulation directly to steel studs or exterior grade sheathing at 16 inches on center with manufacturer recommended mechanical fasteners. Tape all joints with manufacturer's minimum 4 inch wide sealant tape; comply with ASTM E2357.
- D. Install boards horizontally on walls.
 - 1. Place boards to maximize adhesive contact.
 - 2. Install in running bond pattern.
 - 3. Butt edges and ends tightly to adjacent boards and to protrusions.
- E. Extend boards over expansion joints, unbonded to wall on one side of joint.
- F. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.
- G. Tape insulation board joints.

3.04 BOARD INSTALLATION UNDER CONCRETE SLABS

- A. Place insulation under slabs on grade after base for slab has been compacted.
- B. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.
- C. Prevent insulation from being displaced or damaged while placing vapor retarder and placing slab.

3.05 BOARD INSTALLATION OVER LOW SLOPE ROOF DECK

- A. Installation of board insulation over low slope roof deck is specified in Section _____.

3.06 BATT INSTALLATION

- A. Install insulation and vapor retarder in accordance with manufacturer's instructions.
- B. Install in exterior wall, ceiling, and soffit spaces without gaps or voids. Do not compress insulation.
- C. Trim insulation neatly to fit spaces. Insulate miscellaneous gaps and voids.
- D. Fit insulation tightly in cavities and tightly to exterior side of mechanical and electrical services within the plane of the insulation.

- E. Retain insulation batts in place with wire mesh secured to framing members.
- F. Coordinate work of this section with construction of air barrier seal specified in Section 07 25 00.

END OF SECTION

**SECTION 07 25 00
WEATHER BARRIER**

PART 1 GENERAL

1.1 RELATED REQUIREMENTS

- A. Section 03 30 00 - Cast-In-Place Concrete: Vapor retarder under concrete slabs on grade.
- B. Section 07 24 19 – Water-Drainage Exterior Insulation and Finish System: Vapor retarder installed behind the EIFs system.
- C. Section 07 42 14 – Fascia Panels: Vapor retarder installed as part of siding system.
- D. Section 07 41 13 - Metal Roof Panels: Vapor retarder installed as part of roofing system.

1.2 DEFINITIONS

- A. Weather Barrier: Assemblies that form either water-resistive barriers, air barriers, or vapor retarders.
- B. Air Barrier: Air tight barrier made of material that is relatively air impermeable but water vapor permeable, both to the degree specified, with sealed seams and with sealed joints to adjacent surfaces. Note: For the purposes of this specification, vapor impermeable air barriers are classified as vapor retarders.
- C. Vapor Retarder: Air tight barrier made of material that is relatively water vapor impermeable, to the degree specified, with sealed seams and with sealed joints to adjacent surfaces.
 - 1. Water Vapor Permeance: For purposes of conversion, $57.2 \text{ ng}/(\text{Pa s sq m}) = 1 \text{ perm}$.
- D. Water-Resistive Barrier: Water-shedding barrier made of material that is moisture-resistant, to the degree specified, intended to be installed to shed water without sealed seams.

1.3 REFERENCE STANDARDS

- A. ASTM D1970/D1970M - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection; 2013.
- B. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2013.
- C. ASTM E2178 - Standard Test Method for Air Permeance of Building Materials; 2013.

1.4 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on material characteristics.

PART 2 PRODUCTS

2.1 WEATHER BARRIER ASSEMBLIES

- A. Exterior Vapor Retarder, Air Barrier and Water-Resistive:
 - 1. On outside surface of sheathing use vapor retarder sheet, self-adhesive type.
 - 2. On underside of elevated floors over enclosed soffit space use vapor retarder sheet, self-adhesive type.

2.2 VAPOR RETARDER MATERIALS (AIR BARRIER AND WATER-RESISTIVE)

- A. Vapor Retarder Sheet : ASTM D1970.
 - 1. Type: Rubberized asphalt bonded to thermoplastic sheet, self-adhesive.
 - 2. Thickness: 40 mil (0.040 inch), nominal.
 - 3. Water Vapor Permeance: 0.08 perm, maximum, when tested in accordance with ASTM E96/E96M A, desiccant method.
 - 4. Products:
 - a. Carlisle Coatings and Waterproofing, Inc.; CCW-705 Air and Vapor Barrier Sheet: www.carlisle-ccw.com.
 - b. Substitutions: See Section 01 60 00 - Product Requirements.

2.3 SEALANTS

- A. Primers, Cleaners, and Other Sealant Materials: As recommended by air barrier/vapor retarder manufacturer, appropriate to application, and compatible with adjacent materials.

2.4 ADHESIVES

- A. Contact Adhesive - Type which is compatible with air barrier/vapor retarder membrane sheet and recommended by manufacturer of same, appropriate to application, and compatible with adjacent materials.

2.5 ACCESSORIES

- A. Flexible Flashing: Self-adhesive sheet flashing complying with ASTM D1970, except slip resistance requirement is waived if not installed on a roof.
 - 1. Composition: Any material that meets physical requirements of ASTM D1970 with exceptions indicated.
 - 2. Thickness: 40 mil (0.040 inch), nominal.
 - 3. Products:
 - a. DuPont Building Innovations; FlexWrap NF: www.dupont.com.
 - b. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Thinners and Cleaners: As recommended by material manufacturer.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that surfaces and conditions are ready to accept the work of this section.

3.2 PREPARATION

- A. Remove projections, protruding fasteners, and loose or foreign matter that might interfere with proper installation.
- B. Clean and prime substrate surfaces to receive adhesives in accordance with manufacturer's instructions.

3.3 INSTALLATION

- A. Install materials in accordance with manufacturer's instructions.
- B. Vapor Retarders: Install continuous air tight barrier over surfaces indicated, with sealed seams and with sealed joints to adjacent surfaces.
- C. Apply sealants and adhesives within recommended application temperature ranges.

Consult manufacturer if temperature is out of this range.

D. Self-Adhesive Sheets:

1. Prepare substrate in manner recommended by sheet manufacturer; fill and tape joints in substrate and between dissimilar materials.
2. Lap sheets shingle-fashion to shed water and seal laps air tight.
3. Once sheets are in place, press firmly into substrate with resilient hand roller; ensure that all laps are firmly adhered with no gaps or fishmouths.
4. Use same material, or other material approved by sheet manufacturer for the purpose, to seal to adjacent construction and as flashing.
5. At wide joints, provide extra flexible membrane allowing joint movement.

E. Openings and Penetrations in Exterior Weather Barriers:

1. Install flashing over sills, covering entire sill frame member, extending at least 5 inches onto weather barrier and at least 6 inches up jambs; mechanically fasten stretched edges.
2. At openings to be filled with frames having nailing flanges, seal head and jamb flanges using a continuous bead of sealant compressed by flange and cover flanges with at least 4 inches wide; do not seal sill flange.
3. At openings to be filled with non-flanged frames, seal weather barrier to all sides of opening framing, using flashing at least 9 inches wide, covering entire depth of framing.
4. At head of openings, install flashing under weather barrier extending at least 2 inches beyond face of jambs; seal weather barrier to flashing.
5. At interior face of openings, seal gap between window/door frame and rough framing, using joint sealant over backer rod.
6. Service and Other Penetrations: Form flashing around penetrating item and seal to weather barrier surface.

3.4 FIELD QUALITY CONTROL

- A. Do not cover installed weather barriers until required inspections have been completed.
- B. Obtain approval of installation procedures by the weather barrier manufacturer based on a mock-up installed in place, prior to proceeding with remainder of installation.

3.5 PROTECTION

- A. Do not leave materials exposed to weather longer than recommended by manufacturer.

END OF SECTION

Metal Wall Panels

Section 07 42 13

PART 1: GENERAL

1.01 SCOPE

A. SECTION INCLUDES

1. The extent of panel system work and integrated sunscreen louvers is indicated on the drawings and in these specifications.
2. System requirements include the following components:
 - a. Aluminum faced composite panels with mounting system. Panel mounting system including anchorages, shims, furring, fasteners, gaskets and sealants, related flashing adapters, and masking (as required) for a complete watertight installation.
 - b. Eave/rake coping/flashing, fascia panels, soffits, border, and filler items indicated as integral components of the panel system or as designed as required for a complete watertight installation.

B. RELATED DOCUMENTS

Drawings and general provisions of the Contract, including General and Supplementary Conditions, Division 1 Specification Sections, and Technical Specification Divisions 2 through 16 apply to this Section.

C. RELATED WORK SPECIFIED ELSEWHERE

1. Section 05 40 00: Cold-formed Metal Framing
2. Section 07 21 00: Thermal Insulation
3. Section 07 60 00: Flashing and Sheet Metal
4. Section 07 92 00: Joint Sealants
5. Section 09 20 00: Plaster and Gypsum Board

1.02 QUALITY ASSURANCE

1. Composite Panel Manufacturer shall have a minimum of 20 years experience in the manufacturing of this product.
2. Composite Panel Manufacturer shall be solely responsible for panel manufacture and application of the finish.
3. Fabricator/installer shall be acceptable to the composite panel manufacturer.
4. Fabricator/Installer shall have a minimum 5 years experience of metal panel work similar in scope and size to this project.
5. Field measurements should be taken prior to the completion of shop fabrication whenever possible. However, coordinate fabrication schedule with construction progress as directed by the Contractor to avoid delay of work. Field fabrication may be allowed to ensure proper fit. However, field fabrication shall be kept to an absolute minimum with the majority of the fabrication being done under controlled shop conditions.
6. Shop drawings shall show the preferred joint details providing a watertight and structurally sound wall panel system that allows no uncontrolled water penetration on the inside face of the panel system as determined by ASTM E 331. Systems not utilizing a construction sealant at the panel joints (i.e. Rout and Return Dry and Rear Ventilated System) shall

provide a means of concealed drainage with baffles and weeps for water which may accumulate in members of the system.

7. Maximum deviation from vertical and horizontal alignment of erected panels: 6mm (1/4") in 6m (20') non-accumulative.
8. Panel fabricator/installer shall assume undivided responsibility for all components of the exterior panel system including, but not limited to attachment to sub-construction, panel-to-panel joinery, panel to dissimilar material joinery, and joint seal associated with the panel system and vertical sunscreen louvers.
9. Composite panel manufacturer shall have established a Certification Program acceptable to the local Code Authorities.

1.03 REFERENCES

A. ALUMINUM ASSOCIATION

1. AA-C22-A41: Anodized - Clear Coatings.
2. AA-C22-A42: Anodized - Integral Color Coatings.

B. AMERICAN ARCHITECTURAL MANUFACTURERS ASSOCIATION

1. AAMA 508-05: Voluntary Test Method and Specification for Pressure Equalized Rain Screen Wall Cladding Systems

C. AMERICAN SOCIETY FOR TESTING AND MATERIALS

1. E 330 Structural Performance of Exterior Windows, Curtain Walls, and Doors Under the Influence of Wind Loads
2. E 283 Rate of Leakage through Exterior Windows, Curtain Walls, and Doors
3. D 1781 Climbing Drum Peel Test for Adhesives
4. E 84 Surface Burning Characteristics of Building Materials
5. D 3363 Method for Film Hardness by Pencil Test
6. D 2794 Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact)
7. D 3359 Methods for Measuring Adhesion by Tape Test
8. D 2247 Practice for Testing Water Resistance of Coatings in 100% Relative Humidity
9. B 117 Method of Salt Spray (Fog) Testing
10. D 822 Practice for Operating Light and Water Exposure Apparatus (Carbon-Arc Type) for Testing Paint, Varnish, Lacquer, and Related Products
11. D 1308 Effect of Household Chemicals on Clear and Pigmented Organic Finishes
12. D 1735 Method for Water Fog Testing of Organic Coatings.
13. D 1929 Standard Test Method for Determining Ignition Temperature of Plastics
14. D 635 Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position

1.04 SUBMITTALS

A. SUBMITTALS SHALL BE IN CONFORMANCE WITH DIVISION 1

B. SAMPLES

1. Panel System Assembly: Two samples of each type of assembly. 304mm (12") x 304mm (12") minimum.
2. Two samples of each color or finish selected, 76mm (3") x 102mm (4") minimum.

C. SHOP DRAWINGS

Submit shop drawings showing project layout and elevations; fastening and anchoring methods; detail and location of joints, sealants, and gaskets, including joints necessary to accommodate thermal movement; trim; flashing; and accessories.

D. AFFIDAVIT CERTIFYING MATERIAL MEETS REQUIREMENTS SPECIFIED.

E. TWO COPIES OF MANUFACTURER'S LITERATURE FOR PANEL MATERIAL.

F. CODE COMPLIANCE

Documents showing product compliance with the national and local building code shall be submitted prior to the bid. These documents shall include, but not be limited to, appropriate Evaluation Reports and/or test reports supporting the use of the product.

G. ALTERNATE MATERIALS MUST BE APPROVED BY THE ARCHITECT PRIOR TO THE BID DATE.

1.05 DELIVERY, STORAGE AND HANDLING

1. Protect finish and edges in accordance with panel manufacturer's recommendations.
2. Store material in accordance with panel manufacturer's recommendations.

PART 2: PRODUCTS

2.01 PANELS

A. COMPOSITE PANELS

1. ALUCOBOND material manufactured by 3A Composites USA, Inc. 208 West 5th Street, Benton, KY 42025 (800-626-3365 or 270-527-4200)
2. Items of the same function and performance, which have received prior approval from the architect, shall be allowed for this project. Approval shall be based on documentation submitted showing the adequacy of the material.

B. THICKNESS: 4MM (0.157")

C. PRODUCT PERFORMANCE

1. Bond Integrity
When tested for bond integrity, in accordance with ASTM D1781 (simulating resistance to panel delamination), there shall be no adhesive failure of the bond a) between the core and the skin nor b) cohesive failure of the core itself below the following values:

Peel Strength: 115 N mm/mm (22.5 in lb/in) as manufactured

115 N mm/mm (22.5 in lb/in) after 21 days soaking in water at 70°F

2. Fire Performance

ASTM E 84 Flame Spread Index must be less than 25, Smoke Developed Index must be less than 450.

ASTM D 1929 A self ignition temperature of 650°F or greater

ASTM D-635 Requires a CC1 classification

D. FINISHES

1. Coil coated KYNAR® 500

a. Color:

1) Type 1: Color as selected by architect.

b. Coating Thickness:

1) Colors: 1.0 mil (±0.2 mil).

2) Clear: 0.50 mil (± 0.05 mil).

c. Hardness: ASTM D-3363; HB minimum using Eagle Turquoise Pencil.

d. Impact:

1) Test method: ASTM D-2794; Gardner Variable Impact Tester with 5/8" mandrel.

2) Coating shall withstand reverse impact of 1.5"/pounds per mil substrate thickness.

3) Coating shall adhere tightly to metal when subjected to #600 Scotch Tape pick-off test. Slight minute cracking permissible. No removal of film to substrate.

e. Adhesion:

1) Test Method: ASTM D-3359.

2) Coating shall not pick off when subjected to an 11" x 11" x 1/16" grid and taped with #600 Scotch Tape.

f. Humidity Resistance

1) Test Method: ASTM D-2247.

2) No formation of blisters when subject to condensing water fog at 100% relative humidity and 100°F for 4000 hours.

g. Salt Spray Resistance:

1) Test Method: ASTM B-117; Expose coating system to 4000 hours, using 5% NaCl solution.

2) Corrosion creepage from scribe line: 1/16" max.

3) Minimum blister rating of 8 within the test specimen field.

h. Weather Exposure

1) Outdoor:

a. Ten-year exposure at 45° angle facing south Florida exposure.

b. Maximum color change of 5 Delta E units as calculated in accordance with ASTM D-2244.

c. Maximum chalk rating of 8 in accordance with ASTM D-4214.

d. No checking, crazing, adhesion loss.

i. Chemical Resistance:

1) ASTM D-1308 utilizing 10% Muriatic Acid for an exposure time of 15 minutes. No loss of film adhesion or visual change when viewed by the unaided eye.

- 2) ASTM D-1308 utilizing 20% Sulfuric Acid for an exposure time of 18 hours. No loss of film adhesion or visual change when viewed by the unaided eye.
- 3) AAMA 2605 utilizing 70% reagent grade Nitric Acid vapor for an exposure time of 30 minutes. Maximum color change of 5 Delta E units as calculated in accordance with ASTM D-2244.

2.02 PANEL FABRICATION

A. COMPOSITION:

Two sheets of aluminum sandwiching a solid core of extruded thermoplastic material formed in a continuous process with no glues or adhesives between dissimilar materials. The core material shall be free of voids and/or air spaces and not contain foamed insulation material. Products laminated sheet by sheet in a batch process using glues or adhesives between materials shall not be acceptable.

B. ALUMINUM FACE SHEETS:

Thickness: 0.50mm (0.0197") (nominal)
Alloy: AA3000 Series (Painted material)

Panel Weight:

1. 4mm (0.157"): 1.12 lbs./ft²

C. TOLERANCES

1. Panel Bow: Maximum 0.8% of any 1828mm (72") panel dimension.
2. Panel Dimensions: Field fabrication shall be allowed where necessary, but shall be kept to an absolute minimum. All fabrication shall be done under controlled shop conditions when possible.
3. Panel lines, breaks, and angles shall be sharp, true, and surfaces free from warp and buckle.
4. Maximum deviation from panel flatness shall be 1/8" in 5'0" on panel in any direction for assembled units. (Non-accumulative - No Oil Canning)

D. SYSTEM CHARACTERISTICS

1. Plans, elevations, details, characteristics, and other requirements indicated are based upon standards by one manufacturer. It is intended that other manufacturers, receiving prior approval, may be acceptable, provided their details and characteristics comply with size and profile requirements, and material/performance standards.
2. System must not generally have any visible fasteners, telegraphing or fastening on the panel faces or any other compromise of a neat and flat appearance.
3. System shall comply with the applicable provisions of the "Metal Curtain Wall, Window, Storefront, and Entrance Guide Specifications Manual" by AAMA and ANSI/AAMA 302.9 requirements for aluminum windows.
4. Fabricate panel system to dimension, size, and profile indicated on the drawings based on a design temperature of 70°F.
5. Fabricate panel system so that no restraints can be placed on the panel, which might result in compressive skin stresses. The installation detailing shall be such that the panels remain flat regardless of temperature change and at all times remain air and water tight.
6. The finish side of the panel shall have a removable plastic film applied prior to fabrication, which shall remain on the panel during fabrication, shipping, and erection to protect the surface from damage.

E. SYSTEM TYPE

1. Rout and Return Wet:
System must provide a wet seal (caulked) reveal joint as detailed on drawings. The sealant type shall be as specified in Section 07900 and with foamed type backer rod as indicated on architectural drawings.

F. SYSTEM PERFORMANCE

1. Composite panels shall be capable of withstanding building movements and weather exposures based on the following test standards required by the Architect and/or the local building code.

- a. Wind Load

If system tests are not available, mock-ups shall be constructed and tests performed under the direction of an independent third party laboratory, which show compliance to the following minimum standards:

Panels shall be designed to withstand the Design Wind Load based upon the local building code, but in no case less than that specified on the Structural drawings. Wind load testing shall be conducted in accordance with ASTM E330 to obtain the following results.

Normal to the plane of the wall between supports, deflection of the secured perimeter-framing members shall not exceed $L/175$ or $3/4"$, whichever is less.

Normal to the plane of the wall, the maximum panel deflection shall not exceed $L/60$ of the full span.

Maximum anchor deflection shall not exceed $1/16"$.

At 1-1/2 times design pressure, permanent deflections of framing members shall not exceed $L/100$ of span length and components shall not experience failure or gross permanent distortion. At connection points of framing members to anchors, permanent set shall not exceed $1/16"$.

- b. Air/Water System Test

If system tests are not available, mock-ups shall be constructed and tests performed under the direction of an independent third party laboratory, which show compliance to the following minimum standards:

Air Infiltration - When tested in accordance with ASTM E283, air infiltration at 1.57 psf must not exceed 0.06 cfm/ft² of wall area.

Water Infiltration - Water infiltration is defined as uncontrolled water leakage through the exterior face of the assembly. Systems not using a construction sealant at the panel joints (i.e. Rout and Return Dry and Rear Ventilated Systems) shall be designed to drain any water leakage occurring at the joints. No water infiltration shall occur in any system under a differential static pressure of 6.24 psf after 15 minutes of exposure in accordance with ASTM E331.

- c. Pressure Equalized Rain Screen Systems shall comply with AAMA 508-05 Voluntary Test Method and Specification for Pressure Equalized Rain Screen Wall Cladding Systems

2.03 ACCESSORIES

1. Extrusions, formed members, sheet, and plate shall conform with ASTM B209 and the recommendations of the manufacturer.
2. Panel stiffeners, if required, shall be structurally fastened or restrained at the ends and shall be secured to the rear face of the composite panel with silicone of sufficient size and

strength to maintain panel flatness. Stiffener material and/or finish shall be compatible with the silicone.

3. Sealants and gaskets within the panel system shall be as per manufacturer's standards to meet performance requirements.
4. Fabricate flashing materials from 0.030" minimum thickness aluminum sheet painted to match the adjacent curtain wall / panel system where exposed. Provide a lap strap under the flashing at abutted conditions and seal lapped surfaces with a full bed of non-hardening sealant.
5. Fasteners (concealed/exposed/non-corrosive): Fasteners as recommended by panel manufacturer. Do not expose fasteners except where unavoidable and then match finish of adjoining metal.

PART 3: EXECUTION

3.01 INSPECTION

1. Surfaces to receive panels shall be even, smooth, sound, clean, dry and free from defects detrimental to work. Notify contractor in writing of conditions detrimental to proper and timely completion of the work. Do not proceed with erection until unsatisfactory conditions have been corrected.
2. Surfaces to receive panels shall be structurally sound as determined by a registered Architect/Engineer.

3.02 INSTALLATION

1. Erect panels plumb, level, and true. Coordinate panel installation with that of the sun screen panels.
2. Attachment system shall allow for the free and noiseless vertical and horizontal thermal movement due to expansion and contraction for a material temperature range of -20°F to +180°F. Buckling of panels, opening of joints, undue stress on fasteners, failure of sealants or any other detrimental effects due to thermal movement will not be permitted. Fabrication, assembly, and erection procedure shall account for the ambient temperature at the time of the respective operation.
3. Panels shall be erected in accordance with an approved set of shop drawings.
4. Anchor panels securely per engineering recommendations and in accordance with approved shop drawings to allow for necessary thermal movement and structural support.
5. Conform to panel fabricator's instructions for installation of concealed fasteners.
6. Do not install component parts that are observed to be defective, including warped, bowed, dented, abraded, and broken members.
7. Do not cut, trim, weld, or braze component parts during erection in a manner which would damage the finish, decrease strength, or result in visual imperfection or a failure in performance. Return component parts which require alteration to shop for refabrication, if possible, or for replacement with new parts.
8. Separate dissimilar metals and use gasketed fasteners where needed to eliminate the possibility of corrosive or electrolytic action between metals.

3.03 ADJUSTING AND CLEANING

1. Remove and replace panels damaged beyond repair as a direct result of the panel installation. After installation, panel repair and replacement shall become the responsibility of the General Contractor.
2. Repair panels with minor damage.

3. Remove masking (if used) as soon as possible after installation. Masking intentionally left in place after panel installation on an elevation, shall become the responsibility of the General Contractor.
4. Any additional protection, after installation, shall be the responsibility of the General Contractor.
5. Make sure weep holes and drainage channels are unobstructed and free of dirt and sealants.
6. Final cleaning shall not be part of the work of this section.

End of Section

SECTION 07 62 00
SHEET METAL FLASHING AND TRIM

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Fabricated sheet metal items, including flashings and counter flashings.
- B. Sealants for joints within sheet metal fabrications.

1.02 RELATED REQUIREMENTS

- A. Section 04 20 01: Through-wall flashings in masonry.
- B. Section 06 10 00 - Rough Carpentry: Wood nailers for sheet metal work.
- C. Section 07 71 00 - Roof Specialties: Preformed flashings and manufactured expansion joint covers.
- D. Section 07 92 00 - Joint Sealants.

1.03 REFERENCE STANDARDS

- A. AAMA 2603 - Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2015.
- B. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.
- C. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate [Metric]; 2014.
- D. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2014.
- E. ASTM D4586/D4586M - Standard Specification for Asphalt Roof Cement, Asbestos-Free; 2007 (Reapproved 2012)e1.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate material profile, jointing pattern, jointing details, fastening methods, flashings, terminations, and installation details.
- C. Samples: Submit two samples 6 x 6 inch in size illustrating metal finish color.

1.05 QUALITY ASSURANCE

- A. Perform work in accordance with SMACNA (ASMM) and CDA A4050 requirements and standard details, except as otherwise indicated.
- B. Fabricator and Installer Qualifications: Company specializing in sheet metal work with 10 years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Stack material to prevent twisting, bending, and abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.
- B. Prevent contact with materials that could cause discoloration or staining.

PART 2 PRODUCTS

2.01 SHEET MATERIALS

- A. Pre-Finished Aluminum: ASTM B209 (ASTM B209M); 20 gage (0.032 inch) thick; plain finish shop pre-coated with modified silicone coating.
 - 1. Modified Silicone Polyester Coating: Pigmented Organic Coating System, AAMA 2603; baked enamel finish system.
 - 2. Color: As selected by Architect from manufacturer's standard colors.

2.02 ACCESSORIES

- A. Fasteners: Same material and finish as flashing metal, with soft neoprene washers.

- B. Primer: Zinc chromate type.
- C. Protective Backing Paint: Zinc molybdate alkyd.
- D. Sealant to be Concealed in Completed Work: Non-curing butyl sealant.
- E. Sealant to be Exposed in Completed Work: ASTM C920; elastomeric sealant, 100 percent silicone with minimum movement capability of plus/minus 25 percent and recommended by manufacturer for substrates to be sealed; clear.
- F. Sealant: Type S2 specified in Section 07 9005.
- G. Plastic Cement: ASTM D4586, Type I.

2.03 FABRICATION

- A. Form sections true to shape, accurate in size, square, and free from distortion or defects.
- B. Fabricate cleats of same material as sheet, minimum 4 inches wide, interlocking with sheet.
- C. Form pieces in longest possible lengths.
- D. Hem exposed edges on underside 1/2 inch; miter and seam corners.
- E. Form material with flat lock seams, except where otherwise indicated. At moving joints, use sealed lapped, bayonet-type or interlocking hooked seams.
- F. Fabricate corners from one piece with minimum 18 inch long legs; seam for rigidity, seal with sealant.
- G. Fabricate vertical faces with bottom edge formed outward 1/4 inch and hemmed to form drip.
- H. Fabricate flashings to allow toe to extend 2 inches over roofing membrane. Return and brake edges.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify roofing termination and base flashings are in place, sealed, and secure.

3.02 PREPARATION

- A. Install starter and edge strips, and cleats before starting installation.
- B. Back paint concealed metal surfaces with protective backing paint to a minimum dry film thickness of 15 mil.

3.03 INSTALLATION

- A. Secure flashings in place using concealed fasteners.
- B. Apply plastic cement compound between metal flashings and felt flashings.
- C. Fit flashings tight in place. Make corners square, surfaces true and straight in planes, and lines accurate to profiles.
- D. Seal metal joints watertight.

3.04 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements, for field inspection requirements.
- B. Inspection will involve surveillance of work during installation to ascertain compliance with specified requirements.

END OF SECTION

SECTION 07 81 00
SPRAY 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 Hospital.
 - 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. Preconstruction Test Reports: For fireproofing.
- E. 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 40 deg F 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.
 - 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. Low-Emitting Materials: Fireproofing used within the weatherproofing system shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- F. Asbestos: Provide products containing no detectable asbestos.
- G. Dry mix sprayed fire resistive materials containing mineral fibers are not allowed.

2.2 SPRAYED FIRE-RESISTIVE MATERIALS

- A. Standard Durability SFRM Interior Locations, Accessible and Concealed Conditions: 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 before conveyance and application.
 - 1. Products: Subject to compliance with requirements, provide the following:
 - a). Grace Construction Products; W.R. Grace & Co. ----- Conn; Grace

Construction Products; Monokote MK-6 Series

2. Bond Strength: Minimum 200-lbf/sq. ft. cohesive and adhesive strength based on field testing according to ASTM E 736.
3. Density: Not less than 15 lb/cu. ft. and as specified in the approved fire-resistance design, according to ASTM E 605.
4. 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.
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: 0.
 - b). Smoke-Developed Index: 0.
6. Compressive Strength: Minimum 10 lbf/sq. in. according to ASTM E 761. 7. 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 0.0 g/sq. ft. 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.
11. Finish: Spray-textured finish.

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.

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.
- D. For applications visible on completion of Project, repair substrates to remove surface imperfections that could affect uniformity of texture and thickness in finished surface of fireproofing. Remove minor projections and fill voids that would telegraph through fire-resistive products after application.

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. For applications over encapsulant materials, including lockdown (post-removal) encapsulants, apply fireproofing that differs in color from that of encapsulant over which it is applied.
- J. Where sealers are used, apply products that are tinted to differentiate them from fireproofing over which they are applied.
- K. Provide a uniform finish complying with description indicated for each type of fireproofing material and matching finish approved for required mockups.
- L. Cure fireproofing according to fireproofing manufacturer's written recommendations.
- M. Do not install enclosing or concealing construction until after fireproofing has been applied, inspected, and tested and corrections have been made to deficient applications.
- N. Finishes: Where indicated, apply fireproofing to produce the following finishes:
 - 1. Manufacturer's Standard Finishes: Finish according to manufacturer's written instructions for each finish selected.
 - 2. Spray-Textured Finish: Finish left as spray applied with no further treatment.
 - 3. Rolled, Spray-Textured Finish: Even finish produced by rolling spray-applied finish with a damp paint roller to remove drippings and excessive roughness.
 - 4. Skip-Troweled Finish: Even leveled surface produced by troweling spray-applied finish to smooth out the texture and neaten edges.
 - 5. Skip-Troweled Finish with Corner Beads: Even, leveled surface produced by troweling spray-applied finish to smooth out the texture, eliminate surface markings, and square off edges.

3.4 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:
 - 1. Test and inspect as required by Chapter 17 of the applicable IBC.
- 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 07 81 00

OUTLET BOXES AND FITTINGS CLASSIFIED FOR FIRE RESISTANCE (CEYY)

THIS CATEGORY COVERS OUTLET BOXES AND FITTINGS INVESTIGATED FOR USE IN FIRE-RESISTANCE DESIGNS AS DETAILED IN FIRE RESISTANCE RATINGS – ANSI/UL 263 (BXUV). THESE ARE SPECIAL-PURPOSE BOXES INTENDED FOR INSTALLATION IN FLOORS, AND NONMETALLIC OUTLET BOXES INTENDED FOR INSTALLATION IN FLOORS, WALLS AND PARTITIONS, AND/OR CEILINGS. THEY ARE INTENDED FOR INSTALLATION IN ACCORDANCE WITH ANSI/NFPA 70, "NATIONAL ELECTRIC CODE" (NEC). THEY HAVE SHOWN A DEGREE OF FIRE RESISTANCE WHEN INSTALLED IN THE PARTICULAR FLOOR(S), WALL(S) AND/OR CEILING(S) DESCRIBED FOR EACH CLASSIFIED COMPANY. NONMETALLIC OUTLET BOXES DESCRIBED FOR INSTALLATION IN FIRE-RESISTANCE ASSEMBLIES CONSISTING OF WOOD JOISTS AND GYPSUM-BOARD CEILINGS ARE ALSO SUITABLE FOR USE IN ASSEMBLIES CONSISTING OF PRE-ENGINEERED WOOD JOISTS OR TRUSSES AND GYPSUM BOARD CEILINGS. AUTHORITIES HAVING JURISDICTION SHOULD BE CONSULTED BEFORE INSTALLATION.

NONMETALLIC ELECTRICAL OUTLET BOXES

OUTLET BOXES AND FITTINGS CLASSIFIED FOR FIRE RESISTANCE INCLUDES CLASSIFICATIONS FOR NONMETALLIC OUTLET AND SWITCH BOXES FOR USE IN WALL OR PARTITION ASSEMBLIES. THE INFORMATION PROVIDED FOR EACH CLASSIFICATION INCLUDES THE MODEL NUMBERS FOR THE CLASSIFIED PRODUCTS, A DESCRIPTION OF THE RATED ASSEMBLIES, THE SPACING LIMITATIONS FOR THE BOXES AND THE INSTALLATION DETAILS. NONMETALLIC BOXES SHOULD NOT BE INSTALLED ON OPPOSITE SIDES OF WALLS OR PARTITIONS OF STAGGERED STUD CONSTRUCTION UNLESS CLASSIFIED FOR USE IN SUCH CONSTRUCTION.

METALLIC ELECTRICAL OUTLET BOXES

LISTED SINGLE AND DOUBLE GANG METALLIC OUTLET AND SWITCH BOXES WITH METALLIC OR NONMETALLIC COVER PLATES MAY BE USED IN BEARING AND NONBEARING WOOD STUD AND STEEL STUD WALLS WITH RATINGS NOT EXCEEDING 2 HOURS. THE METALLIC OUTLET OR SWITCH BOXES SHOULD BE SECURELY FASTENED TO THE STUDS AND THE OPENING IN THE GYPSUM WALLBOARD FACING SHOULD BE CUT SO THAT THE CLEARANCE BETWEEN THE BOX AND THE WALLBOARD DOES NOT EXCEED $\frac{1}{8}$ INCH. THE SURFACE AREA OF INDIVIDUAL METALLIC OUTLET OR SWITCH BOXES SHOULD NOT EXCEED 16 SQUARE INCHES. THE AGGREGATE SURFACE AREA OF THE BOXES SHOULD NOT EXCEED 100 SQUARE INCHES PER 100 SQUARE FEET OF WALL SURFACE. THE AGGREGATE SURFACE AREA OF THE BOXES MAY BE EXCEEDED WHEN WALL OPENING PROTECTIVE MATERIALS ARE INSTALLED ACCORDING TO THE REQUIREMENTS OF THEIR CLASSIFICATION.

METALLIC BOXES LOCATED ON OPPOSITE SIDES OF WALLS OR PARTITIONS SHOULD BE SEPARATED BY A MINIMUM HORIZONTAL DISTANCE OF 24 INCHES. THIS MINIMUM SEPARATION DISTANCE BETWEEN METALLIC BOXES MAY BE REDUCED WHEN WALL OPENING PROTECTIVE MATERIALS ARE INSTALLED ACCORDING TO THE REQUIREMENTS OF THEIR CLASSIFICATION.

METALLIC BOXES SHOULD NOT BE INSTALLED ON OPPOSITE SIDES OF WALL OR PARTITIONS OF STAGGERED STUD CONSTRUCTION UNLESS WALL OPENING PROTECTIVE MATERIALS ARE INSTALLED WITH THE METALLIC BOXES IN ACCORDANCE WITH CLASSIFICATION REQUIREMENTS FOR THE PROTECTIVE MATERIALS.

FLOOR BOXES

BOXES INTENDED FOR USE WITH FLOORS HAVE BEEN INVESTIGATED FOR USE WITH ELECTRICAL RECEPTACLES FABRICATED OF MELAMINE, PHENOLIC OR UREA MATERIALS, UNLESS SPECIFIED OTHERWISE IN THE INSTALLATION INSTRUCTIONS AND CLASSIFICATION INFORMATION. FLOOR BOXES AND FITTINGS ARE INTENDED TO BE INSTALLED IN ACCORDANCE WITH INSTALLATION INSTRUCTIONS PROVIDED WITH THE PRODUCT.

BOXES WITH INTEGRAL CONNECTORS FOR ELECTRIC METALLIC TUBING OR FOR UNTHREADED RIGID METALLIC CONDUIT ARE PROVIDED WITH A MARKING ON THE CARTON TO INDICATE THE SPECIFIC TYPE OR TYPES OF WIRING SYSTEM FOR WHICH THE BOX HAS BEEN TESTED.

FLOOR BOXES DESIGNATED FOR FLOOR INSTALLATION AS COVERED IN THE NEC ARE PROVIDED WITH COVERS AND GASKETS TO EXCLUDE SURFACE WATER AND SWEEPING COMPOUNDS THAT MIGHT BE PRESENT IN FLOOR-CLEANING OPERATIONS. THOSE BOXES INTENDED FOR INSTALLATION IN CONCRETE FLOORS ARE FREQUENTLY PROVIDED WITH LEVELING SCREWS, THREADED HUBS, OR BOTH AND ARE PROVIDED WITH A MARKING ON THE CARTON TO IDENTIFY THE BOXES OF THIS TYPE, SUCH AS "FLOOR BOX" OR "FLOOR BOX, CONCRETE TYPE" AS APPROPRIATE.

WALL, PARTITION AND CEILING BOXES

NONMETALLIC OUTLET BOXES INVESTIGATED FOR INSTALLATION IN FIRE-RESISTIVE ASSEMBLIES ARE PROVIDED WITH THE APPROPRIATE LISTING MARK FOR ELECTRICAL PRODUCTS AND OTHER MARKINGS AS DESCRIBED IN "NONMETALLIC OUTLET BOXES". THE BOXES ARE CLASSIFIED FOR USE IN CERTAIN FIRE-RESISTIVE DESIGNS WHEN INSTALLED IN ACCORDANCE WITH THE DETAILS DESCRIBED FOR EACH CLASSIFIED COMPANY. ANY LISTED METALLIC OR NONMETALLIC COVER IS SUITABLE FOR USE WITH THESE NONMETALLIC BOXES.

WALL-OPENING PROTECTIVE MATERIALS

THIS CATEGORY COVERS WALL-OPENING PROTECTIVE MATERIALS INVESTIGATED FOR USE IN FIRE-RESISTANCE DESIGNS AS DETAILED IN FIRE RESISTANCE RATINGS – ANSI/UL 263 (BXUV). THE PROTECTIVE MATERIALS ARE PROPRIETARY COMPOSITIONS USED TO MAINTAIN HOURLY RATINGS OF FIRE-RESISTIVE WALLS AND PARTITIONS CONTAINING FLUSH-MOUNTED DEVICES, SUCH AS OUTLET BOXES, ELECTRICAL CABINETS AND MECHANICAL CABINETS.

FOR METALLIC OR NONMETALLIC ELECTRICAL OUTLET BOXES AND SWITCHES, IT MAY BE POSSIBLE TO INSTALL THE BOXES UNDER LESS STRINGENT CONDITIONS WHEN SUCH BOXES ARE USED IN CONJUNCTION WITH WALL-OPENING PROTECTIVE MATERIALS. THE USE OF WALL-OPENING PROTECTIVE MATERIALS MAY ALLOW FOR (1) REDUCING THE SPACING BETWEEN BOXES CONTAINED ON OPPOSITE SIDES OF THE WALL, (2) INCREASING THE SIZE OF THE BOXES, (3) INCREASING THE DENSITY OF BOXES INSTALLED, AND/OR (4) ALLOWING THE USE OF BOXES ON EACH SIDE OF STAGGERED STUD WALLS.

NOTES

1. EACH ELECTRICAL OUTLET BOX AND SWITCH MANUFACTURER (CLASSIFIED COMPANY) TESTED AND LISTED BY UL, HAVE VERY SPECIFIC TYPES OF OUTLET BOXES AND SWITCHES WHICH HAVE BEEN APPROVED FOR VERY SPECIFIC SITUATIONS. THEREFORE, NOT EVERY TYPE OF BOX OR SWITCH MAY BE APPROPRIATE FOR EVERY TYPE OF SITUATION AND FIRE-RESISTANCE CLASSIFICATION.
2. CONTRACTOR MUST IDENTIFY THE APPROPRIATE TYPE AND MANUFACTURER FOR EACH OUTLET BOX OR SWITCH FOR EACH SITUATION ENCOUNTERED, AND PROVIDE THE APPROPRIATE UL-LISTED ASSEMBLY (INCLUDING SPACING OF OUTLET BOXES AND SWITCHES, INDIVIDUAL AND AGGREGATE AREA(S) OF OUTLET BOXES AND SWITCHES, WALL-OPENING PROTECTIVE MATERIALS, ETC.) FOR THE PARTICULAR SITUATION.
3. REFER TO THE UNDERWRITERS LABORATORIES, INC. DIRECTORY FOR ADDITIONAL INFORMATION.

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Through Penetration Details General Notes

Drawing No:

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MEMBRANE PENETRATIONS AND WALL-OPENING PROTECTIVE MATERIALS

1. ALL ELECTRICAL AND DATA WIRING AND CABLING MUST TERMINATE WITHIN AN APPROVED ELECTRICAL OUTLET BOX, AND MUST BE INSTALLED WITHIN APPROVED CONDUIT, UNLESS OTHERWISE PERMITTED BY CODE.
2. APPROPRIATE MATERIALS FOR FIRE PROTECTION AND METHODS OF INSTALLATION SHALL BE SELECTED FOR EACH SPECIFIC CONDITION ENCOUNTERED, IN ACCORDANCE WITH THE UL DIRECTORY LISTING. VARIABLES INCLUDE SIZE, TYPE, AND MANUFACTURER OF OUTLET BOX INSTALLED (EITHER METALLIC OR NON-METALLIC), HORIZONTAL SPACING BETWEEN THE OUTLET BOXES, BACK-TO-BACK INSTALLATIONS, FIRE-RESISTANCE RATING OF THE PARTITION IN WHICH OUTLETS ARE TO BE INSTALLED IN, AND THE TYPE OF WALL PLATES TO BE INSTALLED (PLASTIC OR STEEL).
3. USE HILTI BRAND CP 617 FIRESTOP MOLDABLE PUTTY PADS, MIN. 1/8" THK., TO COMPLETELY COVER THE EXTERIOR SURFACE OF THE OUTLET BOX (EXCEPT FOR THE SIDE OF THE OUTLET BOX AGAINST THE STUD) AND TO COMPLETELY SEAL THE BOX AGAINST THE STUD.
 - A. 4" X 4" X 2-1/8" FLUSH DEVICE METALLIC OUTLET BOX WITH STEEL COVER PLATE
 - 1 AND 2 HOUR RATINGS AVAILABLE
 - HORIZONTAL DISTANCE BETWEEN BOXES ON OPPOSITE SIDES OF PARTITION SHALL BE NOT LESS THAN 24 INCHES
 - BOXES SHALL NOT BE INSTALLED BACK-TO-BACK
 - B. 4 11/16" X 4 11/16" X 2-1/8" FLUSH DEVICE METALLIC OUTLET BOX WITH STEEL COVER PLATE
 - 1 AND 2 HOUR RATINGS AVAILABLE
 - HORIZONTAL DISTANCE BETWEEN BOXES ON OPPOSITE SIDES OF PARTITION SHALL BE NOT LESS THAN 24 INCHES
 - BOXES SHALL NOT BE INSTALLED BACK-TO-BACK
 - C. 4" X 3 3/4" X 3" NON-METALLIC OUTLET BOX WITH STEEL OR PLASTIC COVER PLATE
 - 1 AND 2 HOUR RATINGS AVAILABLE
 - HORIZONTAL DISTANCE BETWEEN BOXES ON OPPOSITE SIDES OF PARTITION SHALL BE NOT LESS THAN 24 INCHES
 - BOXES SHALL NOT BE INSTALLED BACK-TO-BACK
 - D. 4" X 4" X 2 7/8" NON-METALLIC OUTLET BOX WITH STEEL OR PLASTIC COVER PLATE
 - 1 HOUR RATING AVAILABLE
 - HORIZONTAL DISTANCE BETWEEN BOXES ON OPPOSITE SIDES OF PARTITION MAY BE LESS THAN 24 INCHES
 - BOXES MAY BE INSTALLED BACK-TO-BACK, IF BOTH BOXES ARE PROTECTED
 - E. 4" X 4" X 1 1/2" FLUSH DEVICE METALLIC OUTLET BOX WITH STEEL COVER PLATE
 - 1 HOUR RATING AVAILABLE
 - HORIZONTAL DISTANCE BETWEEN BOXES ON OPPOSITE SIDES OF PARTITION MAY BE LESS THAN 24 INCHES
 - BOXES MAY BE INSTALLED BACK-TO-BACK, IF BOTH BOXES ARE PROTECTED AND 5" X 4" CP 657 FIRE BLOCK IS INSTALLED IN THE CAVITY BETWEEN THE TWO BOXES
4. USE HILTI BRAND FIRESTOP BOX INSERT, ADHERED TO THE INTERIOR BACK WALL OF THE OUTLET BOX
 - A. 4 11/16" X 4 11/16" X 2-1/8" FLUSH DEVICE METALLIC OUTLET BOX WITH STEEL OR PLASTIC COVER PLATE
 - 1 HOUR (PLASTIC COVER PLATE) AND 2 HOUR (STEEL COVER PLATE) RATINGS AVAILABLE
 - HORIZONTAL DISTANCE BETWEEN BOXES ON OPPOSITE SIDES OF PARTITION MAY BE LESS THAN 24 INCHES, WHERE EACH BOX IS PROTECTED
 - BOXES SHALL NOT BE INSTALLED BACK-TO-BACK
 - B. 4" X 4" X 1 1/2" OR 2 1/8" FLUSH DEVICE METALLIC OUTLET BOX WITH STEEL OR PLASTIC COVER PLATE
 - 1 HOUR (PLASTIC COVER PLATE) AND 2 HOUR (STEEL COVER PLATE) RATINGS AVAILABLE
 - HORIZONTAL DISTANCE BETWEEN BOXES ON OPPOSITE SIDES OF PARTITION MAY BE LESS THAN 24 INCHES, WHERE EACH BOX IS PROTECTED
 - BOXES SHALL NOT BE INSTALLED BACK-TO-BACK
 - C. 4 1/2" X 8 1/2" X 1 5/8" FLUSH DEVICE METALLIC OUTLET BOX WITH STEEL COVER PLATE
 - 1 AND 2 HOUR RATINGS AVAILABLE
 - HORIZONTAL DISTANCE BETWEEN BOXES ON OPPOSITE SIDES OF PARTITION MAY BE LESS THAN 24 INCHES, WHERE EACH BOX IS PROTECTED
 - BOXES SHALL NOT BE INSTALLED BACK-TO-BACK
5. THIS LIST DOES NOT PROVIDE FOR ALL CONDITIONS THAT MAY BE ENCOUNTERED. CONTRACTOR SHALL EVALUATE CONDITIONS AND SELECT THE APPROPRIATE UL LISTED ASSEMBLY, MATERIALS, AND METHOD(S) OF INSTALLATION AS NECESSARY.

ARCHITECT



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Through Penetration Details
General Notes

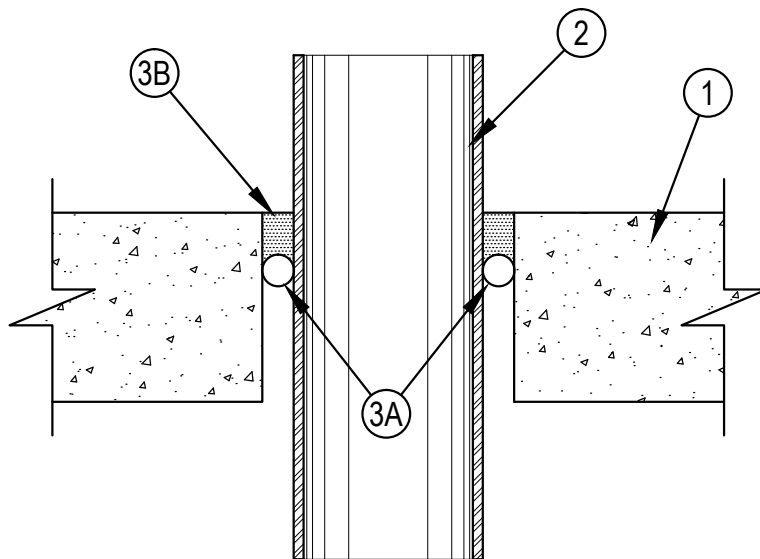
Drawing No:

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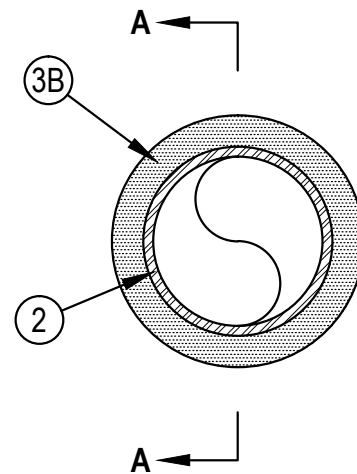
System No. C-AJ-1276

F Rating -- 3 Hr

T Rating -- 0 Hr



SECTION A-A



PLAN

1. Floor or Wall Assembly — Min 4-1/2 in. thick reinforced lightweight or normal weight (100-150 pcf) concrete. Wall may also be constructed of any UL Classified Concrete Blocks*. Max diam of opening is 6 in.

See Concrete Blocks (CAZT) category in the Fire Resistance Directory for names of manufacturers.

2. Through Penetrants — One metallic pipe, conduit or tubing to be centered within the firestop system. Pipe, conduit or tubing to be rigidly supported on both sides of floor or wall assembly. The following types and sizes of metallic pipes, conduits or tubing may be used:

A. Steel Pipe — Nom 4 in. diam (or smaller) Schedule 10 (or heavier) steel pipe. A nom annular space of 3/4 in. is required within the firestop system.

B. Conduit — Nom 4 in. diam (or smaller) steel electrical metallic tubing or steel conduit. A nom annular space of 3/4 in. is required within the firestop system.

3. Firestop System — The firestop system shall consist of the following:

A. Packing or Forming Materials — Optional — One of the following packing or forming materials may be used:

A1. Foam backer rod tightly packed into the opening as a permanent form. Packing material to be recessed from the top surface of floor or both surfaces of wall as required to accommodate the required thickness of putty.

A2. Mineral Wool Batt Insulation — min 4 pcf, tightly packed into the opening as a permanent form. Packing material to be recessed from the top surface of floor or both surfaces of wall as required to accommodate the required thickness of putty.

A3. Forming materials* — Forming material to be foamed into the opening as a permanent form. Forming material to be recessed from the top surface of floor or both surfaces of wall as required to accommodate the required thickness of putty.

HILTI CONSTRUCTION CHEMICALS, DIV OF HILTI INC — CF810, CF812 or CF511 Foam Sealant

B. Fill, Void or Cavity Material* — Putty — Min 1 in. thickness of putty applied within the annulus, flush with top surface of floor or with both surfaces of wall.

HILTI CONSTRUCTION CHEMICALS, DIV OF HILTI INC — CP 618 Firestop Putty Stick

*Bearing the UL Classification Mark

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Through Penetration Details

Metallic Pipe - Concrete Floor/Concrete or Block Wall

Drawing No:

3 of 29

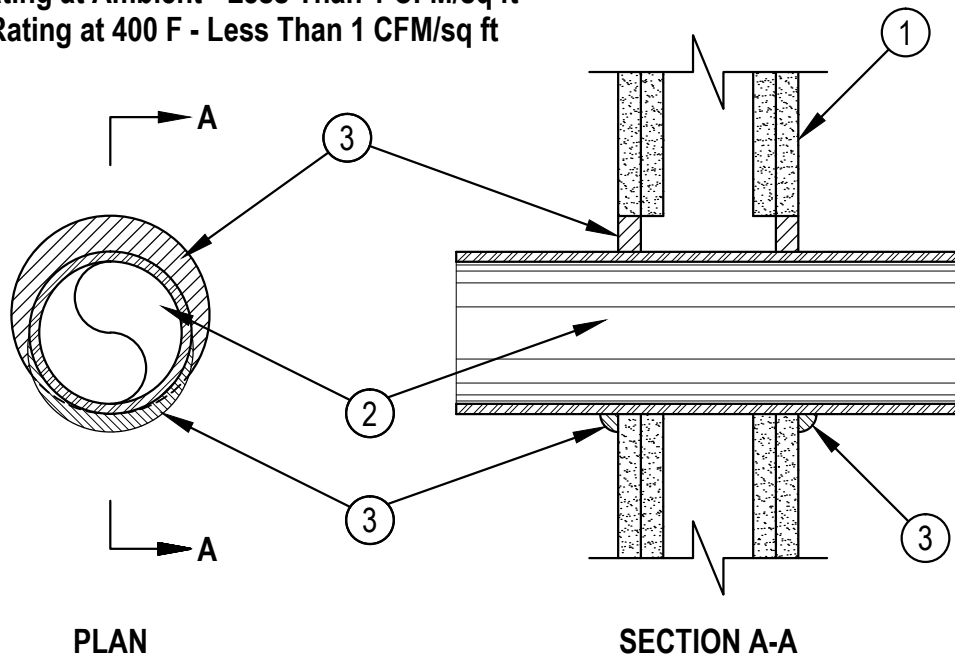
System No. W-L-1175

F Ratings - 1 and 2 Hr (See Item 1)

T Rating - 0 Hr

L Rating at Ambient - Less Than 1 CFM/sq ft

L Rating at 400 F - Less Than 1 CFM/sq ft



1. Wall Assembly — The 1 or 2 hr fire rated wallboard/stud wall assembly shall be constructed of the materials and in the manner specified in the individual U300 or U400 Series Wall and Partition Designs in the UL Fire Resistance Directory and shall include the following construction features.

A. Studs — Wall framing shall consist of either wood studs or steel channel studs. Wood studs to consist of nom 2 by 4 in. lumber spaced 16 in. OC. Steel studs to be min 2-1/2 in. wide and spaced max 24 in. OC.

B. Gypsum Board* — Nom 5/8 in. thick, 4 ft wide with square or tapered edges. The gypsum wallboard type, thickness, number of layers, fastener type and sheet orientation shall be as specified in the individual U300 or U400 Series Design in the Fire Resistance Directory. Max diam of opening is 5-1/2 in.

The hourly F and T Ratings of the firestop system is equal to the hourly fire rating of the wall assembly in which it is installed.

2. Through Penetrant — One metallic tubing or conduit installed concentrically or eccentrically within the firestop system. Tube or conduit to be rigidly supported on both sides of wall assembly. The annular space between the tube or conduit and periphery of the steel sleeve shall be min 0 in. (point contact) to max 1 in. The following types and sizes of metallic tube or conduit may be used:

A. Conduit — Nom 4 in. diam (or smaller) steel electrical metallic tubing or steel conduit.

3. Fill Void or Cavity Material* — Putty — Min 5/8 in. thickness of fill material applied within the annulus, flush with both surfaces of wall. At point contact location between penetrant and wall, a 1/4 in. crown of fill material shall be applied at the conduit/wall interface on both sides of the assembly, lapping 1/4 in. on the conduit and 1/4 in. beyond the periphery of the opening.

HILTI INC — CP618 Putty Stick

*Bearing the UL Classification Mark

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Through Penetration Details

Metallic Pipe - Gypsum Wall

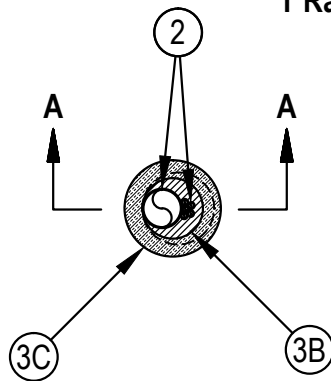
Drawing No:

4 of 29

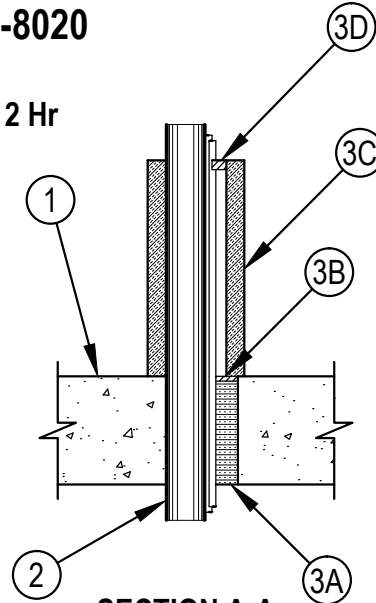
System No. C-BJ-8020

F Rating - 2 Hr

T Rating - 0 Hr and 2 Hr



PLAN



SECTION A-A

1. Floor or Wall Assembly -- Min 6 in. (152 mm) thick reinforced lightweight or normal weight (100-150 pcf or 1600-2400 kg/m³) structural concrete. Floor may also be constructed of any min 6 in. (152 mm) thick UL Classified Precast Concrete Units*. Wall may also be constructed of any UL Classified Concrete Blocks*. Max diam of opening is 4 in. (102 mm).

See Concrete Blocks (CAZT) and Precast Concrete Units (CFTV) categories in the UL Fire Resistance Directory for names of manufacturers.

2. Through Penetrants -- One grouping of any combination of the following pipes, tubing, conduit and cables to be installed within the opening. A maximum of two penetrants shall be copper pipes or tubes. A maximum of one metallic penetrant within the grouping shall have a diam exceeding 1 in. (25 mm). A maximum of three cables shall be included within the grouping of penetrants. The penetrants are installed within the opening such that the annular space between the grouping of penetrants and the periphery of the opening is min 0 in. (point contact) to max 2 in. (51 mm). Penetrants to be rigidly supported on both sides of floor or wall assembly. The following types and sizes of pipes, conduits, tubing or cables may be used:

- A. Steel Pipe -- Nom 2 in. (51 mm) diam (or smaller) Schedule 10 (or heavier) steel pipe.
- B. Iron Pipe -- Nom 2 in. (51 mm) diam (or smaller) cast or ductile iron pipe.
- C. Conduit -- Nom 2 in. (51 mm) diam (or smaller) steel electrical metallic tubing or steel conduit.
- D. Copper Tubing -- Nom 1/4 in. (6 mm) diam (or smaller) Type L (or heavier) copper tubing.
- E. Copper Pipe -- Nom 1/4 in. (6 mm) diam (or smaller) Regular (or heavier) copper pipe.
- F. Cables -- Max 7/C No. 12 AWG cable with polyvinyl chloride (PVC) jacket.

3. Firestop System -- The firestop system shall consist of the following:

- A. Packing Material -- Min 4 pcf (64 kg/m³) mineral wool batt insulation firmly packed into opening as a permanent form. Min 5-3/4 in. (146 mm) thickness of packing material required in floors. Min 5-1/2 in. (140 mm) thickness of packing material required in walls. Packing material to be recessed from top surface of floor or from both surfaces of wall to accommodate the required thickness of fill material.
- B. Fill, Void or Cavity Materials* - Sealant -- Min 1/4 in. (6 mm) thickness of fill material within the annulus, flush with top surface of floor or with both surfaces of wall.

HILTI CONSTRUCTION CHEMICALS, DIV OF HILTI INC -- FS-ONE Sealant

C. Pipe Covering Materials* -- (Optional) - Min 12 in. (305 mm) length of nom 1 in. (25 mm) thick hollow cylindrical heavy density (min 3.5 pcf or 56 kg/m³) glass fiber unit installed around grouping of penetrants on top surface of floor or on both surfaces of wall. Inside diameter of pipe covering material to be sized to max diam of grouped penetrants. One end of pipe covering material to abut the surface of the sealant (Item 3B). Pipe covering is jacketed on the outside with an all service jacket. Longitudinal joint sealed with metal fasteners or factory-applied self-sealing lap tape.

The T Rating is 0 hr except that when the pipe covering material is used, the T Rating is 2 hr.

See Pipe and Equipment Covering - Materials (BRGU) category in the Building Materials Directory for names of manufacturers. Any pipe covering material meeting the above specifications and bearing the UL Classification Marking with a Flame Spread value of 25 or less and a Smoke Developed value of 50 or less may be used.

D. Fill, Void or Cavity Materials* - Sealant -- When Pipe Covering Material (Item 3C) is used, min 1/2 in. (13 mm) thickness of fill material applied within the annulus between the grouping of penetrants and the pipe covering material, flush with end of pipe covering material above floor or on both sides of wall.

HILTI CONSTRUCTION CHEMICALS, DIV OF HILTI INC -- FS-ONE Sealant

*Bearing the UL Classification Mark

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Through Penetration Details

Multiple Penetrations - Concrete
Floor

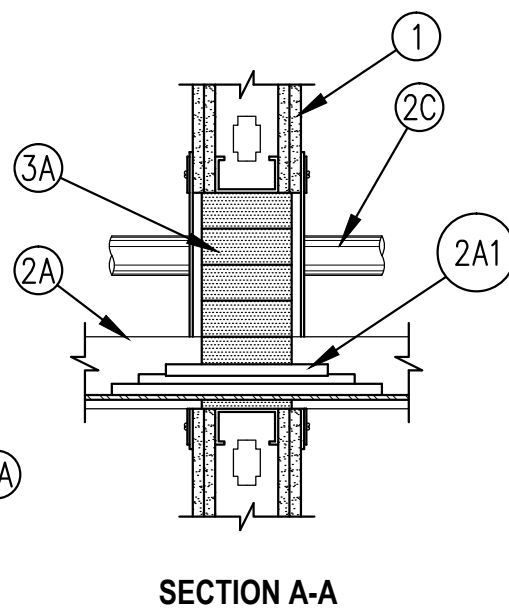
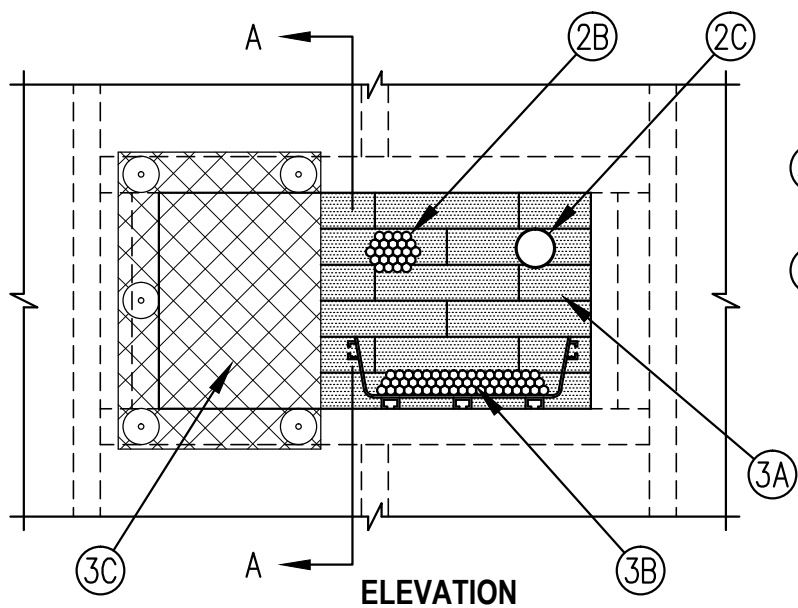
Drawing No:

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System No. W-L-8035

F Rating - 1 and 2 Hr (See Item 1)

T Rating - 1, 1-1/2 and 2 Hr (See Item 2)



1. Wall Assembly The 1 or 2 hr fire-rated gypsum board/stud wall assembly shall be constructed of the materials and in the manner specified if the individual U300 or U400 Series Wall and Partition Designs in the Fire Resistance Directory and shall include the following construction features:

- A. Studs Wall framing shall consist of either wood studs or channel shaped steel studs. Wood studs to consist of 2 by 4 in. lumber spaced 16 in. OC. Steel studs to be min 2-1/2 in. wide, fabricated from min 25 MSG galvanized steel, spaced max 24 in. OC. Additional framing member shall be used to completely frame around opening.
- B. Gypsum Board* Nom 5/8 in. thick with square or tapered edges. The gypsum board type, number of layers and sheet orientation shall be as specified in the individual Wall and Partition Design Number. Max area of opening is 288 sq in. with max dimension of 24 in. The hourly F Rating of the firestop system is equal to the hourly fire rating of the wall assembly in which it is installed.

2. Through Penetrants Max. three of the following penetrants, limited to one of each type in any combination:

- A. Optical Fiber/Communications Cable Raceways+ Max 12 in wide by 4 in. deep communications cable raceway and optional cover plate, formed from Acrylonitrile Butadiene Styrene (ABS). The annular space between the cable raceway and the periphery of the opening shall be min 0 in. (point contact) to max 12 in. Raceway to be rigidly supported on both sides of wall assembly. The minimum space between adjacent penetrants shall be 3-1/2 in.
- A1. Fiber Optic Cables Multiple fiber communication cable jacketed on the outside with polyvinyl chloride (PVC) and having a max outside diam of 1/2 in. Aggregate cross-sectional area of cables in raceway not to exceed 40 percent of the cross-sectional area of the raceway.
- B. Cables Max 3 in. diam tightly bundled cable bundle. The annular space between the cable bundle and the periphery of the opening shall be minimum 1-3/4 in. The min space between adjacent penetrants shall be 3-1/2 in. Raceway to be rigidly supported on both sides of wall assembly. Cable bundle may be any combination of the following types and sizes of cables:

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Through Penetration Details

Multiple Penetrations - Concrete
Floor

Drawing No:

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- B. Cables Max 3 in. diam tightly bundled cable bundle. The annular space between the cable bundle and the periphery of the opening shall be minimum 1-3/4 in. The min space between adjacent penetrants shall be 3-1/2 in. Raceway to be rigidly supported on both sides of wall assembly. Cable bundle may be any combination of the following types and sizes of cables:
1. Max 100 pair No. 24 AWG copper telephone cables with polyvinyl (PVC) insulation and jacket materials.
 2. Max 7/C No. 12 AWG cable with PVC insulation and jacket materials.
 3. Multiple fiber optical communication cables with PVC jacket material and having a max outside diameter of 1/2 in.
- C. Optical Fiber/Communication Cable Raceways+ Nom 2 in. diam (or smaller) optical fiber raceway, formed from polyvinyl chloride (PVC). Raceway to be installed in accordance with Article No. 770 of the National Electrical Code (NFPA No. 70). The annular space between the raceway and the periphery of the opening shall be minimum 2 in. The minimum space between adjacent penetrants shall be 3-1/2 in. Raceway to be rigidly supported on both sides of wall assembly.

See Optical Fiber/Communication Cable Raceways (QAZM) category in the Electrical Construction Materials Directory for names of manufacturers.

The T Rating of the firestop system is dependent upon the type of cable or penetrant within the firestop system as shown in the following table:

Type of Penetrant	T Rating, Hr
A	2
A1	2
B1	1/2
B2	1
B3	1-1/2
C	2

3. Firestop System - The firestop system shall consist of the following:

- A. Fill, Void or Cavity Material* - Fire blocks For walls incorporating max 3-5/8 in. steel studs or max 2 by 4 in. wood studs, fire block installed with 5 in. dimension projecting through and centered in opening. For walls constructed of larger steel or wood studs, fire block installed with long dimension passing through and centered in opening. Blocks may or may not be cut flush with both surfaces of wall. When multiple layers of gypsum board are used, blocks may be recessed 1/2 in. from surface of wall. When optional cover plate is used with communications cable raceway, blocks shall be placed within the raceway at the point of the penetration to fully fill the void between cables and cover plate.

HILTI CONSTRUCTION CHEMICALS, DIV OF HILTI INC -- FS657 Fire Blocks

- B. Fill, Void or Cavity Material* Fill material to be forced into interstices of cables, between cables and cable tray and in obvious openings between blocks and between blocks and the periphery of the opening to the max extent possible on both surfaces of wall.

HILTI CONSTRUCTION CHEMICALS, DIV OF HILTI INC -- FS-ONE Sealant, CP618 Firestop Putty Stick or CP 620 Fire Foam

- C. Wire Mesh When the annular space exceeds 4 in. to the periphery of opening, a nom 2 by 2 in. wire fencing shall be used to keep the blocks in place. The wire fencing shall be fabricated from min No. 16 SWG (0.060 in.) galv steel wire. The wire mesh shall begin 2-1/2 in. from the penetrant and overlap min 3 in. beyond the periphery of the opening. Wire fencing secured to both surfaces of the wall assembly by means of 1/4 in diam hollow wall anchors and 1/2 in. by 1-1/2 in. diam fender washers spaced max 8 in. OC or attached to steel studs with steel screws and 1-7/16 in. diam steel washers spaced max 6 in. OC.

*Bearing the UL Classification Mark

+Bearing the UL Listing Mark

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Through Penetration Details

Multiple Penetrations - Concrete
Floor

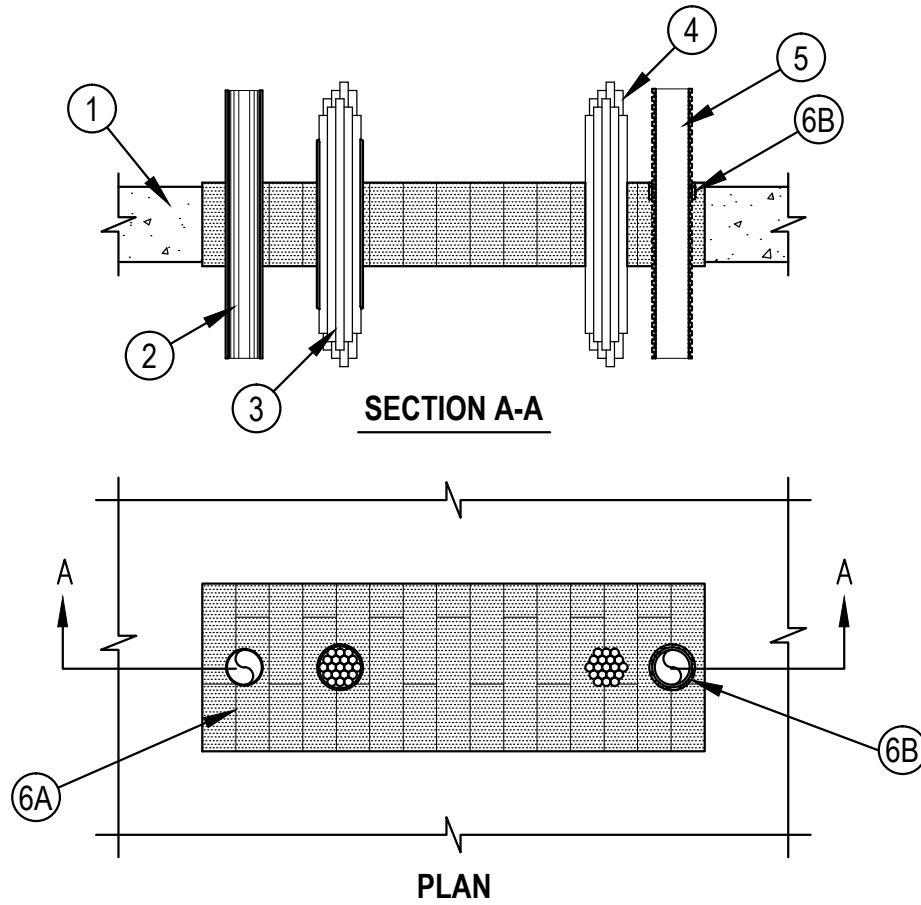
Drawing No:

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System No. C-AJ-8107

F Rating -- 3 Hr

T Ratings - 3/4, 1, 1-3/4 and 3 Hr (See Items 2, 3, 4 and 5)



1. Floor or Wall Assembly -- Min 4-1/2 in. thick reinforced lightweight or normal weight (100-150 pcf) concrete floor or concrete wall. Wall may also be constructed of any solid or filled UL Classified Concrete Blocks*. Max area of 300 sq. in. with max dimension of 30 in.
See Concrete Blocks (CAZT) category in the Fire Resistance Directory for names of manufacturers.
2. Electrical Metallic Tubing -- Nom 2 in. diam (or smaller) steel electrical metallic tubing (EMT), or steel conduit. The min space between adjacent penetrants shall be 3 in. Tubing or conduit to be rigidly supported on both sides of floor assembly. When EMT is used, T Rating is 3/4 Hr.
3. Cable -- 1800 pair - No. 24 AWG 01 ARMM telephone cable with polyvinyl chloride (PVC) insulation and jacket. The min space between adjacent penetrants shall be 3 in. Cable to be rigidly supported on both sides of floor assembly. When 1800 pair cable is used, T Rating is 1 Hr.
4. Cables -- Max 3 in. diam tightly bundled cable bundle. The minimum space between adjacent penetrants shall be 1-1/2 in. Cables to be rigidly supported on both sides of wall assembly.
 - A. Max 300 pair No. 24 AWG copper telephone cables with polyvinyl chloride (PVC) insulation and jacket materials. When 300 pair cable is used, T Rating is 1 Hr.
 - B. Max 7/C No. 12 AWG cable with PVC insulation and jacket materials. When 7/C No. 12 cable is used, T Rating is 1 Hr.
 - C. Multiple fiber optical communication cables with PVC jacket material and having a max outside diameter of 1/2 in. When fiber optic cable is used, T Rating is 1-3/4 Hr.

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Through Penetration Details

Multiple Penetrations - Concrete
or Concrete Block Wall

Drawing No:

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5. Optical Fiber/Communication Cable Raceways+ -- Nom 2 in. diam (or smaller) optical fiber raceway, formed from polyvinyl chloride (PVC). Raceway to be installed in accordance with Article No. 770 of the National Electrical Code (NFPA No. 70). The min space between adjacent penetrants shall be 3 in. Raceway to be rigidly supported on both sides of floor assembly. When raceway is used, T Rating is 3 Hr.

See Optical Fiber/Communication Cable Raceways (QAZM) category in the Electrical Construction Materials Directory for names of manufacturers

6. Firestop System -- The annular space between the individual penetrants and the periphery of the opening shall be min ½ in. to max 11-1/4 in. The firestop system shall consist of the following:

A. Fill, Void or Cavity Material* -- Fire Blocks - Blocks installed with 5 in. dimension projecting through and centered within opening.

HILTI CONSTRUCTION CHEMICALS, DIV OF HILTI INC -- FS657 Fire Block

B. Fill, Void or Cavity Material* -- - Wrap Strip - (Optional) - Nom 3/16 in. thick by 1 in. wide intumescent wrap strip. One layers of wrap strip is individually wrapped around raceway with ends butted and held in place with tape. Wrap strip installed flush with top surface of block in floor assemblies or both surfaces of fire block in wall assemblies.

HILTI CONSTRUCTION CHEMICALS, DIV OF HILTI INC -- CP648-E- W25/1" Wrap Strip

C. Fill, Void or Cavity Material* -- - Fill material to be forced into interstices of cables, between cables and cable tray and in obvious openings between blocks and between blocks and the periphery of the opening to the max extent possible on both surfaces of wall.

HILTI CONSTRUCTION CHEMICALS, DIV OF HILTI INC -- FS-ONE Sealant, CP618 Firestop Putty Stick or CP620 Fire Foam

D. Wire Mesh-(Not Shown) -- When the annular space exceeds 4 in. between penetrants or between penetrants and the periphery , a nom 2 by 2 in. wire fencing shall be used to keep the blocks in place. The wire fencing shall be fabricated from min No. 16 SWG (0.060 in.) galv steel wire. The wire is cut to fit the contour of the penetrating items with a min 3 in. overlap beyond the periphery of the opening. Wire fencing secured to top surface of floor and both surfaces of the wall assembly by means of 1/4 in. diam by 1 in. long concrete anchors and 1/4 in. by 1-1/2 in. diam fender washers spaced max 8 in. OC.

+Bearing the UL Listing Mark

*Bearing the UL Classification Mark

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Through Penetration Details

Multiple Penetrations - Concrete
or Concrete Block Wall

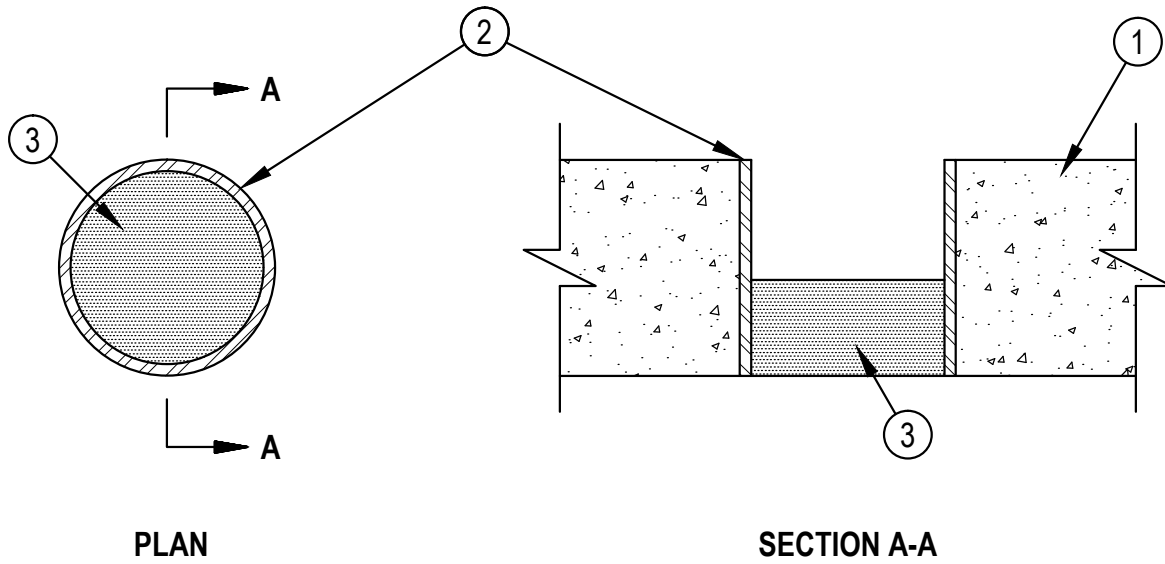
Drawing No:

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System No. C-AJ-0055

F Rating -- 3 Hr

T Rating -- 0 Hr



1. Floor or Wall Assembly -- Min 4-1/2 in. thick reinforced lightweight or normal weight (100-150 pcf) concrete. Wall may also be constructed of any UL Classified Concrete Blocks*. Max diam of opening is 4 in.

See Concrete Blocks (CAZT) category in the Fire Resistance Directory for names of manufacturers.

2. Metallic Sleeve -- Nom 4 in. diam (or smaller) Schedule 40 (or heavier) steel pipe cast or grouted into floor or wall assembly, flush with floor or wall surfaces.

3. Fill, Void or Cavity Material* -- Fire block min 2 in. thick cut to a diam 1/2 in. larger than the opening, flush with bottom surface of floor or with both surfaces of wall.

HILTI CONSTRUCTION CHEMICALS, DIV OF HILTI INC -- FS-Fire Block

*Bearing the UL Classification Mark

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Through Penetration Details

Blank Openings - Concrete Floor

Drawing No:

8 of 29

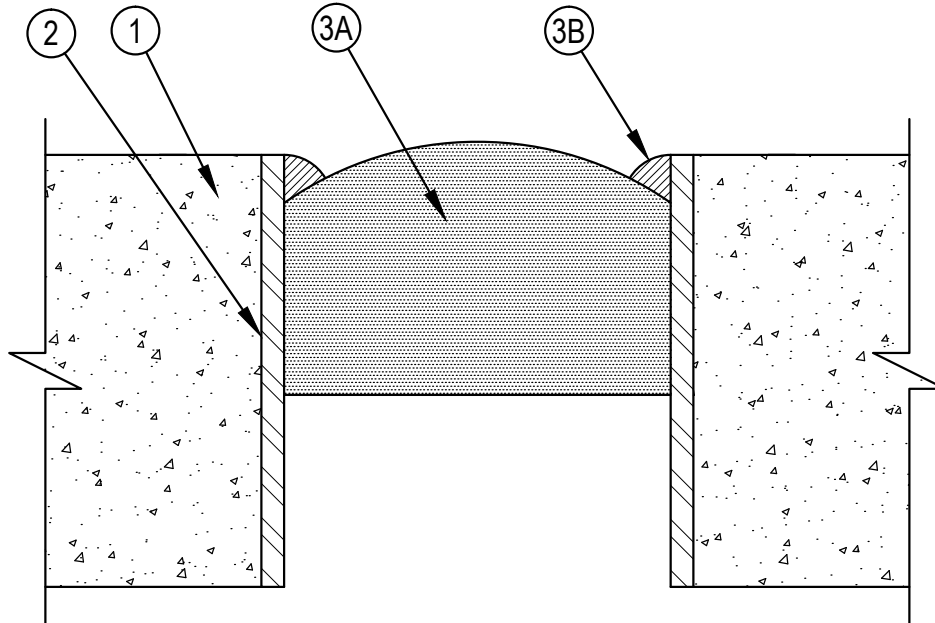
System No. C-AJ-0097

F Rating -- 2 Hr

T Ratings -- 0 and 1/2 Hr (See Item 2)

L Rating At Ambient - Less Than 1 CFM/sq ft

L Rating At 400 F - Less Than 1 CFM/sq ft



SECTION

1. Floor or Wall Assembly -- Min 4-1/2 in. (114 mm) thick reinforced lightweight or normal weight (100-150 pcf or 1600-2400 kg/m³) concrete. Wall may also be constructed of any UL Classified Concrete Blocks*.

See Concrete Blocks (CAZT) category in the Fire Resistance Directory for names of manufacturers.

2. Metallic Sleeve -- Nom 4 in. (102 mm) diam (or smaller) Schedule 40 (or heavier) steel pipe cast or grouted into floor or wall flush with floor or wall surfaces. Sleeve may extend max 2 in. (51 mm) above top surface of floor or both surfaces of wall. When sleeve extends above top surface of floor or either surface of wall, T Rating is 0 Hr.

3. Firestop System -- The firestop system shall consist of the following:

A. Fill, Void or Cavity Materials* - Plug -- Plug sized for the steel sleeve friction-fitted within the sleeve with edges recessed 1/2 in. (13 mm) from the top surface of the floor or from both surfaces of the wall.

HILTI CONSTRUCTION CHEMCIALS, DIV OF HILTI INC -- CP 658T Firestop Plug

B. Fill, Void or Cavity Materials* - Putty -- Nom 1/2 in. (13 mm) diam bead of putty applied around periphery of opening at plug/sleeve interface.

HILTI CONSTRUCTION CHEMCIALS, DIV OF HILTI INC -- CP 618 Firestop Putty Stick

*Bearing the UL Classification Mark

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Through Penetration Details

Blank Openings - Concrete or
Concrete Block Wall

Drawing No:

9 of 29

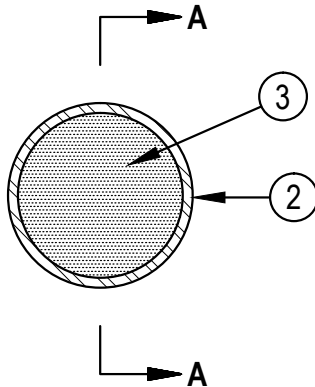
System No. W-L-0018

F Ratings — 1 and 2 Hr (See Item 1)

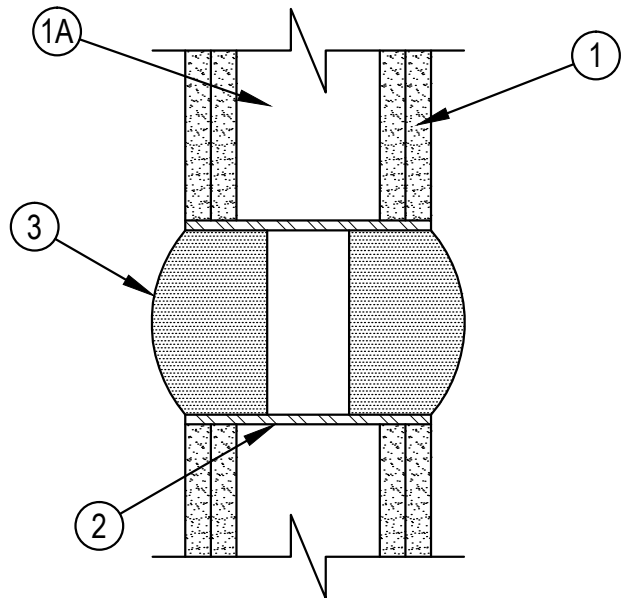
T Ratings — 0 and 1-1/2 Hr (See Item 2)

L Rating At Ambient - Less Than 1 CFM/sq ft

L Rating At 400 F - Less Than 1 CFM/sq ft



ELEVATION



SECTION A-A

1. Wall Assembly — The 1 or 2 hr fire-rated gypsum board/stud wall assembly shall be constructed of the materials and in the manner specified if the individual U300, U400 or V400 Series Wall and Partition Designs in the Fire Resistance Directory and shall include the following construction features:
 - A. Studs — Wall framing shall consist of either wood studs or channel shaped steel studs. Wood studs to consist of 2 by 4 in. (51 by 102 mm) lumber spaced max 16 in. (406 mm) OC. Steel studs to be min 3-1/2 in. (89 mm) wide, fabricated from min 25 MSG galvanized steel, spaced max 24 in. (610 mm) OC.
 - B. Gypsum Board* — Nom 5/8 in. (16 mm) thick with square or tapered edges. The gypsum board type, number of layers and sheet orientation shall be as specified in the individual Wall and Partition Design Number. Max diam of opening is 5-1/2 in. (140 mm).

The hourly F Rating of the firestop system is equal to the hourly fire rating of the wall assembly in which it is installed.
2. Metallic Sleeve — Nom 4 in. (102 mm) diam (or smaller) Schedule 5 (or heavier) steel pipe sleeve. Sleeve to be flush with wall surfaces or may extend up to 12 in. (305 mm) beyond either or both wall surfaces. The annular space between steel sleeve and periphery of opening shall be min 0 in. (continuous point contact) to max 1 in. (25 mm). Where sleeve extends more than 2 in. (51 mm) beyond the surface of the wall it shall be rigidly supported.

The T Rating of the firestop system is 0 Hr when sleeve extends beyond one or both wall surfaces. T Rating is 1-1/2 Hr when the sleeve is flush with both wall surfaces.
3. Firestop System — The firestop system shall consist of the following:
 - A. Fill, Void or Cavity Materials* - Plug — Plug sized for the steel sleeve friction fit within the sleeve flush with the end of the sleeve on both sides of the wall assembly.

HILTI CONSTRUCTION CHEMICALS, DIV OF HILTI INC — CP 658T Firestop Plug
 - B. Fill, Void or Cavity Material* — Sealant — (Not shown) — Min 5/8 in. (16 mm) thickness of fill material applied within the annulus between sleeve and periphery of opening, flush with both sides of wall. At point contact, a min 1/2 in. (13 mm) bead of fill material shall be applied at sleeve/wall interface when sleeve extends beyond surface of wall.

HILTI CONSTRUCTION CHEMICALS, DIV OF HILTI INC — FS-ONE Sealant

*Bearing the UL Classification Mark

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Through Penetration Details

Blank Openings - Gypsum Wall

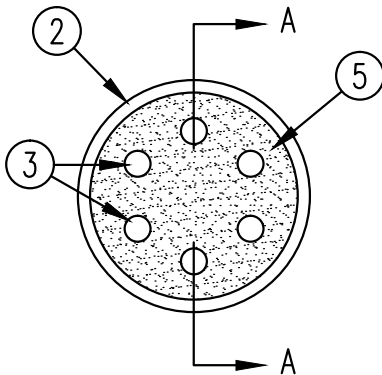
Drawing No:

10 of 29

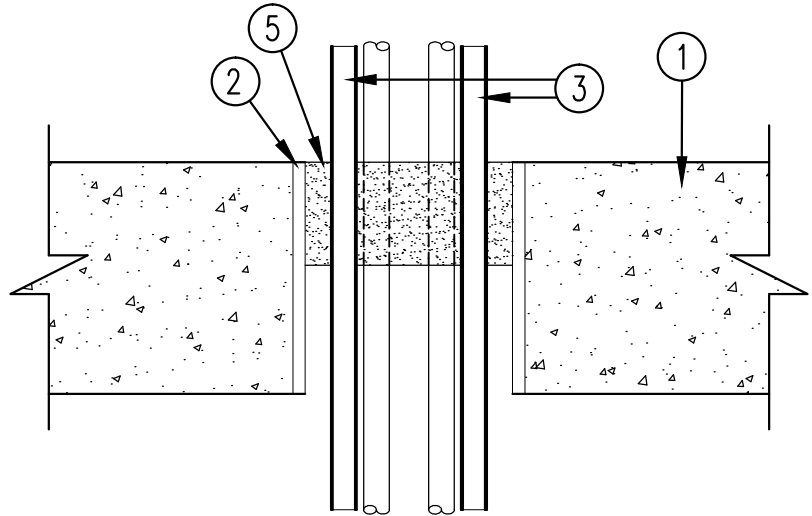
System No. C-AJ-3084

F Rating - 3 Hr

T Rating - 2-1/2 Hr



PLAN



SECTION A-A

1. Floor or Wall Assembly Min 4-1/2 in. thick reinforced lightweight or normal weight (100-150 pcf) concrete. Wall may also be constructed of any UL Classified Concrete Blocks*. Max diam of opening is 4 in.

See Concrete Blocks (CAZT) category in the Fire Resistance Directory for names of manufacturers.

2. Nonmetallic Sleeve (Optional) -- Nom 4 in. diam (or smaller) Schedule 40 solid-core polyvinyl chloride (PVC) pipe.

3. Cables Six, max 25 pair No. 24 AWG telephone cables with polyvinyl chloride (PVC) insulation and jacket materials to be used in the assembly. The annular space shall be min 1/4 in. to max 1-1/4 in. Cables to be rigidly supported on both sides of floor or wall assembly.

4. Packing Material (Not Shown) -- Mineral wool insulation firmly packed into the opening as a temporary form. Packing material to be recessed from the top surface of floor or both surfaces of wall to accommodate the required thickness of fill material. In floors form may be removed after fill material has cured.

5. Fill, Void or Cavity Material* - Sealant Min 2 in. thickness of fill material applied within the annulus, flush with top surface of floor or with both surfaces of wall.

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Through Penetration Details

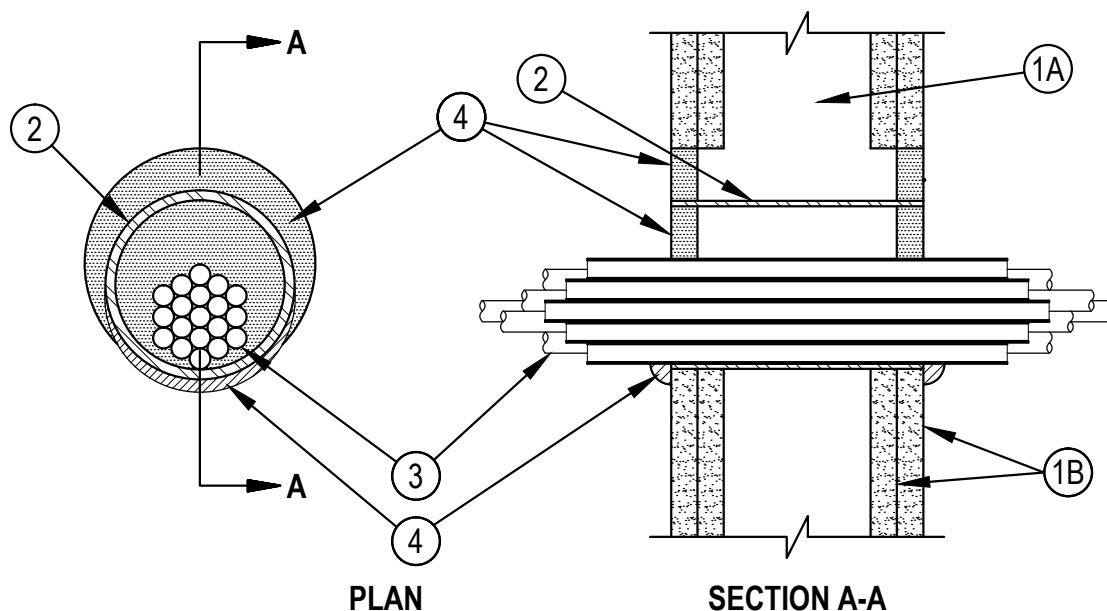
Cable - Concrete Floor/Concrete
or Concrete Block Wall

Drawing No:

11 of 29

System No. W-L-3065

F Ratings — 1 and 2 Hr (See Item 1)
T Rating — 0 Hr



- Wall Assembly — The 1 or 2 fire-rated gypsum wallboard/stud wall assembly shall be constructed of the materials and in the manner specified in the individual U300, U400 or V400 Series Wall and Partition Designs in the UL Fire Resistance Directory and shall include the following construction features:
 - Studs — Wall framing may consist of either wood studs or steel channel studs. Wood studs to consist of nom 2 by 4 in. (51 by 102 mm) lumber spaced 16 in. (406 mm) OC. Steel studs to be min 2-1/2 in. (64 mm) wide and spaced max 24 in. (610 mm) OC.
 - Gypsum Board* — Nom 5/8 in. (16 mm) thick gypsum board, with square or tapered edges. The gypsum board type, thickness, number of layers, fastener type and sheet orientation shall be as specified in the individual U300, U400 or V400 Series Design in the UL Fire Resistance Directory. Max diam of opening is 5-1/2 in. (138 mm) when sleeve (Item 2) is employed. Max diam of opening is 4 in. (102 mm) when sleeve (Item 2) is not employed.
 The F Rating of the firestop system is equal to the fire rating of the wall assembly.
- Metallic Sleeve — (Optional) - Nom 4 in. (102 mm) diam (or smaller) steel electrical metallic tubing (EMT) or Schedule 5 (or heavier) steel pipe or min 0.016 in. thick (0.41 mm, No. 28 ga) galv steel sleeve installed flush with wall surfaces. The annular space between steel sleeve and periphery of opening shall be min 0 in. (0 mm, point contact) to max 1 in. (25mm). When Schedule 5 steel pipe or EMT is used, sleeve may extend up to 18 in. (457 mm) beyond the wall surfaces.
- Cables — Aggregate cross-sectional area of cable in opening to be max 45 percent of the cross-sectional area of the opening. The annular space between the cable bundle and the periphery of the opening to be min 0 in. (0 mm, point contact) to max 1 in. (25 mm) Cables to be rigidly supported on both sides of the wall assembly. Any combination of the following types and sizes of copper conductor cables may be used:
 - Max 7/C No. 12 AWG with polyvinyl chloride (PVC) insulation and jacket.
 - Max 25 pair No. 24 AWG telephone cable with PVC insulation and jacket.
 - Type RG/U coaxial cable with polyethylene (PE) insulation and PVC jacket having a max outside diameter of 1/2 in. (13 mm).
 - Multiple fiber optical communication cable jacketed with PVC and having a max OD of 5/8 in. (16 mm).
 - Through Penetrating Products* — Max three copper conductor No. 8 AWG . Metal-Clad Cable+.
 AFC CABLE SYSTEMS INC
 F. Max 3/C (with ground)(or smaller) No. 8 AWG copper conductor cable with PVC insulation and jacketing.
 G. Max 3/4 in. (19 mm) diam copper ground cable with or without a PVC jacket.
 H. Fire Resistive Cables* - Max 1-1/4 in. (32 mm) diam single conductor or multi conductor Type MI cable. A min 1/8 in. (3 mm) separation shall be maintained between MI cables and any other types of cable.
 Through Penetrating Product* - Any cables, Metal-Clad Cable+ or Armored Cable+ currently Classified under the Through Penetrating Products category.
 See Through Penetrating Product (XHLY) category in the Fire Resistance Directory for names of manufacturers.
- Fill, Void or Cavity Material* — Sealant or Putty — Fill material applied within the annulus, flush with each end of the steel sleeve or wall surface. Fill material installed symmetrically on both sides of the wall. A min 5/8 in. (16 mm) thickness of sealant is required for the 1 or 2 hr F Rating . An additional 1/2 in. (13 mm) diam bead of fill material shall be applied around the perimeter of sleeve on both sides of the wall when sleeve extends beyond surface of wall.
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*Bearing the UL Classification Mark

+Bearing the UL Listing Mark

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Through Penetration Details

Cable - Gypsum Wall

Drawing No:

12 of 29

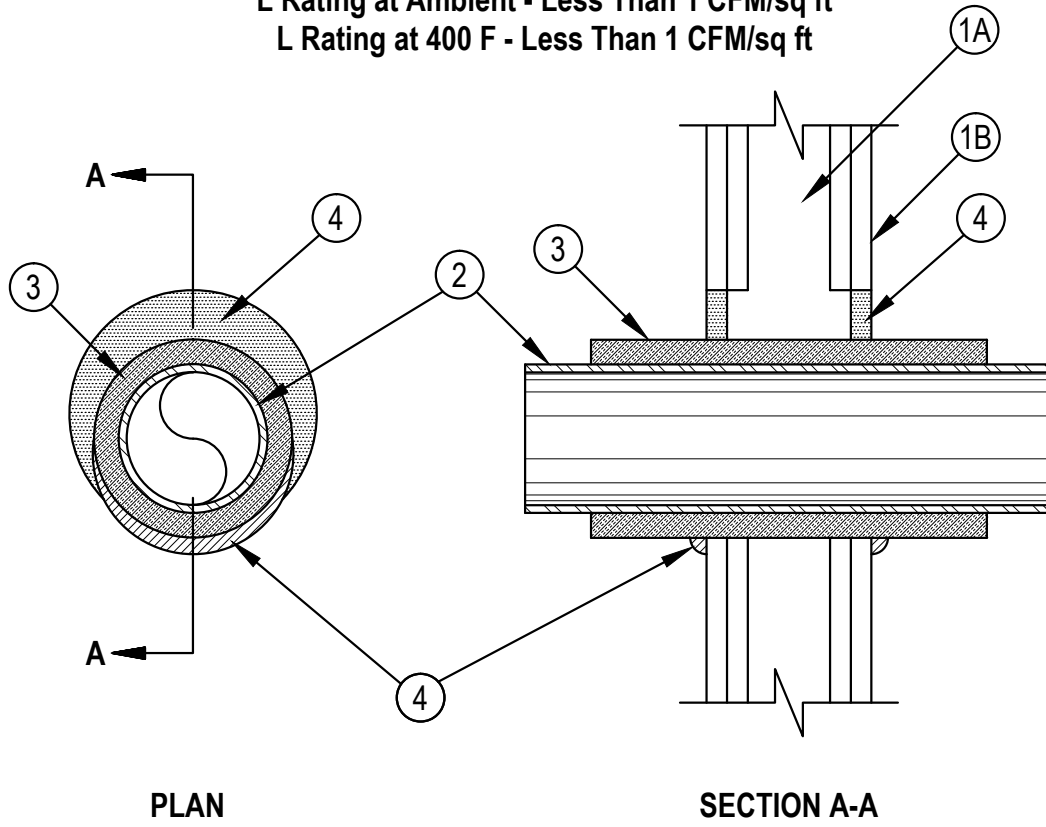
System No. W-L-5028

F Ratings - 1 and 2 Hr (See Item 1)

T Ratings - 3/4 Hr

L Rating at Ambient - Less Than 1 CFM/sq ft

L Rating at 400 F - Less Than 1 CFM/sq ft



PLAN

SECTION A-A

1. Wall Assembly — The 1 or 2 hr fire-rated gypsum wallboard/stud wall assembly shall be constructed of the materials and in the manner specified in the individual U300 or U400 Series Wall and Partition Designs in the UL Fire Resistance Directory and shall include the following construction features:

A. Studs — Wall framing may consist of either wood studs or steel channel studs. Wood studs to consist of nom 2 by 4 in. lumber spaced 16 in. OC. Steel studs to be min 2-1/2 in. wide and spaced max 24 in. OC.

B. Gypsum Board* — 5/8 in. thick, 4 ft wide with square or tapered edges. The gypsum wallboard type, thickness, number of layers, fastener type and sheet orientation shall be as specified in the individual Wall and Partition Design. Max diam of opening is 7-1/2 in. The hourly F Rating of the firestop system is equal to the hourly fire rating of the wall assembly in which it is installed.

2. Through Penetrants — One metallic pipe or tubing to be centered within the firestop system. Pipe or tubing to be rigidly supported on both sides of wall assembly. The following types and sizes of metallic pipes or tubing may be used:

A. Steel Pipe — Nom 4 in. diam (or smaller) Schedule 40 (or heavier) steel pipe.

B. Copper Tubing — Nom 2 in. diam (or smaller) Type L (or heavier) copper tubing.

C. Copper Pipe — Nom 2 in. diam (or smaller) Regular (or heavier) copper pipe.

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Through Penetration Details

Insulated Pipe - Gypsum Wall

Drawing No:

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3. Tube Insulation — Plastics+ — Nom 3/4 in. thick acrylonitrile butadiene/polyvinyl chloride (AB/PVC) flexible foam furnished in the form of tubing. An annular space of min 0 in. (point contact) to max 1-1/2 in. is required within the firestop system.

See Plastics+ (QMFZ2) category in the Recognized Component Directory for names of manufacturers. Any Recognized Component tube insulation material meeting the above specifications and having a UL 94 Flammability Classification of 94-5VA may be used. The hour T Rating of the firestop system is dependent on the hourly fire rating of the wall assembly in which it is installed, the size and type of through penetrant and the pipe covering thickness, as shown in the table below:

Wall Assembly Hr Rating	Type +	Through Penetrant Max Diam In.
1	A	4
1	A, B, or C	2
2	A	4
2	A, B, or C	2

+Indicates penetrant type as itemized in Item 2.

4. Fill, Void or Cavity Material* — Sealant — Min 5/8 in. thickness of fill material applied within the annulus, flush with both surfaces of wall. At the point contact location between pipe covering and gypsum wallboard, a min 1/2 in. diam bead of fill material shall be applied at the pipe covering/gypsum wallboard interface on both surfaces of wall.

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HILTI INC — FS-ONE Sealant

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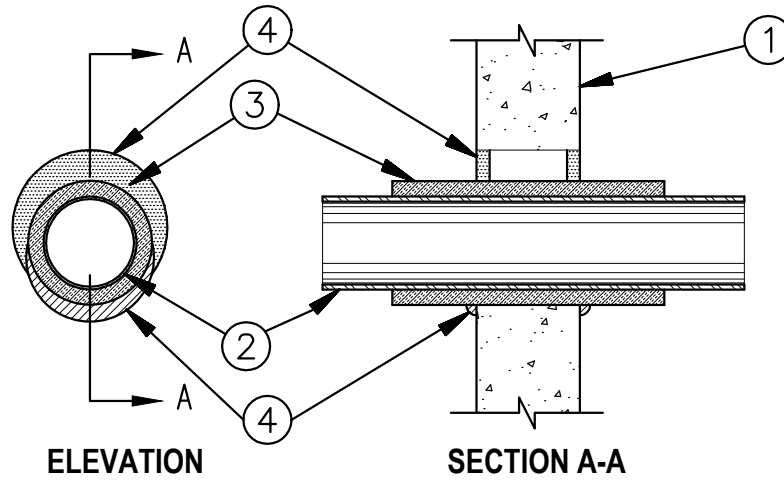
Through Penetration Details

Insulated Pipe - Gypsum Wall

Drawing No:

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System No. W-J-5041
F Ratings - 1 and 2 Hr (See Items 1)
T Ratings - 3/4 Hr



1. Wall Assembly Min 3-3/4 in. and 5 in. thick reinforced lightweight or normal weight (100-150 pcf) concrete for 1 and 2 h rated assemblies respectively. Wall may also be constructed of any UL Classified Concrete Blocks*. Max diam of opening is 7-1/2 in.

See Concrete Blocks (CAZT) category in the Fire Resistance Directory for names of manufacturers.

2. Through-- Penetrants One metallic pipe, conduit or tubing to be centered within the firestop system. Pipe, conduit or tubing to be rigidly supported on both sides of wall assembly. The following types and sizes of metallic pipes, conduits or tubing may be used:

- A. Steel Pipe Nom 4 in. diam (or smaller) Schedule 40 (or heavier) steel pipe.
- B. Conduit Nom 4 in. diam (or smaller) electrical metallic tubing or steel conduit.
- C. Copper Tubing Nom 2 in. diam (or smaller) Type L (or heavier) copper tubing.
- D. Copper Pipe Nom 2 in. diam (or smaller) regular (or heavier) copper pipe.

3. Tube Insulation--Plastics+ Nom 3/4 in. thick acrylonitrile butadiene/polyvinyl chloride (AB/PVC) flexible foam furnished in the form of tubing. An annular space of min 0 in. (point contact) to max 1-1/2 in. is required within the firestop system.

See Plastics+ (QMFZ2) category in the Recognized Component Directory for names of manufacturers.

Any Recognized Component tube insulation material meeting the above specifications and having a UL 94 Flammability Classification of 94-5VA may be used.

The hour T Rating of the firestop system is dependent on the size and type of through penetrant and the pipe diam, as shown in the table below:

Type +	Through Penetrant Max. Diameter, In.
A or B	4
A,B,C or D	2

+ Indicates penetrant type as itemized in Item 2.

4. Fill, Void or Cavity Material*--Sealant Min 5/8 in. thickness of fill material applied within the annulus, flush with both surfaces of wall. At the point contact location between pipe covering and wall, a min 1/2 in. diam bead of fill material shall be applied at the pipe covering/wall interface on both surfaces of wall.

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Through Penetration Details

Insulated Pipe - Concrete or
Concrete Block Wall

Drawing No:

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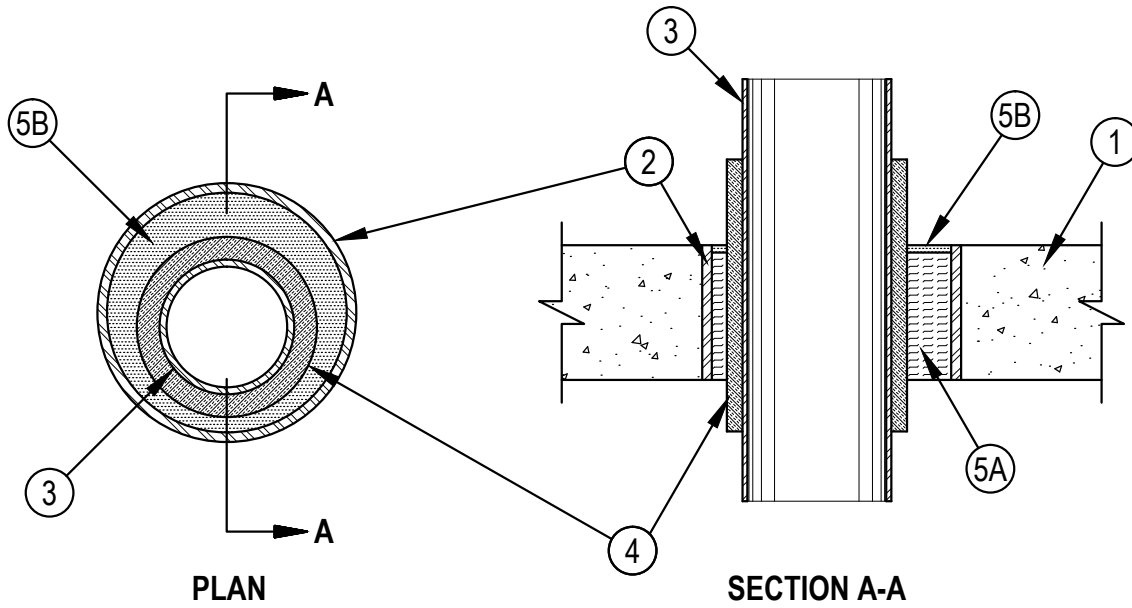
System No. C-AJ-5090

F Rating — 3 Hr

T Rating — 0 Hr

L Rating At Ambient — 4 CFM/Sq Ft

L Rating At 400 F — Less Than 1 CFM/Sq Ft



1. Floor or Wall Assembly — Min 4-1/2 in. (114 mm) thick reinforced lightweight or normal weight (100-150 pcf or 1600-2400 kg/m³) concrete. Wall may also be constructed of any UL Classified Concrete Blocks*. Max diam of opening is 8 in. (203 mm).

See Concrete Blocks (CAZT) Category in the Fire Resistance Directory for names of manufacturers.

2. Metallic Sleeve — (Optional) — Nom 8 in. (203 mm) diam (or smaller) Schedule 10 (or heavier) steel sleeve cast or grouted into floor or wall assembly, flush with floor or wall surfaces or extending a max of 3 in. (76 mm) above floor or beyond both surfaces of wall.

3. Through Penetrants — One metallic pipe or tubing to be centered within the firestop system. Pipe or tubing to be rigidly supported on both sides of floor or wall assembly. The following types and sizes of metallic pipes or tubing may be used:

A. Steel Pipe — Nom 4 in. (102 mm) diam (or smaller) Schedule 5 (or heavier) steel pipe.

B. Copper Pipe — Nom 4 in. (102 mm) diam (or smaller) Regular (or heavier) copper tubing.

C. Copper Tubing — Nom 4 in. (102 mm) diam (or smaller) Type L (or heavier) copper tubing.

4. Tube Insulation — Plastics+ — Nom 3/4 in. (19 mm), thick acrylonitrile butadiene/polyvinyl chloride (AB/PVC) flexible foam furnished in the form of tubing. A annular space shall be min 1/2 in. (13 mm) to max of 1-1/2 in. (38 mm).

See Plastics+ (QMFZ2) Category in the Recognized Component Directory for names of manufacturers. Any Recognized Component tube insulation material meeting the above specifications and having a UL 94 Flammability Classification of 94-5VA may be used.

5. Firestop System — The firestop system shall consist of the following:

A. Packing Material — Min 4 in. (102 mm) thickness of min 4 pcf (64 kg/m³) mineral wool batt insulation firmly packed into opening as a permanent form. Packing material to be recessed from top surface of floor or from both surfaces of wall as required to accommodate the required thickness of fill material.

B. Fill, Void or Cavity Material* — Sealant — Min 1/4 in. (6 mm) thickness of fill material applied within the annulus, flush with top surface of floor or with both surfaces of wall.

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Through Penetration Details

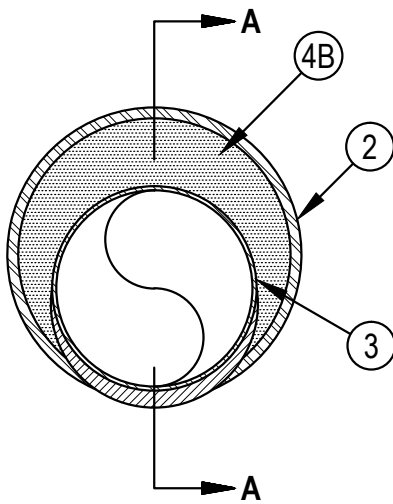
Insulated Pipe - Concrete Floor

Drawing No:

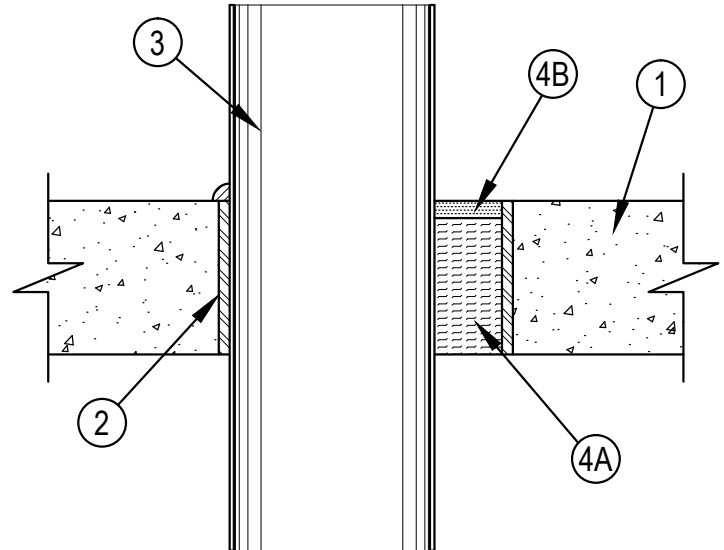
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System No. C-AJ-7103

F Rating -- 2 Hr
T Rating -- 1/4 Hr



PLAN



SECTION A-A

1. Floor or Wall Assembly -- Min 4-1/2 in. (114 mm) thick reinforced lightweight or normal weight (100-150 pcf or 1600-2400 kg/m³) concrete. Floor may also be constructed of any min 6 in. thick UL Classified hollow-core Precast Concrete Units*. Wall may also be constructed of any UL Classified Concrete Blocks*. Max diam of opening is 8 in. (203 mm). Max diam of opening in floors constructed of hollow-core precast concrete units is 7 in. (178 mm).

See Concrete Blocks (CAZT) and Precast Concrete Units (CFTV) categories in the Fire Resistance Directory for names of manufacturers.

2. Steel Sleeve (Optional) -- Nom 8 in. (203 mm) diam (or smaller) Schedule 10 (or heavier) steel pipe sleeve cast or grouted into floor or wall assembly, flush with both surfaces of floor or wall.
3. Steel Vent Duct -- Nom 6 in. (152 mm) diam (or smaller) No. 28 gauge (or heavier) galv steel duct. One duct to be installed either concentrically or eccentrically within the firestop system. The annular space shall be min 0 in. (0 mm, point contact) to max 2 in. (51 mm). Duct to be rigidly supported on both sides of floor or wall assembly.
4. Firestop System -- The firestop system shall consist of the following:
 - A. Packing Material -- Min 4 in. (102 mm) thickness of min 4 pcf (64 kg/m³) mineral wool batt insulation firmly packed into opening as a permanent form. Packing material to be recessed from bottom or top surface of floor or from both surfaces of wall as required to accommodate the required thickness of fill material.
 - B. Fill, Void or Cavity Material* -- Min 1/2 in. (13 mm) thickness of fill material applied within the annulus, flush with bottom or top surface of floor or with both surfaces of wall. A min 1/2 in. (13 mm) diam bead of caulk shall be applied at the point contact location between pipe and sleeve/concrete.

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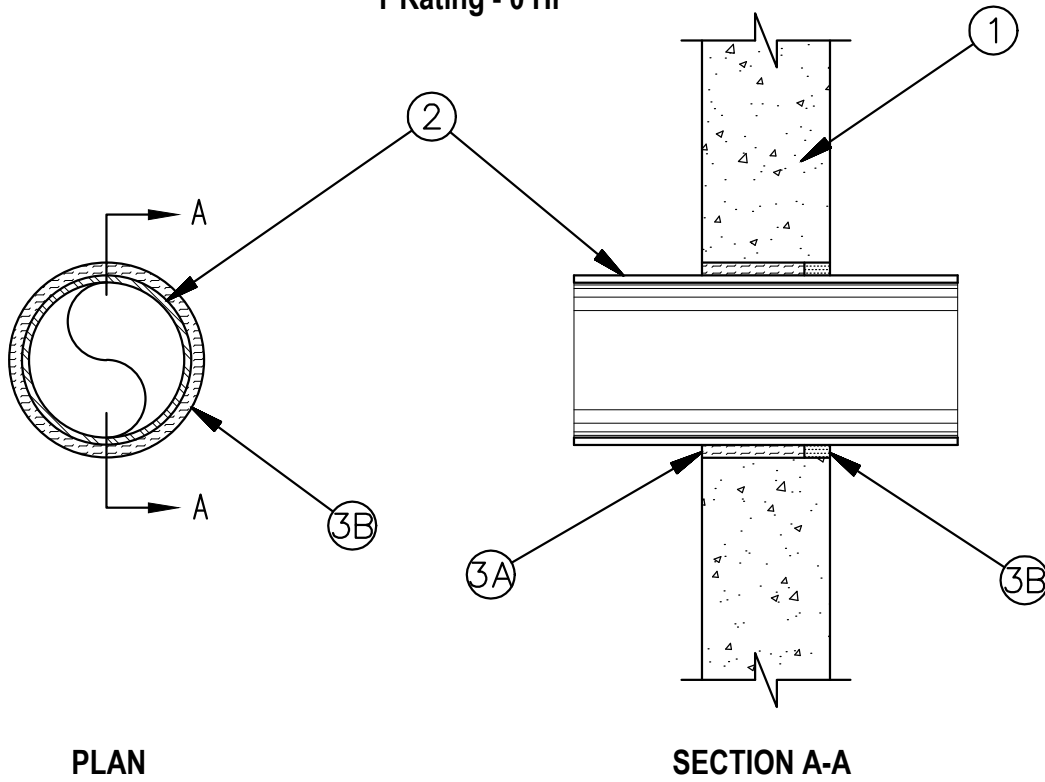
Through Penetration Details

HVAC Penetration - Concrete
Floor

Drawing No:

16 of 29

System No. W-J-7038
F Rating - 1 and 2 Hr (See Items 1 and 3)
T Rating - 0 Hr



1. Wall Assembly Min 3-1/8 and 3-3/4 in. thick reinforced lightweight or normal weight (100-150 pcf) concrete for 1 and 2 hr ratings, respectively. Wall may also be constructed of any UL Classified Concrete Blocks*. Maximum diameter of opening 7 in. See Concrete Blocks (CAZT) category in the Fire Resistance Directory for names of manufacturers.
2. Steel Duct Nom 6 in. diam (or smaller) No. 28 gauge (or heavier) galv steel duct to be installed either concentrically or eccentrically within the firestop system. The annular space shall be min 1/2 in. to max 3/4 in. Duct to be rigidly supported on both sides of the wall assembly.
3. Firestop System The firestop system shall consist of the following:
 - A. Packing Material Min 2-1/8 in. or 2-3/4 in. thickness of min 4 pcf mineral wool batt insulation firmly packed into opening on one side of the wall as a permanent form for 1 and 2 hr walls, respectively. Packing material to be recessed from one side of wall as required to accommodate the required thickness of fill material.
 - B. Fill, Void or Cavity Material -- Sealant* Min 1 in. thickness of fill material applied within opening, flush with one surface of wall.

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Through Penetration Details

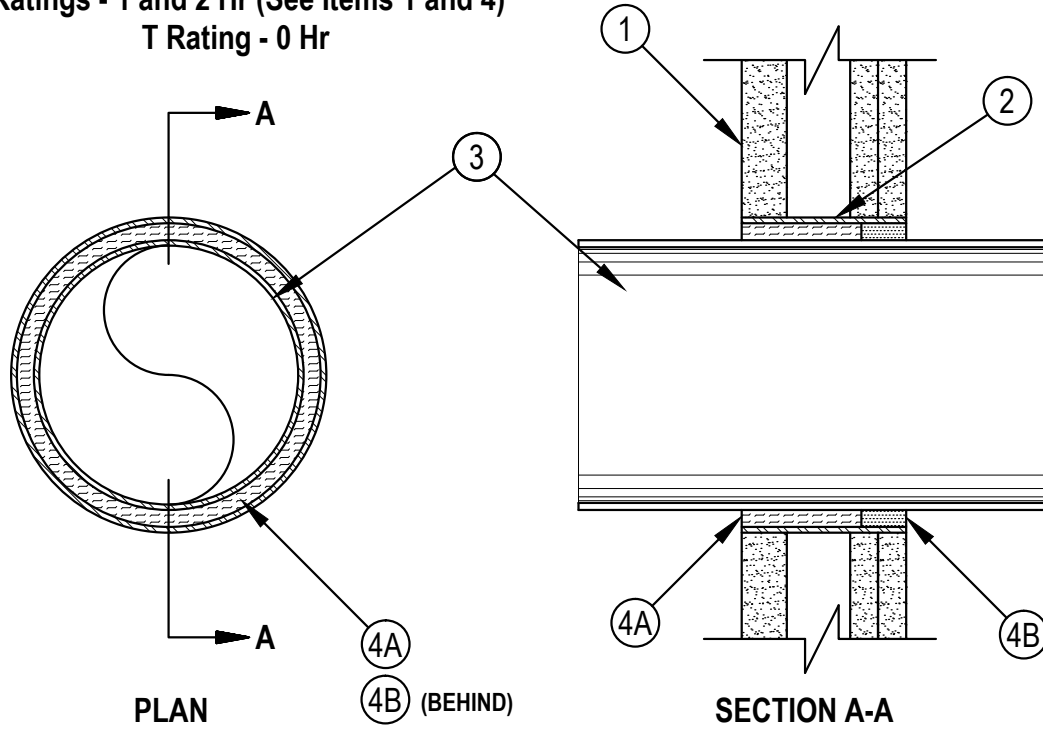
HVAC Penetration - Concrete or
 Concrete Block Wall

Drawing No:

17 of 29

System No. W-L-7068

F Ratings - 1 and 2 Hr (See Items 1 and 4)
T Rating - 0 Hr



1. Wall Assembly — The 1 or 2 hr fire-rated gypsum board/stud wall assembly shall be constructed of the materials and in the manner described in the individual U400 or V400 Series Wall and Partition Design in the UL Fire Resistance Directory and shall include the following construction features:

A. Studs — "C-T" shaped studs -1-5/8 in. wide by 2-1/2 in. deep, fabricated from 25 MSG galv steel, spaced max 24 in. OC.

B. Gypsum Board* — One layer of nom 1in. thick, 24 in. wide gypsum liner and one or two layers of nom 5/8 in. thick, 4 ft. wide gypsum board with square or tapered edges. The gypsum board type, number of layers, fastener type and sheet orientation shall be as specified in the individual Wall and Partition Design. Max diam of opening is 7 in.

1A. Wall Assembly — As an alternate to the above wall assembly, the 1 or 2 Hr fire rated gypsum board/stud wall assembly shall be constructed of the materials and in the manner specified in the individual U300, U400 or V400 Series Wall and Partition Designs in the UL Fire Resistance Directory and shall include the following construction features:

A. Studs — Wall framing may consist of either wood studs or steel channel studs. Steel studs to be min 2-1/2 in. wide and spaced max 24 in. OC. Wood studs to consist of nom 2 by 4 in. lumber spaced 16 in. OC.

B. Gypsum Board* — Thickness, type, number of layers and fasteners as required in the individual Wall and Partition Design. Max diam of opening is 7 in.

The hourly F Rating of the firestop system is equal to the hourly fire rating of the wall assembly in which it is installed.

2. Metallic Sleeve — Max 7 in. diam cylindrical sleeve fabricated from min 0.016 in. thick (28 gauge) galv sheet steel and having a min 1 in. lap along the longitudinal seam. Length of steel sleeve to be equal to thickness of wall. Sleeve installed by coiling the sheet steel to a diam smaller than the through opening, inserting the coil through the opening and releasing the coil to let it uncoil against the circular cutouts in the gypsum board layers. Sleeve may also be formed of No. 8 steel wire mesh having a min 1 in. lap along the longitudinal seam.

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Through Penetration Details

HVAC Penetration - Gypsum
Wall

Drawing No:

18a of 29

3. Steel Duct — Nom 6 in. diam (or smaller) No. 28 gauge (or heavier) galv steel duct to be installed either concentrically or eccentrically within the firestop system. The annular space shall be min 1/4 in. to max 3/4 in. Duct to be rigidly supported on both sides of the wall assembly.

4. Firestop System — The firestop system shall consist of the following:

A. Packing Material — Min 2-1/8 or 2-3/4 in. thickness of min 4 pcf mineral wool batt insulation firmly packed into sleeve on one side of the wall as a permanent form for 1 and 2 hr walls, respectively. Packing material to be recessed from the room side of wall as required to accommodate the required thickness of fill material. In alternate wall assembly, packing material to be flush with either side of the wall and recessed from the other side of the wall to accommodate the required thickness of fill material.

B. Fill, Void or Cavity Material — Sealant* — Min 1 in. thickness of fill material applied within opening, flush with one surface of wall.

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HILTI INC — FS-ONE Sealant

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Through Penetration Details

HVAC Penetration - Gypsum
Wall

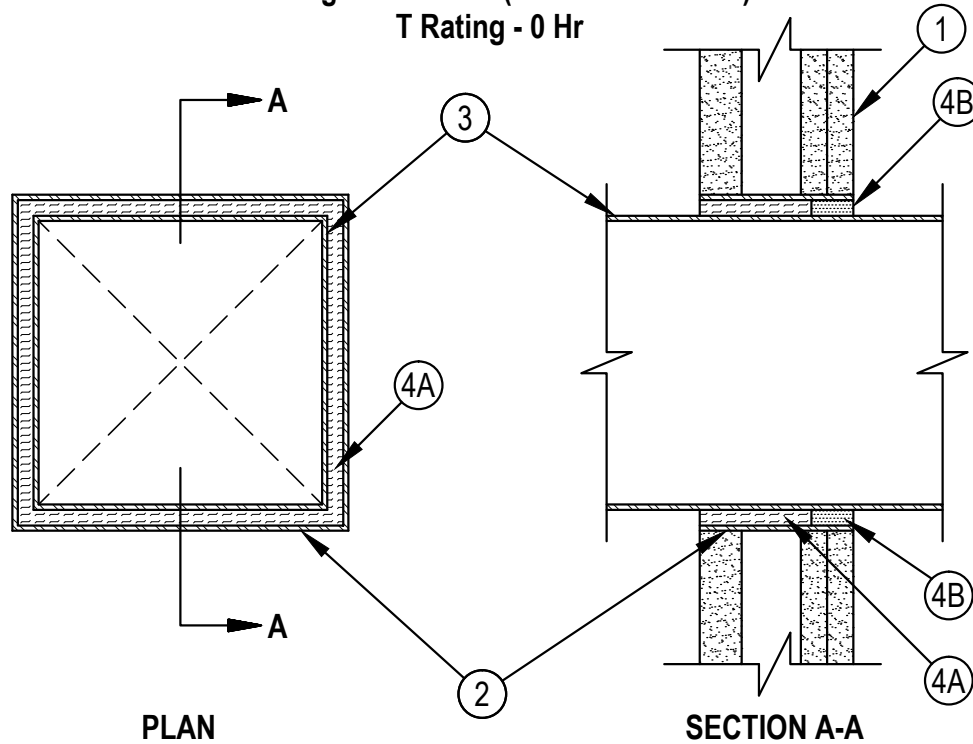
Drawing No:

18b of 29

System No. W-L-7069

F Rating - 1 and 2 Hr (See Items 1 and 4)

T Rating - 0 Hr



1. Wall Assembly — The 1 or 2 hr fire-rated gypsum board/stud wall assembly shall be constructed of the materials and in the manner described in the individual U400 or V400 Series Wall or Partition Design in the UL Fire Resistance Directory and shall include the following construction features:

A. Studs — "C-T" shaped studs 1-5/8 in. wide by 2-1/2 in. deep, fabricated from 25 MSG galv steel, spaced max 24 in. OC.

B. Gypsum Board* — One layer of nom 1 in. thick, 24 in. wide gypsum liner and one or two layers of nom 5/8 in. thick, 4 ft. wide gypsum board with square or tapered edges. The gypsum board type, number of layers, fastener type and sheet orientation shall be as specified in the individual Wall and Partition Design. Max size of opening is 64 sq in. with max dimension of 8 in.

The hourly F Rating of the firestop system is equal to the hourly fire rating of the wall assembly in which it is installed.

1A. Wall Assembly — As an alternate to the above wall assembly, the 1 or 2 hr fire rated gypsum board/stud wall assembly shall be constructed of the materials and in the manner specified in the individual U300, U400 or V400 Series Wall and Partition Designs in the UL Fire Resistance Directory and shall include the following construction features:

A. Studs — Wall framing may consist of either wood studs or steel channel studs. Steel studs to be min 2-1/2 in. wide and spaced max 24 in. OC. Wood studs to consist of nom 2 by 4 in. lumber spaced 16 in. OC.

B. Gypsum Board* — Thickness, type, number of layers and fasteners as required in the individual Wall and Partition Design. Max size of opening is 64 sq in. with max dimension of 8 in.

2. Metallic Sleeve — Nom 8 in. by 8 in. (or smaller) steel sleeve fabricated from min 0.016 in. thick (28 gauge) (or heavier) galv sheet steel and having a 1 in. lap along the longitudinal seam. Steel sleeve friction fit flush with both surfaces of wall.

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Through Penetration Details

HVAC Penetration - Gypsum
Wall

Drawing No:

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3. Steel Duct — Nom 7 in. by 7 in. (or smaller) No 24 gauge (or heavier) galv steel duct to be installed either concentrically or eccentrically within the firestop system. The annular space shall be min 1/4 in. to max 3/4 in. Duct to be rigidly supported on both sides of the wall assembly.

4. Firestop System — The firestop system shall consist of the following:

A. Packing Material — Min 1-5/8 or 2-1/4 in. thickness of min 4 pcf mineral wool batt insulation firmly packed into sleeve on one side of the wall as a permanent form for 1 and 2 hr walls, respectively. Packing material to be recessed from the room side of wall as required to accommodate the required thickness of fill material. In alternate wall assembly, packing material to be flush with either side of the wall and recessed from the other side of the wall to accommodate the required thickness of fill material.

B. Fill, Void or Cavity Material — Sealant* — Min 1-1/2 in. thickness of fill material applied within sleeve, flush with the room surface of wall or either surface in the alternate wall assembly.

HILTI CONSTRUCTION CHEMICALS, DIV OF HILTI INC — FS-ONE Sealant

*Bearing the UL Classification Mark

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Through Penetration Details

HVAC Penetration - Gypsum
Wall

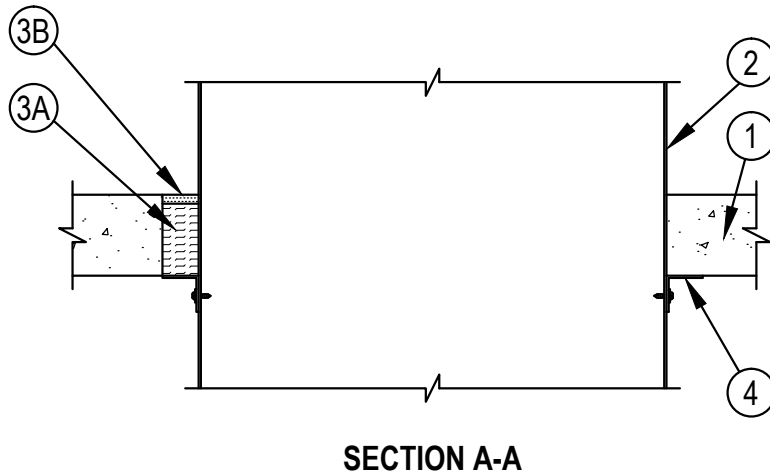
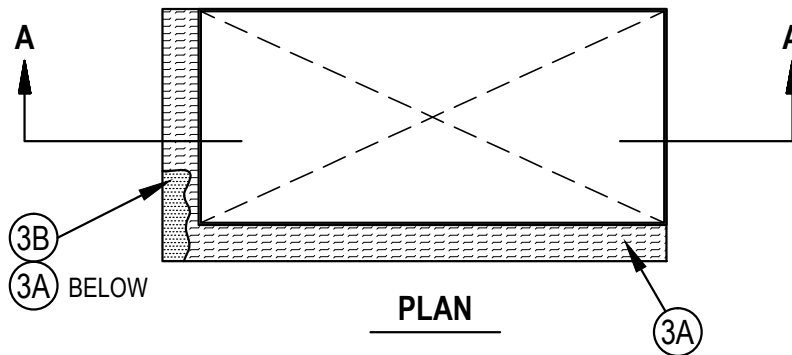
Drawing No:

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System No. C-AJ-7104

F Rating -- 2 Hr

T Rating -- 1/4 Hr



1. Floor or Wall Assembly -- Min 4-1/2 in. thick reinforced lightweight or normal weight (100-150 pcf) concrete. Wall may also be constructed of any UL Classified Concrete Blocks*. Max area of opening is 364 in². with a max dimension of 26 in.
See Concrete Blocks (CAZT) category in the Fire Resistance Directory for names of manufacturers.
 2. Steel Duct -- Max 24 in. by 12 in. by No. 24 gauge (or heavier) galv steel duct. One steel duct to be positioned within the firestop system. The annular space shall be min 0 in. (point of contact max two adjacent sides) to max 2 in. Duct to be rigidly supported on both sides of floor or wall assembly.
 3. Firestop System -- The firestop system shall consist of the following:
 - A. Packing Materials -- Min 4 in. thickness of min 4 pcf mineral wool batt insulation firmly packed into opening as a permanent form between the bare steel duct and the periphery of the opening. Packing material to be recessed from top surface of floor or both surfaces of wall as required to accommodate the required thickness of fill material.
 - B. Fill, Void or Cavity Material* -- Sealant -- Min 1/2 in. thickness of fill material applied within the annulus, flush with bottom surface of floor or with both surfaces of wall. Min 1/2 in. diam bead of sealant along point of contact.
HILTI CONSTRUCTION CHEMICALS, DIV OF HILTI INC -- FS-ONE Sealant
 4. Steel Retaining Angles -- Nom 2 by 2 by No. 18 gauge (or heavier) steel angles attached to steel duct on all four sides on the bottom surface of floor or both surfaces of wall. The angles shall be attached to the duct with No. 8 (or larger) steel sheet metal screws spaced max of 6 in.
- *Bearing the UL Classification Mark

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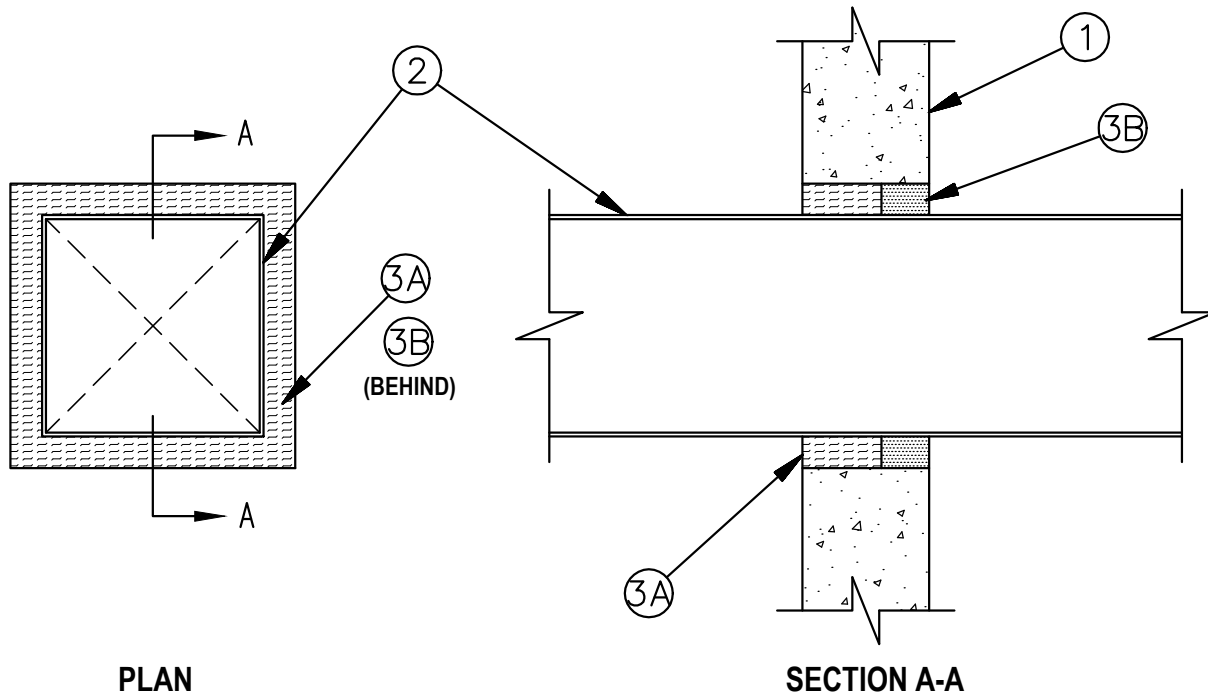
Through Penetration Details

HVAC Penetration - Concrete Floor

Drawing No:

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System No. W-J-7039
F Rating - 1 and 2 Hr (See Items 1 and 3)
T Rating - 0 Hr



1. Wall Assembly Min 3-1/8 and 3-3/4 in. thick reinforced lightweight or normal weight (100-150 pcf) concrete for 1 and 2 hr ratings, respectively. Wall may also be constructed of any UL Classified Concrete Blocks*. Max size of opening to be 64 sq in. with max dimension of 8 in.

See Concrete Blocks (CAZT) category in the Fire Resistance Directory for names of manufacturers.

2. Steel Duct Nom 7 in. by 7 in. (or smaller) No. 24 gauge (or heavier) galv steel duct to be installed either concentrically or eccentrically within the firestop system. The annular space shall be min 1/4 in. to max 3/4 in. Duct to be rigidly supported on both sides of the wall assembly.

3. Firestop System The firestop system shall consist of the following:

A. Packing Material Min 1-5/8 in. or 2-1/4 in. thickness of min 4 pcf mineral wool batt insulation firmly packed into opening on one side of the wall as a permanent form for 1 and 2 hr walls, respectively. Packing material to be recessed from one side of wall as required to accommodate the required thickness of fill material.

B. Fill, Void or Cavity Materials - Sealant* Min 1-1/2 in. thickness of fill material applied within opening, flush with one surface of wall.

HILTI CONSTRUCTION CHEMICALS, DIV OF HILTI INC -- FS-ONE Sealant

*Bearing the UL Classification Mark

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Through Penetration Details

HVAC Penetration - Concrete or
 Concrete Block Wall

Drawing No:

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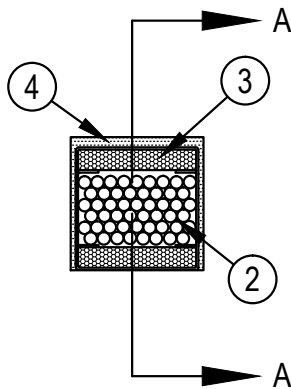
System No. W-L-3219

F Ratings - 1 and 2 Hr (See Item 1)

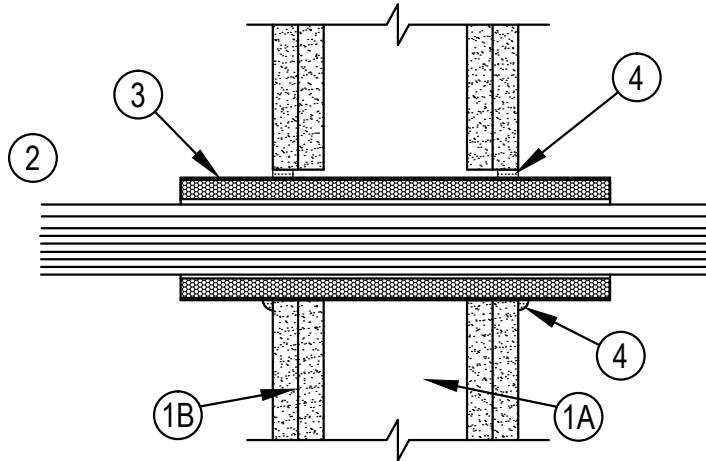
T Ratings - 3/4 and 1 Hr (See Item 2)

L Rating At Ambient - Less than 1, 1.3, 4 or 7 cfm (See Item 3)

L Rating At 400 F - Less than 1, 2 or 3 cfm (See Item 3)



PLAN



SECTION A-A

1. Wall Assembly - The 1 or 2 hr fire-rated gypsum board/stud wall assembly shall be constructed of the materials and in the manner described within the individual U300, U400 or V400 Series Wall or Partition Designs in the UL Fire Resistance Directory and shall incorporate the following construction features:

- Studs - Wall framing shall consist of either wood studs or steel channel studs. Wood studs to consist of nom 2 by 4 in. (51 by 102 mm) lumber spaced max 16 in. (406 mm) OC. Steel studs to be min 3-1/2 in. (89 mm) wide and spaced max 24 in. (610 mm) OC.
- Gypsum Board* - Thickness, type, number of layers and fasteners as specified in the individual Wall and Partition Design. Opening in gypsum board to accommodate firestop device to be max 4 in. (102 mm) wide by max 3-1/2 in. (89 mm) high. or nom 4 in. (102 mm) diameter.

The hourly F Rating of the firestop system is dependent upon the hourly rating of the wall in which it is installed.

2. Cables - Within the loading area for each firestop device module, the cables may represent a 0 to 100 percent visual fill. Cable fill to be distributed at a uniform height across the width of the firestop device module. Cables to be rigidly supported on both sides of the wall assembly. Any combination of the following types of cables may be used:

- Max 100 pair No. 24 AWG (or smaller) copper conductor telecommunication cable with polyvinyl chloride (PVC) jacketing and insulation.
- Max 350 kcmil single copper conductor power cable with XLPE jacket and insulation
- Max 7/C No. 12 AWG copper conductor control cable with PVC or XLPE jacket and insulation.
- Max 3/C No. 10 AWG metal clad or armored cable with steel or aluminum jacket.
- Max 3/C No. 8 AWG NM cable (Romex) with PVC insulation and jacket.
- Max four pair No. 22 AWG (or smaller) copper conductor data cable with polyvinyl chloride (PVC) or plenum rated jacketing and insulation.
- Max RG/U coaxial cable with fluorinated ethylene insulation and jacketing.
- Fiber optic cable with polyvinyl chloride (PVC) or polyethylene (PE) jacket and insulation having a max diam of 5/8 in. (16 mm).
- Optical Fiber Raceway+ - Max 1-1/2 in. (38 mm) diam (or smaller) optical fiber raceway ("innerduct") formed of either polyvinyl chloride (PVC) or polyvinylidene fluoride (PVDF) with optical fiber cable fill. Raceways installed in accordance with the National Electrical Code (NFPA 70).

When the hourly rating of the wall assembly is 1 hr, the T Rating is 3/4 hr. When the hourly rating of the wall assembly is 2 hr, the T Rating is 3/4 hr when Item 2A, 2B, 2C, 2D or 2E is used. Otherwise the T Rating is 1 hr.

The L Rating for the empty firestop device is less than 1 cfm at ambient and at 400F. When Item 3A is used, the L Rating for the firestop device with 100 percent visual fill is 4 cfm at ambient and 3 cfm at 400F. When Item 3F is used, the L Rating for the firestop device with 100 percent visual fill is 1.3 cfm at ambient and less than 1 cfm at 400F. When Item 3G or 3H is used, the L Rating for the firestop device with 100 percent visual fill is 7 cfm at ambient and 2 cfm at 400F.

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Through Penetration Details

EZ-Path 22 Series - Stud and
Gypsum Wall

Drawing No:

22a of 29

3. Firestop Device* - Firestop device consists of a 3 by 3 by 10-1/2 in. (76 by 76 by 267 mm) long galv steel tube with an intumescent material lining. Firestop device to be installed in accordance with the accompanying installation instructions. Prior to installation within wall, attachment screws and lid removed from device to capture grouped cables. After installation of cables, lid replaced and reattached with same screws. Device slid along cables into wall such that lid is on top and ends project an equal distance from the approximate centerline of the wall assembly. The space between the device and the periphery of the opening shall be min 0 in. (0 mm, point contact) to max 1/2 in. (13 mm).

SPECIFIED TECHNOLOGIES INC - EZ PATH Series 33 Fire Rated Pathway

- 3A. Firestop Device* - Extension Module - (Optional, Not Shown) - Module attached to ends of 3 by 3 by 10-1/2 in. (76 by 76 by 267 mm) long firestop device (Item 3) to increase its length to facilitate installation in thicker walls. Each module consists of a 3 by 3 by 6 in. (76 by 76 by 152 mm) long galv steel tube with an intumescent material lining. Extension module to be installed in accordance with the accompanying installation instructions. When module is used, firestop device (Item 3) and extension module(s) secured in place by means of steel wall plates installed with gasketing material supplied with product. Steel wall plates installed on both sides of wall and secured to each device or extension module(s) by means of steel set screws provided with wall plates. Firestop device and extension module(s) assembly to be installed with ends projecting an equal distance beyond each surface of the wall assembly.

SPECIFIED TECHNOLOGIES INC - EZ PATH Extension

4. Fill, Void or Cavity Material* - Sealant - Min 5/8 in. (16 mm) thickness of sealant to be applied in annular space between firestop device and periphery of opening on each side of wall assembly. Nom 3/8 in. (10 mm) diam bead of fill material applied at the firestop device/gypsum board interface on both sides of the wall assembly.

SPECIFIED TECHNOLOGIES INC - SpecSeal 100, 101, 102, 105, 120 or 129 Sealant, SpecSeal LCI Sealant, SpecSeal LC150 Sealant, Pensil 300 Sealant or SpecSeal Series SIL300 Sealant

*Bearing the UL Classification Mark

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Drawing No:

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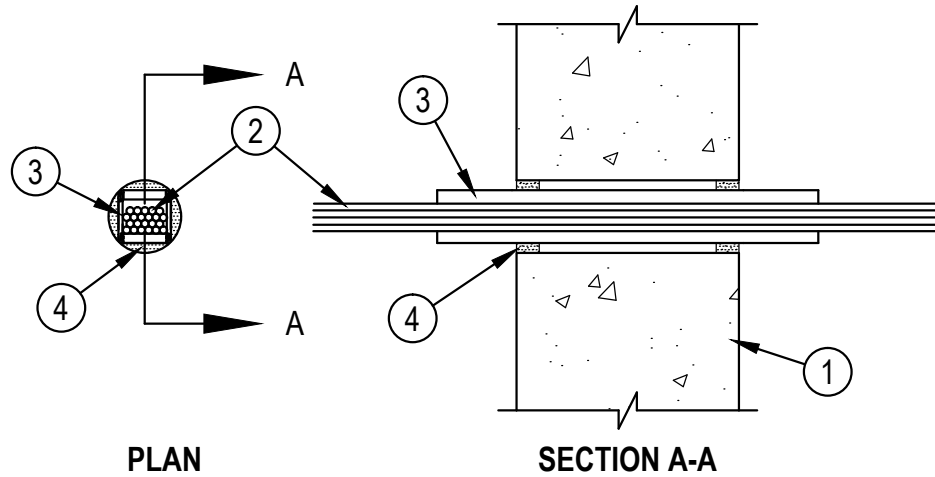
System No. W-J-3131

F Ratings - 2 Hr

T Ratings - 1-1/4 and 1-3/4 Hr (See Item 2)

L Rating At Ambient - Less than 1 OR 1.4 cfm (See Item 3)

L Rating At 400 F - Less than 1 CFM OR 1.4 CFM (See Item 3)



1. Wall Assembly - Min 6 in. (154 mm) thick reinforced lightweight or normal weight (100-150 pcf) concrete wall. Wall may also be constructed of any UL Classified Concrete Blocks*. Max area of opening is 9 sq in. (59 cm²) with a max dim of 3 in. (76 mm) or 3 in. diam (76 mm).

See Concrete Blocks (CAZT) category in Fire Resistance Directory for names of manufacturers.

2. Cables - Within the loading area for each firestop device, the cables may represent a 0 to 100 percent visual fill. Cable fill to be distributed at a uniform height across the width of the firestop device module. Cables to be rigidly supported on both sides of the wall assembly. Any combination of the following types of cables may be used:
 - A. Max four pair No. 22 AWG (or smaller) copper conductor data cable with polyvinyl chloride (PVC) or plenum rated jacketing and insulation.
 - B. Coaxial cable with fluorinated ethylene or PVC insulation and jacketing or plenum rated jacketing and insulation having a max diam of 5/8 in. (16 mm).
 - C. Fiber optic cable with polyvinyl chloride (PVC) or polyethylene (PE) jacket and insulation having a max diam of 1/4 in. (6 mm).

The T Rating is 1-1/4 hr when cables are installed. Otherwise the T Rating is 1-3/4 hr.

The L Rating for the empty firestop device is 1.4 cfm at ambient and at 400F. The L Rating with 100 percent visual fill of cable is less than 1 CFM/firestop device at ambient and at 400F.

3. Firestop Device* - Firestop device consists of a 1.4 by 1.4 by 10-1/2 in. (36 by 36 by 267 mm) long galv steel tube with an intumescent material lining. Firestop device to be installed in accordance with the accompanying installation instructions. Prior to installation within wall, lid removed from device to capture grouped cables. After installation of cables, lid replaced and snapped into place. Device slid along cables into wall such that lid is on top and ends project an equal distance from the approximate centerline of the wall assembly. The space between the device and the periphery of the opening shall be min 0 in. (0 mm, point contact) to max 1/2 in. (13 mm).

SPECIFIED TECHNOLOGIES INC - EZ PATH Series 22 Fire Rated Pathway

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Through Penetration Details

EZ-Path 22 Series - Concrete
Wall

Drawing No:

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- 4 Fill, Void or Cavity Material* - Sealant - Min 5/8 in. (16 mm) thickness of sealant to be applied in annular space between firestop device and periphery of opening on each side of wall assembly. Nom 3/8 in. (10 mm) diam bead of fill material applied at the point contact location between the firestop device and concrete wall on both sides of the wall assembly.
- SPECIFIED TECHNOLOGIES INC - SpecSeal 100, 101, 102, 105, 120 or 129 Sealant, SpecSeal LCI Sealant, SpecSeal LC150 Sealant, Pensil 300 Sealant or SpecSeal Series SIL300 Sealant
- 5 Fill, Void or Cavity Material* - Mortar - (Not Shown) - As an alternate to Item 4, mortar applied to fill annular space between firestop device and periphery of opening flush with both surfaces of the wall.
- SPECIFIED TECHNOLOGIES INC - SpecSeal Mortar
- 5A Mortar - (Not Shown) - As an alternate to Items 4 and 5, mortar or hydraulic cement applied to fill annular space between firestop device and periphery of opening flush with both surfaces of the wall.
- *Bearing the UL Classification Mark

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Through Penetration Details

EZ-Path 22 Series - Concrete
Wall

Drawing No:

23b of 29

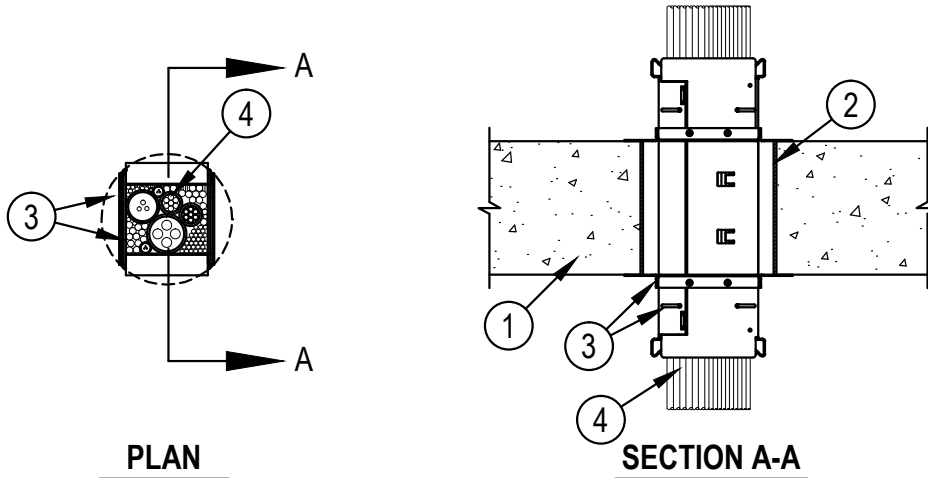
System No. C-AJ-3260

F Ratings - 2 Hr

T Ratings - 0 and 1/2 Hr (See Item 4)

L Rating At Ambient - 2.3, 6.2 or 7.4 CFM/Device Module (See Item 4)

L Rating At 400F - 2.3, 4.5 or 5 CFM/Device Module (See Item 4)



1. Floor or Wall Assembly - Min 4-1/2 in. (114 mm) thick reinforced lightweight or normal weight (100-150 pcf or 1600-2400 kg/m³) concrete. Wall may also be constructed of any UL Classified Concrete Blocks*. Floor may also be constructed of any UL Classified hollow-core Precast Concrete Units*. Diam of opening to be 6 in. (152 mm).

See Concrete Blocks (CAZT) or Precast Concrete Units (CFTV) category in the Fire Resistance Directory for names of manufacturers.

2. Steel Sleeve - (Optional) - Nom 6 in. (152 mm) diam Schedule 10 to Schedule 40 steel pipe or rigid steel conduit cast or grouted into concrete floor or wall flush with floor or wall surfaces.
3. Firestop Device* - One firestop device module centered within the opening. The firestop device module consists of a 4 by 4-5/8 by 14 in. (102 by 118 by 356 mm) long galv steel tube with spring loaded retainer plates and an intumescent material lining. Firestop device module to be installed in accordance with the accompanying installation instructions. The space between the firestop device module and the periphery of the opening shall be min 0 in. (0 mm, point contact) to max 1 in. (25 mm). Firestop device module secured in place by means of steel restraint plates sized to accommodate the firestop device module. Steel restraint plates each provided with an intumescent gasket and sized to lap onto floor or wall surfaces. Steel restraint plate installed on both sides of floor or wall and secured to firestop device module with steel set screws. The firestop device module is to be installed with its ends projecting an equal distance beyond each surface of the floor or wall assembly. As an option, firestop device may be cast or grouted into floor wall assembly. When device is cast or grouted in place, the steel restraint plates are optional.

SPECIFIED TECHNOLOGIES INC - EZ PATH Series 44 Fire Rated Pathway

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Through Penetration Details

EZ-Path 44 Series - Concrete
Floor

Drawing No:

24a of 29

4. Cables - Within the loading area for each firestop device module, the loose or grouped cables may represent a 0 to 100 percent visual fill. Cables to be rigidly supported on both sides of the floor or wall assembly. Any combination of the following types of cables may be used:

- A. Max 400 pair No. 24 AWG (or smaller) copper conductor telecommunication cable with polyvinyl chloride (PVC) or plenum-rated jacketing and insulation.
- B. Max 750 kcmil single copper conductor power cable with XLPE jacket and insulation
- C. Max 7/C No. 12 AWG copper conductor control cable with PVC or XLPE jacket and insulation.
- D. Max 3/C No. 2/0 AWG metal clad or armored cable with steel or aluminum jacket.
- E. Max 3/C No. 8 AWG NM cable (Romex) with PVC insulation and jacket.
- F. Max 4 pair No. 22 AWG (or smaller) copper conductor data cable with PVC or plenum rated jacketing and insulation.
- G. Coaxial cable with fluorinated ethylene or PVC insulation and jacketing having a max diam of 5/8 in. (16 mm).
- H. Optical fiber cable with PVC or polyethylene (PE) jacket and insulation and having a max diam of 5/8 in. (16 mm).
- I. Optical Fiber Raceway+ - Max 1-1/2 in. (38 mm) diam (or smaller) optical fiber raceway ("innerduct") formed of either PVC or polyvinylidene fluoride (PVDF) with optical fiber cable fill. Raceways installed in accordance with the National Electrical Code (NFPA 70).

When cable fill within the device is min 0 percent (empty) to max 20 percent, the T Rating is 0 Hr. When cable fill within the device is greater than 20 percent, the T Rating is 1/2 Hr.

The L Rating for each empty firestop device module is 2.3 cfm at ambient and at 400F. When Item 4A is used, the L Rating with 100 percent visual fill of cable is 7.4 CFM/firestop device module at ambient and 5 CFM/firestop device module at 400F. When Item 4F or 4G is used, the L Rating with 100 percent visual fill of cable is 6.2 CFM/firestop device module at ambient and 4.5 CFM/firestop device module at 400F.

+Bearing the UL Listing Mark

*Bearing the UL Classification Mark

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Through Penetration Details

EZ-Path 44 Series - Concrete
Floor

Drawing No:

24b of 29

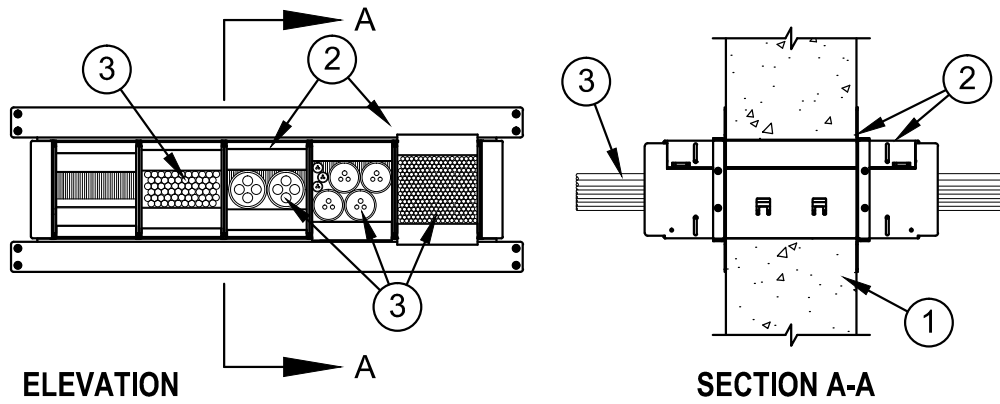
System No. W-J-3158

F Rating - 2 Hr

T Ratings - 0, 1/2, 3/4, 1, 1-1/2 and 2 Hr (See Item 3)

L Rating At Ambient - 2.3, 6.2 or 7.4 CFM/Device Module (See Item 3)

L Rating At 400F - 2.3, 4.5 or 5 CFM/Device Module (See Item 3)



1. Wall Assembly - Min 5 in. (127 mm) thick reinforced lightweight or normal weight (100-150 pcf or 1600-2400 kg/m³) concrete wall. Wall may also be constructed of any UL Classified Concrete Blocks*. Opening to be max 1/4 in. (6 mm) larger than width and height dimensions of firestop device(s). As an option when a single firestop device (Item 2) is installed, max diam of round opening is 6 in. (152 mm).

See Concrete Blocks (CAZT) category in the Fire Resistance Directory for names of manufacturers.

2. Firestop Device* - One, two, three, four or five firestop device modules ganged together and secured by means of integral hook and eye window attachment. Each firestop device module consists of a 4 by 4-5/8 by 14 in. (102 by 118 by 356 mm) long galv steel tube with spring loaded steel retainer plates and an intumescent material lining. Firestop device modules to be installed in accordance with the accompanying installation instructions. The space between the firestop device module(s) and the periphery of the opening shall be min 0 in. (0 mm, point contact) to max 1/8 in. (3.2 mm). In round openings, the space between the firestop device and the periphery of the opening shall be min 0 in. (0mm, point contact) to max 1 in. (25 mm). Firestop device module(s) secured in place by means of steel wall brackets installed with gasketing material supplied with product. Steel wall brackets installed on both sides of wall and secured to outermost device modules by means of steel set screws provided with brackets. Wall brackets secured to each side of wall through predrilled holes in brackets by means of nom 1/8 in. (3.2 mm) concrete screws. Each firestop device module is to be installed with ends projecting an equal distance beyond each surface of the wall assembly. As an option, devices may be cast or grouted into wall assembly. When device is cast or grouted in place, the steel wall plates are optional. To achieve air leakage ratings, integral hook and eye window attachment locations on right and left side of single installed pathways and ganged pathway groups must be sealed using the stickers provided with device module(s).

SPECIFIED TECHNOLOGIES INC - EZ PATH Series 44 Fire Rated Pathway

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Through Penetration Details

EZ-Path 44 Series - Concrete or
Concrete Block Wall

Drawing No:

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3. Cables - Within the loading area for each firestop device module, the loose or grouped cables may represent a 0 to 100 percent visual fill. Cables to be rigidly supported on both sides of the wall assembly. Any combination of the following types of cables may be used:
- A. Max 400 pair No. 24 AWG (or smaller) copper conductor telecommunication cable with polyvinyl chloride (PVC) or plenum-rated jacketing and insulation.
 - B. Max 750 kcmil single copper conductor power cable with XLPE jacket and insulation
 - C. Max 7/C No. 12 AWG copper conductor control cable with PVC or XLPE jacket and insulation.
 - D. Max 3/C No. 2/0 AWG metal clad or armored cable with steel or aluminum jacket.
 - E. Max 3/C No. 8 AWG NM cable (Romex) with PVC insulation and jacket.
 - F. Max four pair No. 22 AWG (or smaller) copper conductor data cable with PVC or plenum rated jacketing and insulation.
 - G. Coaxial cable with fluorinated ethylene or PVC insulation and jacketing having a max diam of 5/8 in. (16 mm).
 - H. Optical fiber cable with PVC or polyethylene (PE) jacket and insulation and having a max diam of 5/8 in. (16 mm).
 - I. Optical Fiber Raceway+ - Max 1-1/2 in. (38 mm) diam (or smaller) optical fiber raceway ("innerduct") formed of either PVC or polyvinylidene fluoride (PVDF) with optical fiber cable fill. Raceways installed in accordance with the National Electrical Code (NFPA 70).

When Item 3A is used, the T Rating is 1 hr. When Item 3B, 3C, 3D, or 3E is used, the T Rating is 1/2 Hr. When Item 3F or 3G is used, the T Rating is 1-1/2 Hr. When Item 3H is used, the T Rating is 2 Hr. When Item 3I is used, the T Rating is 3/4 Hr. When device is empty, the T Rating is 0 Hr.

The L Rating for each empty firestop device module is 2.3 cfm at ambient and at 400F. When Item 3A is used, the L Rating with 100 percent visual fill of cable is 7.4 CFM/firestop device module at ambient and 5 CFM/firestop device module at 400F. When Item 3F or 3G is used, the L Rating with 100 percent visual fill of cable is 6.2 CFM/firestop device module at ambient and 4.5 CFM/firestop device module at 400F.

+Bearing the UL Listing Mark

*Bearing the UL Classification Mark

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Through Penetration Details

EZ-Path 44 Series - Concrete or
Concrete Block Wall

Drawing No:

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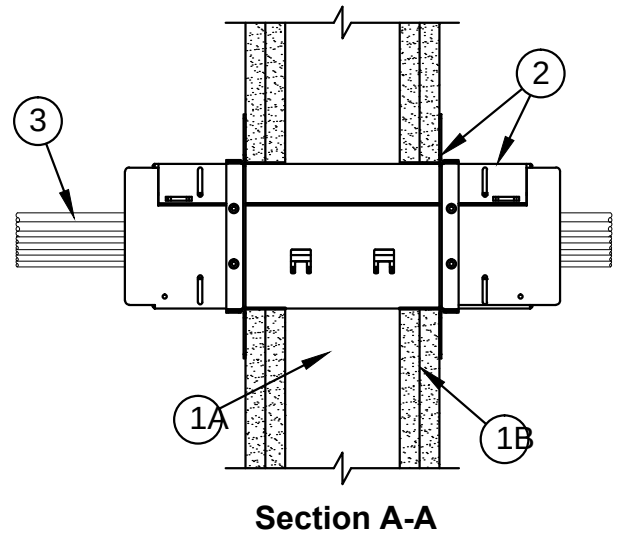
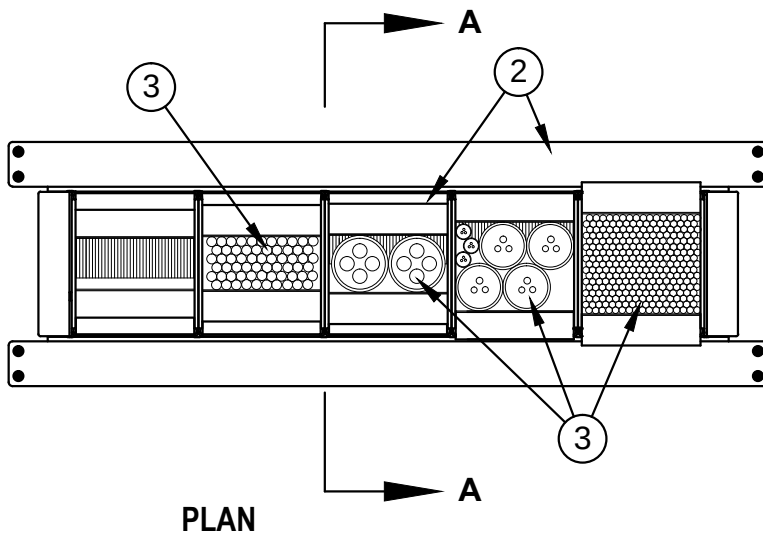
System No. W-L-3306

F Ratings - 1 and 2 Hr

T Ratings - 0, 1/2, 3/4, 1, 1-1/2 and 2 Hr (See Item 3)

L Rating At Ambient - 2.3, 7.4 or 6.2 CFM (See Item 3)

L Rating At 400F - 2.3, 4.5 or 5 CFM (See Item 3)



1. Wall Assembly - The 1 or 2 hr fire-rated gypsum board/stud wall assembly shall be constructed of the materials and in the manner described within the individual U300 or U400 Series Wall or Partition Designs in the UL Fire Resistance Directory and shall incorporate the following construction features:
 - A. Studs - Wall framing shall consist of either wood studs or steel channel studs. Wood studs to consist of nom 2 by 4 in. (51 by 102 mm) lumber spaced max 16 in. (406 mm) OC. Steel studs to be min 3-1/2 in. (89 mm) wide and spaced max 24 in. (610 mm) OC.
 - B. Gypsum Board* - Thickness, type, number of layers and fasteners as specified in the individual Wall and Partition Design. Opening in gypsum board to be max 1/4 in. (6 mm) larger than width and height dimensions of firestop device(s).

The hourly F Rating of the firestop system is dependent upon the hourly rating of the wall in which it is installed.

2. Firestop Device* - One, two, three, four or five firestop device modules ganged together and secured by means of integral hook and eye window attachment. Each firestop device module consists of a 4 by 4-5/8 by 14 in. (102 by 118 by 356 mm) long galv steel tube with spring loaded steel retainer plates and an intumescent material lining. Firestop device modules to be installed in accordance with the accompanying installation instructions. The space between the firestop device module(s) and the periphery of the opening shall be min 0 in. (0 mm, point contact) to max 1/8 in. (3.2 mm). In round openings, the space between the firestop device and the periphery of the opening shall be min 0 in. (0mm, point contact) to max 1 in. (25 mm). Firestop device module(s) secured in place by means of steel wall brackets installed with gasket material supplied with product. Steel wall brackets installed on both sides of wall and secured to outermost device modules by means of steel set screws provided with brackets. Wall brackets secured to each side of wall through predrilled holes in brackets by means of nom 1/8 in. (3.2 mm) Type G steel screws. Each firestop device module is to be installed with ends projecting an equal distance beyond each surface of the wall assembly. To achieve air leakage ratings, integral hook and eye window attachment locations on right and left side of single installed pathways and ganged pathway groups must be sealed using the stickers provided with device module(s).

SPECIFIED TECHNOLOGIES INC - EZ PATH Series 44 Fire Rated Pathway

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Through Penetration Details

EZ-Path 44 Series - Stud and
Gypsum Wall

Drawing No:

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As an alternate, the multi-gang steel wall brackets may be installed directly against the studs for walls having 24 in. (610 mm) center-to-center stud spacing prior to installation of the gypsum board layers. The steel wall plates shall be secured to the stud by means of steel screws. After installation of the steel wall plates and firestop device modules, the gypsum board shall be installed as specified in the individual U300 or U400 Design with a maximum 1/8 in. (3.2 mm) gap between the firestop device module and the cutout in the gypsum board. Gap between the firestop device module and the cutout in the gypsum board may be filled with gypsum joint compound or fill material (Item 4).

3. Cables - Within the loading area for each firestop device module, the loose or grouped cables may represent a 0 to 100 percent visual fill. Cables to be rigidly supported on both sides of the wall assembly. Any combination of the following types of cables may be used:
 - A. Max 400 pair No. 24 AWG (or smaller) copper conductor telecommunication cable with polyvinyl chloride (PVC) or plenum-rated jacketing and insulation.
 - B. Max 750 kcmil single copper conductor power cable with XLPE jacket and insulation.
 - C. Max 7/C No. 12 AWG copper conductor control cable with PVC or XLPE jacket and insulation.
 - D. Max 3/C No. 2/0 AWG metal clad or armored cable with steel or aluminum jacket.
 - E. Max 3/C No. 8 AWG NM cable (Romex) with PVC insulation and jacket.
 - F. Max four pair No. 22 AWG (or smaller) copper conductor data cable with PVC or plenum rated jacketing and insulation.
 - G. Coaxial cable with fluorinated ethylene or PVC insulation and jacketing having a max diam of 5/8 in. (16 mm).
 - H. Optical fiber cable with PVC or polyethylene (PE) jacket and insulation and having a max diam of 5/8 in. (16 mm).
 - I. Optical Fiber Raceway+ - Max 1-1/2 in. (38 mm) diam (or smaller) optical fiber raceway ("innerduct") formed of either PVC or polyvinylidene fluoride (PVDF) with optical fiber cable fill. Raceways installed in accordance with the National Electrical Code (NFPA 70).

When Item 3A is used, the T Rating is 1 hr. When Item 3B, 3C, 3D, or 3E is used, the T Rating is 1/2 Hr. When Item 3F or 3G is used, the T Rating is 1 and 1-1/2 Hr for 1 and 2 hr rated assemblies respectively. When Item 3H is used, the T Rating is 1 or 2 Hr for 1 and 2 hr rated assemblies respectively. When Item 3I is used, the T Rating is 3/4 Hr. When device is empty, the T Rating is 0 Hr.

The L Rating for each empty firestop device module is 2.3 cfm at ambient and at 400F. When Item 3A is used, the L Rating with 100 percent visual fill of cable is 7.4 CFM/firestop device module at ambient and 5 CFM/firestop device module at 400F. When Item 3F or 3G is used, the L Rating with 100 percent visual fill of cable is 6.2 CFM/firestop device module at ambient and 4.5 CFM/firestop device module at 400F.

4. Fill, Void or Cavity Material* - Sealant or Putty - (Not Shown) - As an alternate to gypsum joint compound, the gap between the firestop device module and the cutout in the gypsum board may be sealed with fill material on each side of the wall assembly when four- and seven-gang steel wall plates are installed directly against the wood or steel studs.

SPECIFIED TECHNOLOGIES INC - SpecSeal Series SSS Sealant, SpecSeal LCI Sealant, SpecSeal Putty

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Through Penetration Details

EZ-Path 22 Series - Concrete
Wall

Drawing No:

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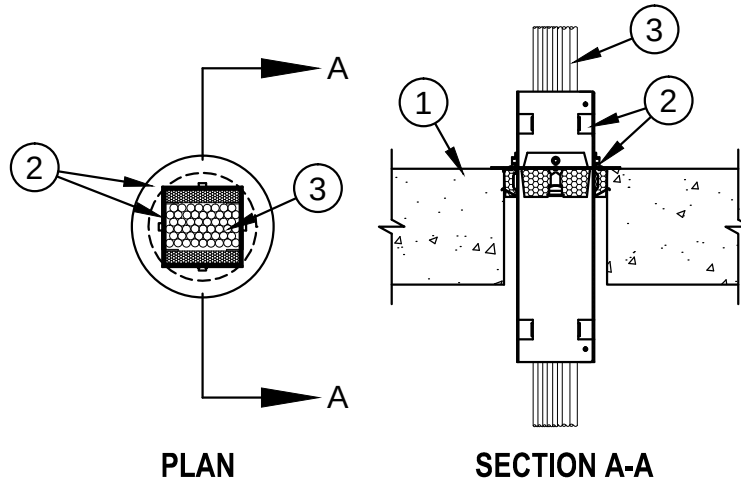
System No. F-A-3021

F Ratings - 2, 3 and 4 Hr (See Items 1 and 3)

T Ratings - 1/2, 1-3/4 and 2 Hr (See Items 1, 2, 3 and 4)

L Rating at Ambient - Less Than 1, 1.3, 4 or 7 CFM/Device Module (See Item 3)

L Rating at 400°F - Less Than 1, 2 or 3 CFM/Device Module (See Item 3)



1. Floor Assembly - Min 4-1/2 in. (114 mm) thick reinforced lightweight or normal weight (100-150 pcf or 1600-2400 kg/m³) concrete. The min concrete thickness for a 4 hr F Rating and for a 1-3/4 hr or 2 hr T Rating is 6 in. (152 mm). Diam of opening to be 4 in. (102 mm).
2. Firestop Device* - One firestop device module centered within the opening. The firestop device module consists of a 3 by 3 by 10-1/2 in. (76 by 76 by 267 mm) long galv steel tube with an intumescent material lining. Firestop device module to be installed in conjunction with kick-in plate in accordance with the accompanying installation instructions. Kick-in plate consists of steel plate with vertical flanges on the top surface and with spring steel locking clips and intumescent foam wedges on the bottom surface. Kick-in plate secured to firestop device module with steel set screws in each of the four vertical flanges. Device with kick-in plate inserted into 4 in. (102 mm) diam core hole from top of floor and pushed into opening until bottom of plate is flush with the top surface of the floor to lock the device in position. The firestop device module is to be installed with its ends projecting an equal distance above and below the floor surfaces. For a 1-3/4 or 2 hr T Rating, the firestop device module is to be installed to project 6 in. (152 mm) above the floor and 4-1/2 in. (114 mm) into the floor. When the firestop device module is cast or grouted into the floor assembly the T Rating is 2 hr.
3. Cables - Within the loading area for the firestop device module, the cables may represent a 0 to 100 percent visual fill. Cable fill to be distributed uniformly across the width of the firestop device module. Cables to be rigidly supported on both sides of the floor assembly. Any combination of the following types of cables may be used:
 - A. Max 400 pair No. 24 AWG (or smaller) copper conductor telecommunication cable with polyvinyl chloride (PVC) or plenum-rated jacketing and insulation.
 - B. Max 750 kcmil single copper conductor power cable with XLPE jacket and insulation
 - C. Max 7/C No. 12 AWG copper conductor control cable with PVC or XLPE jacket and insulation.
 - D. Max 3/C No. 2/0 AWG metal clad or armored cable with steel or aluminum jacket.
 - E. Max 3/C No. 8 AWG NM cable (Romex) with PVC insulation and jacket.
 - F. Max four pair No. 22 AWG (or smaller) copper conductor data cable with PVC or plenum rated jacketing and insulation.
 - G. Coaxial cable with fluorinated ethylene or PVC insulation and jacketing having a max diam of 5/8 in. (16 mm).
 - H. Optical fiber cable with PVC or polyethylene (PE) jacket and insulation and having a max diam of 5/8 in. (16 mm).
 - I. Optical Fiber Raceway+ - Max 1-1/2 in. (38 mm) diam (or smaller) optical fiber raceway ("innerduct") formed of either PVC or polyvinylidene fluoride (PVDF) with optical fiber cable fill. Raceways installed in accordance with the National Electrical Code (NFPA 70).When Item 3A is used, the max size of cable for a 1-3/4 hr or 2 hr T Rating is 100 pair. When Item 3A or 3B is used, an extension module (Item 4) is required to attain a 1-3/4 hr or 2 hr T Rating. Otherwise, the T Rating is 1/2 hr.
When Item 3A is used, the max size of cable is 200 pair for the 3 hr F Rating. Otherwise, the F Rating is 2 hr.
The L Rating for each empty firestop device module is less than 1 cfm at ambient and at 400F. When Item 3A is used, the L Rating for each firestop device module with 100 percent visual cable fill is 4 cfm at ambient and 3 cfm at 400F. When Item 3F is used, the L Rating for each firestop device module with 100 percent visual cable fill is 1.3 cfm at ambient and less than 1 cfm at 400F. When Item 3G or 3H is used, the L Rating for each firestop device module with 100 percent visual cable fill is 7 cfm at ambient and 2 cfm at 400F.
4. Firestop Device* - Extension Module - (Optional, Not Shown) - Module attached to top of 3 by 3 by 10-1/2 in. (76 by 76 by 267 mm) long firestop device (Item 2) to increase its length. Each module consists of a 3 by 3 by 6 in. (76 by 76 by 152 mm) long galv steel tube with an intumescent material lining. Extension module to be installed in accordance with the accompanying installation instructions. When Item 4 is used with Item 3A or 3B, the T Rating is 1-3/4 or 2 hr dependent upon the use or non-use of the kick-in plate.

SPECIFIED TECHNOLOGIES INC - EZ PATH Series 33 Fire Rated Pathway

+Bearing the UL Listing Mark

*Bearing the UL Classification Mark

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Through Penetration Details

EZ-Path 44 Series - Stud and
Gypsum Wall

Drawing No:

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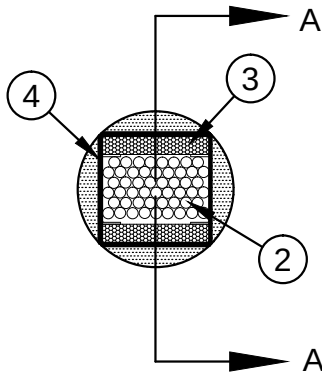
System No. W-J-3099

F Rating - 2 Hr (See Item 1)

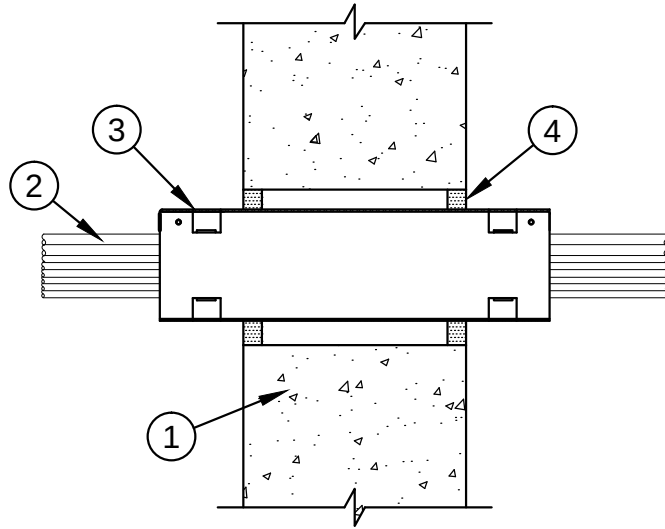
T Ratings - 3/4 and 1 Hr (See Item 2)

L Rating At Ambient - Less than 1, 1.3, 4 or 7 CFM/Device (See Item 3)

L Rating At 400 F - Less than 1, 2 or 3 CFM/Device (See Item 3)



PLAN



SECTION A-A

1. Wall Assembly - Min 6 in. (152 mm) thick reinforced lightweight or normal weight (100-150 pcf or 1600-2400 kg/m³) concrete wall. Wall may also be constructed of any UL Classified Concrete Blocks*. When Item 4 is used, opening to be max 14 sq in. (90 cm²) with a max dim of 4 in. (102 mm) or nominal 4 in. (102 mm) diameter.

See Concrete Blocks (CAZT) category in the Fire Resistance Directory for names of manufacturers.

2. Cables - Within the loading area for each firestop device module, the cables may represent a 0 to 100 percent visual fill. Cable fill to be distributed at a uniform height across the width of the firestop device module. Cables to be rigidly supported on both sides of the wall assembly. Any combination of the following types of cables may be used:

A. Max 100 No. 24 AWG (or smaller) copper conductor telecommunication cable with polyvinyl chloride (PVC) jacketing and insulation.

B. Max 350 kcmil single copper conductor power cable with XLPE jacket and insulation

C. Max 7/C No. 12 AWG copper conductor control cable with PVC or XLPE jacket and insulation.

D. Max 3/C No. 10 AWG metal clad or armored cable with steel or aluminum jacket.

E. Max 3/C No. 8 AWG NM cable (Romex) with PVC insulation and jacket.

F. Max four pair No. 22 AWG (or smaller) copper conductor data cable with polyvinyl chloride (PVC) or plenum rated jacketing and insulation.

G. Max RG/U coaxial cable with fluorinated ethylene insulation and jacketing.

H. Fiber optic cable with polyvinyl chloride (PVC) or polyethylene (PE) jacket and insulation having a max diam of 5/8 in. (16 mm).

I. Optical Fiber Raceway+ - Max 1-1/2 in. (38 mm) diam (or smaller) optical fiber raceway ("innerduct") formed of either polyvinyl chloride (PVC) or polyvinylidene fluoride (PVDF) with optical fiber cable fill. Raceways installed in accordance with the National Electrical Code (NFPA 70).

When Item 3A, 3B, 3C, 3D or 3E is used, the T Rating is 3/4 hr. Otherwise, the T Rating is 1 hr.

The L Rating for the empty firestop device is less than 1 cfm at ambient and at 400F. When Item 3A is used, the L Rating for the firestop device with 100 percent visual fill is 4 cfm at ambient and 3 cfm at 400F. When Item 3F is used, the L Rating for the firestop device with 100 percent visual fill is 1.4 cfm at ambient and less than 1 cfm at 400F. When Item 3G or 3H is used, the L Rating for the firestop device with 100 percent visual fill is 7 cfm at ambient and 2 cfm at 400F.

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Through Penetration Details

EZ-Path 33 Series - Concrete
Wall

Drawing No:

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3. Firestop Device* - Firestop device consists of a 3 by 3 by 10-1/2 in. (76 by 76 by 267 mm) long galv steel tube with an intumescent material lining. Firestop device to be installed in accordance with the accompanying installation instructions. Prior to installation within wall, attachment screws and lid removed from device to capture grouped cables. After installation of cables, lid replaced and reattached with same screws. Device slid along cables into wall such that lid is on top and ends project an equal distance from the approximate centerline of the wall assembly. The space between the device and the periphery of the opening shall be min 0 in. (0 mm, point contact) to max 1/2 in. (13 mm).

SPECIFIED TECHNOLOGIES INC - EZ PATH Series 33 Fire Rated Pathway

- 3A. Firestop Device* - Extension Module - (Optional, Not Shown) - Module attached to ends of 3 by 3 by 10-1/2 in. (76 by 76 by 267 mm) long firestop device (Item 3) to increase its length to facilitate installation in thicker walls. Each module consists of a 3 by 3 by 6 in. (76 by 76 by 152 mm) long galv steel tube with an intumescent material lining. Extension module to be installed in accordance with the accompanying installation instructions. When module is used, firestop device (Item 3) and extension module(s) secured in place by means of steel wall plates installed with gasketing material supplied with product. Steel wall plates installed on both sides of wall and secured to each device or extension module(s) by means of steel set screws provided with wall plates. Firestop device and extension module(s) assembly to be installed with ends projecting an equal distance beyond each surface of the wall assembly.

SPECIFIED TECHNOLOGIES INC - EZ PATH Extension

4. Fill, Void or Cavity Material* - Sealant - Min 5/8 in. (16 mm) thickness of sealant to be applied in annular space between firestop device and periphery of opening on each side of wall assembly. Nom 3/8 in. (10 mm) diam bead of fill material applied at the firestop device/concrete interface on both sides of the wall assembly.

SPECIFIED TECHNOLOGIES INC - SpecSeal 100, 101, 102, 105, 120 or 129 Sealant, SpecSeal LCI Sealant, SpecSeal LC150 Sealant, Pensil 300 Sealant or SpecSeal Series SIL300 Sealant

5. Fill, Void or Cavity Material* - Mortar - (Not Shown) - As an alternate to Item 4, mortar applied to fill annular space between firestop device and periphery of opening flush with both surfaces of the wall.

SPECIFIED TECHNOLOGIES INC - SpecSeal Mortar

- 5A. Mortar - (Not Shown) - As an alternate to Items 4 and 5, mortar or hydraulic cement applied to fill annular space between firestop device and periphery of opening flush with both surfaces of the wall.

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Through Penetration Details

EZ-Path 33 Series - Concrete
Wall

Drawing No:

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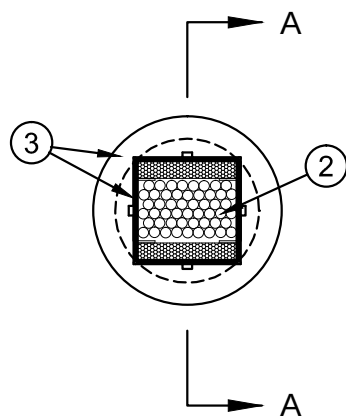
System No. W-L-3265

F Ratings - 1, 2, 3 and 4 Hr (See Items 1 and 3)

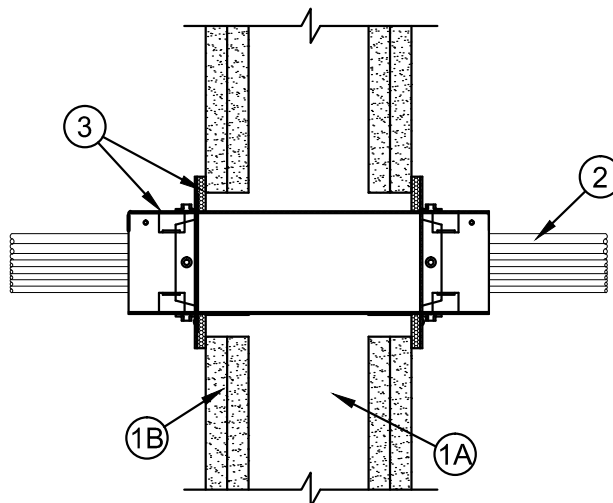
T Ratings - 3/4, 1 and 1-1/2 Hr (See Item 3)

L Rating At Ambient - Less than 1, 1.3, 4 or 7 CFM (See Item 3)

L Rating At 400 F - Less than 1, 2 or 3 CFM (See Item 3)



PLAN



SECTION A-A

1. Wall Assembly - The 1, 2, 3 or 4 hr fire-rated gypsum board/stud wall assembly shall be constructed of the materials and in the manner described within the individual U300 or U400 Series Wall or Partition Designs in the UL Fire Resistance Directory and shall incorporate the following construction features:
 - A. Studs - Wall framing shall consist of either wood studs or steel channel studs. Wood studs to consist of nom 2 by 4 in. (51 by 102 mm) lumber spaced max 16 in. (406 mm) OC. Steel studs to be min 3-1/2 in. (89 mm) wide and spaced max 24 in. (610 mm) OC.
 - B. Gypsum Board* - Thickness, type, number of layers and fasteners as specified in the individual Wall and Partition Design. Max diam of opening to be 4 in. (102 mm).

The hourly F Rating of the firestop system is dependent upon the hourly rating of the wall in which it is installed.

2. Firestop Device* - Single firestop device module consisting of a 3 by 3 by 10-1/2 in. (76 by 76 by 267 mm) long galv steel tube with an intumescent material lining. Firestop device module to be installed in accordance with the accompanying installation instructions. The space between the firestop device module(s) and the periphery of the opening shall be min 0 in. (0 mm, point contact) to max 1/2 in. (13 mm). Firestop device module(s) secured in place by means of circular steel wall plates installed with gasketing material supplied with product. Circular steel wall plates installed on both sides of wall and secured to each device by means of steel set screws provided with device. Firestop device module is to be installed with ends projecting an equal distance beyond each surface of the wall assembly.

SPECIFIED TECHNOLOGIES INC - EZ PATH Series 33 Fire Rated Pathway

- 2A. Firestop Device* - Extension Module - (Optional, Not Shown) - Module attached to ends of 3 by 3 by 10-1/2 in. (76 by 76 by 267 mm) long firestop device (Item 2) to increase its length to facilitate installation in thicker walls. Each module consists of a 3 by 3 by 6 in. (76 by 76 by 152 mm) long galv steel tube with an intumescent material lining. Extension module to be installed in accordance with the accompanying installation instructions. When module is used, firestop device (Item 2) and extension module(s) secured in place by means of steel wall plates installed with gasketing material supplied with product. Steel wall plates installed on both sides of wall and secured to each device or extension module(s) by means of steel set screws provided with wall plates. Firestop device and extension module(s) assembly to be installed with ends projecting an equal distance beyond each surface of the wall assembly.

SPECIFIED TECHNOLOGIES INC - EZ PATH Extension

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Through Penetration Details

EZ-Path 33 Series - Stud and
Gypsum Wall

Drawing No:

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3. Cables - Within the loading area for the firestop device module, the cables may represent a 0 to 100 percent visual fill. Cable fill to be distributed at a uniform height across the width of the firestop device module. Cables to be rigidly supported on both sides of the wall assembly. Any combination of the following types of cables may be used:
- A. Max 400 pair No. 24 AWG (or smaller) copper conductor telecommunication cable with polyvinyl chloride (PVC) jacketing and insulation.
 - B. Max 350 kcmil single copper conductor power cable with XLPE jacket and insulation
 - C. Max 7/C No. 12 AWG copper conductor control cable with PVC or XLPE jacket and insulation.
 - D. Max 3/C No. 10 AWG metal clad or armored cable with steel or aluminum jacket.
 - E. Max 3/C No. 8 AWG NM cable (Romex) with PVC insulation and jacket.
 - F. Max four pair No. 22 AWG (or smaller) copper conductor data cable with polyvinyl chloride (PVC) jacketing and insulation.
 - G. Max RG/U coaxial cable with fluorinated ethylene insulation and jacketing.
 - H. Fiber optic cable with polyvinyl chloride (PVC) or polyethylene (PE) jacket and insulation having a max diam of 5/8 in. (16 mm).
 - I. Max four pair No. 24 AWG (or smaller) copper conductor data cable with plenum rated jacket and insulation.
 - J. Optical Fiber Raceway+ - Max 1-1/2 in. (38 mm) diam (or smaller) optical fiber raceway ("innerduct") formed of either polyvinyl chloride (PVC) or polyvinylidene fluoride (PVDF) with optical fiber cable fill. Raceways installed in accordance with Article 770 of the National Electrical Code (NFPA 70)

When the hourly rating of the wall assembly is 1 hr, the T Rating is 3/4 hr. When the hourly fire rating of the wall assembly is greater than 1 hr, the T Rating is 3/4 hr when Item 3A, 3B, 3C, 3D or 3E is used. Otherwise the T Rating is 1 hr. When no cables are installed within the device module, the T Rating is 1 hr in 1 hr walls and 1-1/2 hr for 2, 3 and 4 hr walls. When Item 3A, 3B, 3C, 3D or 3E is used, the maximum F Rating is 2 hr. When max 200 pair No. 24 AWG telecommunication cable is used or when Item 3F, 3G, 3H, 3I or 3J is used, the maximum F Rating is 4 hr.

The L Rating for each empty firestop device module is less than 1 cfm at ambient and at 400F. When Item 3A is used, the L Rating for each firestop device module with 100 percent visual fill is 4 cfm at ambient and 3 cfm at 400F. When Item 3F is used, the L Rating for each firestop device with 100 percent visual fill is 1.3 cfm at ambient and less than 1 cfm at 400F. When Item 3G or 3H is used, the L Rating for each firestop device with 100 percent visual fill is 7 cfm at ambient and 2 cfm at 400F.

*Bearing the UL Classification Mark

ARCHITECT



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Through Penetration Details

EZ-Path 33 Series - Stud and
Gypsum Wall

Drawing No:

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SECTION 07 84 00 - FIRESTOPPING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

- A. General Contract Provisions and Sections of Division 1 apply to Work of this Section.

1.02 WORK SUMMARY:

- A. Work in this Section includes furnishing and installing all firestopping, firesafing and smoke sealing as required by Drawings and as specified herein, including but not limited to the following:
 - 1. Installing smoke seal materials to seal empty openings, voids, penetrating items such as cables, conduits, pipes ducts, cable trays etc. and the periphery of all "smoke tight" partitions.
 - 2. Fire stopping of ductwork penetrating floor slabs of the lowest terminus.
 - 3. All location where non-combustible insulation/safing are called for on drawings.

1.03 RELATED WORK SPECIFIED ELSEWHERE:

- A. Section 09 20 00: Plaster and Gypsum Board.
- B. Divisions 21, 22, 23, 26, 27, 28: : MEP work.

1.04 SUBMITTALS:

- A. Submit manufacturer's product literature for each type of Firestop/Smoke Seal material to be installed. Literature shall indicate product characteristics, typical uses, performance and limitation criteria, and test data.
- B. Submit manufacturer's installation procedures for each type of product and construction/resistance required for the project.
- C. Submit fire test reports from recognized, independent testing agent(s) indicating the following:
 - 1. Fire test report of Firestop/Smoke Seal material applied to substrate and penetration materials similar to project conditions. Tests to indicate both Flame (F) and Temperature (T) Ratings.
 - 2. Test reports of products to be used shall indicate conformance to ASTM E-814.
- D. Samples: Provide samples of Firestop/Smoke Seal materials and installation in accordance with the following requirements.
 - 1. Apply one sample of appropriate Firestop/Smoke Seal material for each different penetration and fire rating required for the work.
 - 2. Sample areas will comply with thickness, fire resistance ratings, and finished appearance of the project and applicable fire code.

FIRESTOPPING
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3. Acceptable samples will constitute standard of acceptance for method of application, thickness, and finished appearance for Firestop/Smoke Seal application. The sample(s) shall remain visible during completion of the work and shall remain as part of the completed work.

1.05 DELIVERY, STORAGE, AND HANDLING:

- A. Deliver products to job site in manufacturer's original, unopened containers bearing proper U.L. labeling.
- B. Firestop/Smoke Seal material shall be stored off the ground in an area protected from weather, moisture and freezing.
- C. All Firestop materials shall be installed prior to expiration of shelf life.

1.06 PERFORMANCE CRITERIA:

- A. Provide materials and work to conform to Building Code Requirements in fire resistant wall and floor assemblies.
- B. Testing Requirements:
 1. All Firestop/Smoke Seal material shall be tested by a recognized, independent testing agency and shall conform to both Flame (F) and Temperature (T) requirements of ASTM E-814.
 2. Conform to UL Fire Hazard Classification Requirements.
 3. Tested and classified non-combustible per ASTM E-84.
- C. Firestops in place shall be of sufficient thickness, width, and density to provide a fire resistance rating at least equal to the floor, wall, or partition construction into which it is installed.

PART 2 - PRODUCTS

2.01 FIRESTOP SEALANT/SMOKE SEAL COMPOUND:

- A. Provide single component, non-combustible silicone elastomer Firestop sealant Biotherm 100 (Gun Grade) as manufactured by Bio Fireshield, Inc., Concord, Ma.; Dow Corning Fire Stop Sealant 2000 or approved equal.
- B. Sealant shall have U.L. Classification as a "fill, void, or cavity material" for through penetration Firestop system when tested in accordance with ASTM E-814/UL1479.
- C. Sealant shall as a minimum meet or exceed the following physical performance characteristics:

	<u>Property</u>	<u>Test Method</u>
Hardness	ASTM D-2240	32 (Shore A)
Peel Strength	MIL-S-8802E	25.9 lbs.
Flow	MIL-S-802E	0.1"/min.
Tack Free Time	MIL-S-8802E	20 min.
Tear Strength	ASTM D-624	31.1 PSI

2.02 MINERAL FIBER/CERAMIC WOOL NON-COMBUSTIBLE INSTALLATION (FIRE SAFING):

- A. Provide minimum 4 PCF Thermafiber Fire/Smoke blanket as manufactured by U.S.Gypsum Company, minimum 4 PCF FBX Safing Insulation as manufactured by Fibrex, minimum 6 PCF Ceramic Fiber Insulation as manufactured by Manville Corporation, or approved equal to suit conditions and to comply with fire resistance and Firestop manufacturer's requirements.
- B. Material shall be classified non-combustible per ASTM E-814.

PART 3 - EXECUTION

3.01 INSPECTION

- A. Examine the areas and conditions where Firestops and Smokestops are to be installed and notify contractor and architect of conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected and contractor and architect authorizes firestop work to proceed.

3.02 PREPARATION

- A. Surfaces to receive Firestops/Smokestops shall be free of dirt, dust, grease, oil, release agents, or other matter that would impair the bond of the Firestop/Smokestops material to the substrate or penetrating item(s).
- B. Voids and cracks in substrate shall be filled and unnecessary projections removed prior to installation.
- C. All penetrating items shall be permanently installed prior to Firestop/Smokestop Installation.
- D. Substrate shall be frost-free and, when applicable, dry.

3.03 INSTALLATION

- A. General
 - 1. Installation of Firestops/Smokestops shall be performed by applicators/installers qualified and trained by the manufacturer. Installation shall be performed in strict accordance with manufacturer's detailed installation procedures.

2. Apply Firestops/Smokestops in accordance with fire test reports, fire resistance requirements, acceptable sample installations, and manufacturer's recommendations.
 3. Coordinate with plumbing, mechanical, electrical and other trades to assure that all pipe, conduit, cable, ducts and other items which penetrate construction have been permanently installed prior to installation of Firestops/Smokestops, schedule and sequence the work to assure that partitions and other construction which would conceal penetrations are not erected prior to the installation of Firestops and Smokestops.
- B. Safing Insulation:
1. Stuff loose mineral blanket insulation into miscellaneous voids and cavity spaces as indicated leaving no voids. Compress to approximately 40% of normal maximum volume (to a density of approximately 2.5 lbs. per cu. ft.) to seal completely around ducts, piping, telephone cables or other utilities. Seal top of openings with a min. 2" layer of smoke seal compound.
- C. Installation of Smoke Seal Compound/Firestop:
1. Apply with manual or powered caulking gun.
 2. Apply to 1/2" total thickness for 3 hour rating. Apply 1/2" to both sides of wall penetrations; one side only in floor penetrations.
 3. Use incombustible insulation as required to achieve fire resistance rating.
 4. Surface of gun grade silicone Firestop may be tooled using clean, potable water.
 5. Clean excess material off of adjacent surfaces and tools within 10 minutes using either water or XYLOL.
 6. Installation of Firestops/Smokestops shall be performed by applicators/installers qualified and trained by the manufacturer. Installation shall be performed in strict accordance with manufacturer's detailed installation procedures. Installation of Firestops/Smokestops shall be performed by a single contractor on the project.

END OF SECTION 07 84 00.

SECTION 07 92 00 – JOINT SEALANTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

- A. General Contract Provisions and Sections of Division 1 apply to work of this Section.

1.02 WORK SUMMARY:

- A. The extent of sealant work is indicated on Drawings.

- B. Type and basic use of sealants shall be as follows:

Type 1: For Exterior Joints:

1. At all expansion and control joints.

Type 2: For General Exterior building use as required to make exterior joints water tight including but not limited to joints:

1. Between perimeters of metal work (such as frames for doors, louvers and the like) and masonry.
2. At all mechanical, electrical or plumbing work penetrating masonry walls.
3. At exterior window sills, under door thresholds.
4. At metal to metal contact.
5. Between pre-formed reglets and existing masonry.
6. At Steel shelf angles and/or lintels.
7. Between copings or sills.

Type 3: Interior Joints.

1. Between exterior metal work (such as frames for doors, louvers and the like) and interior finish of Gypsum wallboard, plaster and/or masonry.
2. For all general interior use similar to interior control joints, perimeter of door frames, etc.

Type 4: Interior Joints.

1. Between wall or floor finishes and plumbing fixtures i.e. slop sinks, mop and shower receptors and at all other interior locations where a watertight condition requires a sealant.

1.03 QUALITY ASSURANCE:

- A. Installer: Shall be a firm with minimum of five (5) years successful experience in the application of the types of material required, and shall employ only skilled tradesmen for the work.

1.04 SUBMITTALS:

- A. Manufacturer's Data: Submit copies of manufacturer's specifications recommendations and installation instructions for each type of sealant and associated miscellaneous material required. Include letter of certification or certified laboratory test report indicating that each material complies with requirements and is intended generally for applications shown.
- B. Contractor shall submit a list of all locations where sealant occurs: Architect shall match color of sealant required to each of these locations. No sealant work shall proceed until this color list is submitted by the Architect to the Contractor.
- C. Samples: Submit 12" long cured samples of each color required for each type of sealant or caulking compound exposed to view. Install sample between 2 strips of material similar to or representative of typical surfaces where sealant or compound will be used, held apart to represent typical joint widths.

1.05 GUARANTEE:

- A. Submit a written guarantee agreeing to repair or replace sealants which fail to perform as air-tight and water-tight joints; or fail in joint adhesion, cohesion, abrasion resistance, weather resistance, stain resistance, or general durability; or appear to deteriorate in any other manner not clearly specified by submitted manufacturer data, as an inherent quality of the material for exposure indicated.
- B. Guarantee period shall be for a period of 5 years.
- C. Guarantee shall be signed jointly by Installer and Contractor.

1.06 ENVIRONMENTAL CONDITIONS:

- A. Weather Conditions: Do not proceed with installation of sealants under adverse weather conditions, or when temperatures are below or above manufacturer's recommended limitations. Proceed with work only when forecasted weather conditions are favorable for proper cure and development of high early bond strength.

PART 2 - PRODUCTS

2.01 MATERIALS, GENERAL:

- A. Color: Wherever sealant is not exposed to view, provide manufacturer's standard color which has the best overall performance characteristics for application shown. Whenever compound is exposed to view, provide manufacturer's standard colors as selected by the Architect to match adjacent materials.
- B. Hardness and movement capability are specified to indicate the ranges necessary for overall performance. Consult manufacturer's technical representative to determine actual performance parameters recommended for conditions of installation and use. Provide compounds within the following performance ranges of hardness and movement capability as required.
 - Type 1: Multi-Component epoxidized polyurethane terpolymer sealant with a 25 shore A hardness for high percentage movement up to 40% in extension and 25% in compression.
 - Type 2: One part solvent acrylic sealant for moderate movement of the order of $\pm 12.5\%$ joint movement.
 - Type 3: One part acrylic latex sealant for low percentage of movement of the order of $\pm 7.5\%$.
 - Type 4: One part silicone sealant.
- C. Modulus of Elasticity: for joints subject to movement, either thermal expansion or dynamic movement, provide sealants which have the lowest modulus of elasticity.
- D. Compatibility: Sealant shall be compatible with joint surfaces, joint fillers and other materials in the joint system. Provide only manufacturer's recommended materials in the joint system. Provide only manufacturer's recommended materials which are known to be fully compatible with the actual installation condition, as shown by manufacturer's published data or certification.

2.02 SEALANTS:

- A. Type 1: Multi-component polyurethane sealant complying with Fed. Spec. TT-S-00227E, Class A, Type II provide one of the following:
 - 1. Dymeric, Tremco Inc.
 - 2. Pecora
 - 3. Sonolastic NP-2, Sonneborn Building Products
- B. Type 2: One-Component Acrylic Terpolymer Sealant complying with FS TT-S-230 (non-sag). Provide one of the following:
 - 1. Mono, Tremco Inc.
 - 2. Unicrylic 60, Pecora
 - 3. Parr Latex Acrylic Sealant, Parr.

- C. Type 3: Acrylic Latex Sealant, permanently flexible, non-staining and non-bleeding; recommended by manufacturer. Provide one of the following:
1. Acrylic Latex Caulk, Tremco Inc.
 2. AC-20 Acrylic Latex, Pecora
 3. Igas Calking-L, Silka Chemical Corp.
- D. Type 4: One Component Silicone Sealant complying with Fed. Spec. TT-S-001543A. Provide one of the following:
1. 863, Pecora
 2. Sanitary Sealant, General Electric
 3. V23-2, Perennator

2.03 MISCELLANEOUS MATERIALS:

- A. Joint Cleaners: Provide joint cleaning compounds as recommended by sealant manufacturer(s).
- B. Joint Primer Sealer: Provide type(s) of joint primer as recommended by sealant manufacturer(s).
- C. Bond Breaker Tape: Polyethylene tape or other plastic tape as recommended by sealant manufacturer, to be applied to sealant-contact surfaces where bond to the substrate or joint filler must be avoided for proper performance of sealant. Provide self-adhesive tape wherever applicable.
- D. Sealant Backer Rod: Compressible rod stock polyethylene foam, polyethylene jacketed polyurethane foam, butyl rubber foam, neoprene foam or other flexible, permanent, durable non-absorptive material as recommended for compatibility with sealant by the sealant manufacturer. Provide size and shape of rod which will control the joint depth for sealant placement, break bond of sealant at bottom of joint, form optimum shape of sealant bead on back side, and provide a high compressible backer to minimize possibility of sealant extrusion from compressed joint.
- E. Joint filler: Provide expanded neoprene complying with ASTM D1056, Class SC (oil-resistant and medium swell), of 2 to 5 psi compression deflection (Grade SCE 41); except provide 13 to 17 psi compression deflection (Grade SCE 41).

PART 3 - EXECUTION

3.01 PRE-INSTALLATION MEETING:

- A. Prior to all work of this Section, schedule a job site pre-installation meeting to review the procedures and time schedule proposed for installation of all sealant work.
- B. Present at meeting shall be the Contractor, Architect, Installer, Sealant Manufacturer's Technical Representative and other trades involved in coordination with sealant work.

3.02 SURFACE CONDITIONS:

- A. Clean joint surfaces immediately before installation of sealant. Remove dirt, insecure coatings, moisture and other substances which would interfere with bond of sealant.
- B. For Polyurethane sealants, do not proceed with installation of sealant over joint surfaces which have been painted, lacquered, waterproofed or treated with water repellent or other treatment or coating unless a laboratory test for durability (adhesion), in compliance with Paragraph 4.3.9 of FS TT-S-227 has successfully demonstrated that sealant bond is not impaired by the coating or treatment. If laboratory test has not been performed, or shows bond interference, remove coating or treatment from joint surfaces before installing sealant.
- C. Etch concrete and masonry joint surfaces to remove excess alkalinity, unless sealant manufacturer's printed instructions indicate that alkalinity does not interfere with sealant bond and performance. Etch with 5% solution of muriatic acid: neutralize with diluted ammonia solution, rinse thoroughly with water and allow to dry before sealant installation.
- D. Roughen joint surfaces of non-porous materials, wherever sealant manufacturer's data indicates lower bond strength than for porous surfaces. Rub with fine abrasive cloth or wool to produce a dull sheen.

3.03 INSTALLATION:

- A. Comply with sealant manufacturer's printed instructions except where more stringent requirements are shown or specified and except where manufacturer's technical representative directs otherwise.
- B. Prime or seal the joint surfaces wherever recommended by the sealant manufacturer. Do not allow primer-sealer to spill or migrate onto adjoining surfaces.
- C. Install sealant backer rod liquid for elastomeric sealants, except where shown to be omitted or recommended to be omitted by sealant manufacturer for the application shown.
- D. Install bond breaker tape wherever shown and wherever required by manufacturer's recommendations to ensure that elastomeric sealants will perform properly.
- E. Employ only proven installation techniques, which will ensure that sealants will be deposited in uniform, continuous ribbons without gaps or air pockets, with the complete "wetting" of the joint bond surface equally on opposite sides. Except as otherwise indicated, fill sealant rabbet to a slightly concave surface, slightly below adjoining surfaces. Where horizontal joints are between a horizontal surface and a vertical surface, fill joint to form a slight cove, so that joint will not trap moisture and dirt.
- F. Install sealants as recommended by sealant manufacturer but within the following general limitations, measured at center section of bead.

Type 1: Sealant:

- 1. Joints 1¼" to 1½" wide, full joint equal to 100% of joint width.

2. Joints larger than 1½", the depth of sealant shall not be less than 5/8".

Type 2: Sealant:

1. Joints 1/4 to 1/2" wide, fill joint equal to 100% of joint width.
2. Joints larger than 1½" depth of Sealant shall not be less than 3/8".

Type 3&4: Sealants:

1. Fill joints to a depth in the range of 75% to 125% of joint width.

- G. Spillage: Do not allow sealant or compounds to overflow or spill onto adjoining surfaces, or to migrate into the voids of adjoining surfaces. Use masking tape or other precautionary devices to prevent staining of adjoining surfaces, by either the primer/sealer or the sealant compound.
- H. Remove excess and spillage of compounds promptly as work progresses. Clean adjoining surfaces by whatever means may be necessary to eliminate evidence of spillage, without damage to adjoining surfaces or finishes.

3.04 CURE AND PROTECTION:

- A. Cure sealant compounds in compliance with manufacturer's instructions and recommendations, in order to obtain high early bond strength, cohesive strength and surface durability.
- B. Adopt procedures as required for the curing and protection of sealants and caulking compounds during the construction period, so that they will be without deterioration or damage (other than normal wear and weathering) at the time of Owner's acceptance.

3.05 TESTS FOR PERFORMANCE:

- A. After nominal cure of exterior joint sealants which are exposed to the weather, test for water leaks. Flood the joint exposure with water directed from a 3/4" garden hose held perpendicular to wall face, 2'0" from joint, connected to a water system with 30 psi minimum normal water pressure. Move stream of water along joint at an approximate rate of 20 ft. per min.
- B. Test approximately 5% of total joint system, in locations which are typical of every joint condition, and which can be inspected easily for leakage on opposite face. Conduct test in the presence of the Architect, who will determine the actual percentage of joints to be tested and the actual period of exposure to water from hose, based upon extent of observed leakage, or lack thereof.
- C. Repair sealant installation at leak, or, if leakage is excessive, replace sealant installation as directed.
- D. Should joint leak indicating the possibility of inadequate joint bond strength, the Architect may direct that additional testing be performed at a time when joints have been fully cured, followed by natural exposure through both extreme temperatures and returned to the lowest range of temperature in which it is feasible to conduct

testing. Promptly repair or replace work as required. Perform testing at any reasonable time within 24 months of installation date, as directed.

END OF SECTION 07 92 00.

SECTION 080671 – DOOR HARDWARE SCHEDULE

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 references specification sections relating to commercial door hardware for the following:
 - 1. Swinging doors.
 - 2. Sliding Doors.
 - 3. Other doors to the extent indicated.
- B. Commercial door hardware includes, but is not necessarily limited to, the following:
 - 1. Mechanical door hardware.
 - 2. Electromechanical and access control door hardware.
 - 3. Electromechanical and access control door hardware power supplies, back-ups and surge protection.
 - 4. Automatic operators.
 - 5. Cylinders specified for doors in other sections.
- C. Related Sections:
 - 1. Division 08 Section "Door Hardware".
- D. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.
 - 1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
 - 2. ICC/IBC - International Building Code.
 - 3. NFPA 70 - National Electrical Code.
 - 4. NFPA 80 - Fire Doors and Windows.
 - 5. NFPA 101 - Life Safety Code.
 - 6. NFPA 105 - Installation of Smoke Door Assemblies.
 - 7. State Building Codes, Local Amendments.
- E. Standards: Reference Related Sections for requirements regarding compliance with applicable industry standards.

1.3 SUBMITTALS

- A. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, operational descriptions and finishes.
- B. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
 - 1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."
 - 2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening. Organize door hardware sets in same order as in the Door Hardware Sets at the end of Part 3. Submittals that do not follow the same format and order as the Door Hardware Sets will be rejected and subject to resubmission.
 - 3. Content: Include the following information:
 - a. Type, style, function, size, label, hand, and finish of each door hardware item.
 - b. Manufacturer of each item.
 - c. Fastenings and other pertinent information.
 - d. Location of door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
 - e. Explanation of abbreviations, symbols, and codes contained in schedule.
 - f. Mounting locations for door hardware.
 - g. Door and frame sizes and materials.
 - 4. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.
- C. Keying Schedule: Prepared under the supervision of the Owner, separate schedule detailing final keying instructions for locksets and cylinders in writing. Include keying system explanation, door numbers, key set symbols, hardware set numbers and special instructions. Owner to approve submitted keying schedule prior to the ordering of permanent cylinders.
- D. Product Test Reports: Indicating compliance with cycle testing requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified independent testing agency.
- E. Operating and Maintenance Manuals: Provide manufacturers operating and maintenance manuals for each item comprising the complete door hardware installation in quantity as required in Division 01, Closeout Submittals. The manual to include the name, address, and contact information of the manufacturers providing the hardware and their nearest service representatives. The final copies delivered after completion of the installation test to include "as built" modifications made during installation, checkout, and acceptance.

- F. Warranties and Maintenance: Special warranties and maintenance agreements specified in the Related Sections.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Inventory door hardware on receipt and provide secure lock-up and shelving for door hardware delivered to Project site. Do not store electronic access control hardware, software or accessories at Project site without prior authorization.
- B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.
- C. Deliver, as applicable, permanent keys, cylinders, cores, access control credentials, software and related accessories directly to Owner via registered mail or overnight package service. Instructions for delivery to the Owner shall be established at the "Keying Conference".

1.5 WARRANTY

- A. General Warranty: Reference Division 01, General Requirements. Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

1.6 MAINTENANCE SERVICE

- A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

- A. Refer to "PART 3 – EXECUTION" for required specification sections.

PART 3 - EXECUTION

3.1 DOOR HARDWARE SETS

- A. The door hardware sets represent the design intent and direction of the owner and architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware and missing items should be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.

- 1. Quantities listed are for each pair of doors, or for each single door.

2. The supplier is responsible for handing and sizing all products.
 3. Where multiple options for a piece of hardware are given in a single line item, the supplier shall provide the appropriate application for the opening.
 4. At existing openings with new hardware the supplier shall field inspect existing conditions prior to the submittal stage to verify the specified hardware will work as required. Provide alternate solutions and proposals as needed.
- B. Products listed in the hardware sets shall be supplied by and in accordance with the requirements described in the specification section as noted for each item.
1. Section 08 71 00 – Door Hardware.
- C. Manufacturer's Abbreviations:
1. MK - McKinney
 2. MR - Markar
 3. PE - Pemko
 4. SU - Securitron
 5. RO - Rockwood
 6. RU - Corbin Russwin
 7. FO - Folger Adam
 8. HS - HES
 9. RF - Rixson
 10. NO - Norton
 11. OT - Other

Hardware Sets

Set: 1.0

Doors: **201**

Description: CARD ACCESS Wide

2 Hinge (heavy weight)	T4A3786	US26D	MK	087100	
1 Hinge (heavy weight)	T4A3786 QCxxx	US26D	MK	087100	↗
1 Fail Secure Lock	CL33905 NZD 24AD CT6R	626C	RU	087100	↗
1 Interchangeable Core	CR8000- L4	626	RU	087100	
1 Surface Closer	PR7500 / R7500	689	NO	087100	
1 Wall Stop	403	US26D	RO	087100	
1 Gasketing	S88 LAR		PE	087100	
1 ElectroLynx Frame Harness	QC-C2500P		MK	087100	↗
1 ElectroLynx Door Harness	QC-Cxxx LAR		MK	087100	↗
1 Card Reader	Card / FOB Reader provided by Div 28.		OT	281300	↗

1 Power Supply	EPS-05	SU	087100	⚡

Set: 2.0

Doors: 202A

Description: OFFICE SET

3 Hinge, Full Mortise	TA2714	US26D	MK	087100
1 Entrance Lock	CL3351 NZD CT6R	626C	RU	087100
1 Interchangeable Core	CR8000- L4	626	RU	087100
1 Wall Stop	403	US26D	RO	087100
1 Gasketing	S88 LAR		PE	087100

Set: 3.0

Doors: 110, 110a, 111

Description: PUBLIC RESTROOM

3 Hinge (heavy weight)	T4A3786	US26D	MK	087100
1 Privacy Lock	ML2030 NSA M19VN	626C	RU	087100
1 Mop Plate	K1050 4" HIGH HVBEV CSK	US32D-MS	RO	087100
1 Wall Stop	400	US26D	RO	087100
1 Gasketing	S88 LAR		PE	087100

Set: 4.0

Doors: C100B

Description: DOUBLE EGRESS HO

6 Hinge (heavy weight)	T4A3786	US26D	MK	087100
2 Surface Vert Rod Exit, Exit Only	ED5470 EO M55	630	RU	087100
2 Surface Closer	7705PTO DE	689	NO	087100 ⚡
4 Mop Plate	K1050 4" HIGH HVBEV CSK	US32D-MS	RO	087100
2 Astragal	S772C		PE	087100

Set: 5.0

Doors: 101

Description: CAFE ENTRY

1 Continuous Hinge	FM300 7'0	630	MR	087100
1 Exit Device (passage)	ED5200A N910ET	626C	RU	087100
1 Surface Closer	PR7500 / R7500	689	NO	087100
1 Electromagnetic Holder	998M	689	RF	087100 ⚡

Notes: PERIMETER GASKETING SHALL BE PROVIDED BY ALUMINUM DOOR/ FRAME MANUFACTURER.

Set: 6.0

Doors: 104

Description: VENDING MACHINES

3 Hinge, Full Mortise	TA2714	US26D	MK	087100
1 Passage Latch	CL3310 NZD	626C	RU	087100
1 Surface Closer	PR7500 / R7500	689	NO	087100
1 Kick Plate	K1050 10" HVBEV CSK	US32D-MS	RO	087100
1 Mop Plate	K1050 4" HIGH HVBEV CSK	US32D-MS	RO	087100
1 Wall Stop	403	US26D	RO	087100

Set: 7.0

Doors: 103

Description: STORAGE ROOM RATED

3 Hinge (heavy weight)	T4A3786	US26D	MK	087100
1 Storeroom Lock	CL3357 NZD CT6R	626C	RU	087100
1 Interchangeable Core	CR8000- L4	626	RU	087100
1 Surface Closer	PR7500 / R7500	689	NO	087100
1 Kick Plate	K1050 10" HVBEV CSK	US32D-MS	RO	087100
1 Mop Plate	K1050 4" HIGH HVBEV CSK	US32D-MS	RO	087100
1 Wall Stop	400	US26D	RO	087100

Set: 8.0

Doors: 102

Description: STORAGE ROOM

3 Hinge (heavy weight)	T4A3786	US26D	MK	087100
1 Storeroom Lock	CL3357 NZD CT6R	626C	RU	087100
1 Interchangeable Core	CR8000- L4	626	RU	087100
1 Kick Plate	K1050 10" HVBEV CSK	US32D-MS	RO	087100
1 Mop Plate	K1050 4" HIGH HVBEV CSK	US32D-MS	RO	087100
1 Wall Stop	400	US26D	RO	087100

Set: 98.0

Doors: 105, 106, 202B, C100A

Description: ETR

1 Interchangeable Core	CR8000- L4	626	RU	087100

Notes: Provide final core as required for locking requirements.

All hardware existing to remain. Refer to architectural drawings for further information.

Set: 99.0

Doors: 100A, 100B

Description: ALL HARDWARE BY DOOR MANUFACTURER

1 Interchangeable Core	CR8000- L4	626	RU	087100

Notes: Provide final core as required for locking requirements.

END OF SECTION 080671

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 and custom hollow metal doors and frames.
 - 2. Steel sidelight, borrowed lite and transom frames.
 - 3. Louvers installed in hollow metal doors.
 - 4. Light frames and glazing installed in hollow metal doors.

- B. Related Sections:

- 1. Division 08 Section "Flush Wood Doors".
 - 2. Division 08 Section "Door Hardware".
 - 3. Division 09 Sections "Exterior Painting" and "Interior Painting" for field painting hollow metal doors and frames.
 - 4. Division 26 "Electrical" Sections for electrical connections including conduit and wiring for door controls and operators installed on frames with factory installed electrical knock out boxes.
 - 5. Division 28 Section "Access Control" for access control devices installed at door openings and provided as part of a security access control system.

- C. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.

- 1. ANSI/SDI A250.8 - Recommended Specifications for Standard Steel Doors and Frames.
 - 2. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames, Frames Anchors and Hardware Reinforcing.
 - 3. ANSI/SDI A250.6 - Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames.
 - 4. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames.
 - 5. ANSI/SDI A250.11 - Recommended Erection Instructions for Steel Frames.
 - 6. ASTM A1008 - Standard Specification for Steel Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
 - 7. ASTM A653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - 8. ASTM A924 - Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
 - 9. ASTM C 1363 - Standard Test Method for Thermal Performance of Building Assemblies by Means of a Hot Box Apparatus.
 - 10. ANSI/BHMA A156.115 - Hardware Preparation in Steel Doors and Frames.
 - 11. ANSI/SDI 122 - Installation and Troubleshooting Guide for Standard Steel Doors and Frames.

12. ANSI/NFPA 80 - Standard for Fire Doors and Fire Windows; National Fire Protection Association.
13. ANSI/NFPA 105: Standard for the Installation of Smoke Door Assemblies.
14. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; National Fire Protection Association.
15. UL 10C - Positive Pressure Fire Tests of Door Assemblies.
16. UL 1784 - Standard for Air Leakage Tests of Door Assemblies.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, core descriptions, hardware reinforcements, profiles, anchors, fire-resistance rating, and finishes.
- B. Door hardware supplier is to furnish templates, template reference number and/or physical hardware to the steel door and frame supplier in order to prepare the doors and frames to receive the finish hardware items.
- C. Shop Drawings: Include the following:
 1. Elevations of each door design.
 2. Details of doors, including vertical and horizontal edge details and metal thicknesses.
 3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
 4. Locations of reinforcement and preparations for hardware.
 5. Details of anchorages, joints, field splices, and connections.
 6. Details of accessories.
 7. Details of moldings, removable stops, and glazing.
 8. Details of conduit and preparations for power, signal, and control systems.
- D. Samples for Verification:
 1. Samples are only required by request of the architect and for manufacturers that are not current members of the Steel Door Institute.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain hollow metal doors and frames through one source from a single manufacturer wherever possible.
- B. Quality Standard: In addition to requirements specified, furnish SDI-Certified manufacturer products that comply with ANSI/SDI A250.8, latest edition, "Recommended Specifications for Standard Steel Doors and Frames".
- C. Fire-Rated Door Assemblies: 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 UL10C (neutral pressure at 40" above sill) or UL 10C.
 1. Oversize Fire-Rated Door Assemblies Construction: For units exceeding sizes of tested assemblies, attach construction label certifying doors are built to standard construction requirements for tested and labeled fire rated door assemblies except for size.
 2. Temperature-Rise Limit: Where indicated and at vertical exit enclosures (stairwell openings) and exit passageways, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F (250 deg C) above ambient after 30 minutes of standard fire-test exposure.

3. Smoke Control Door Assemblies: Comply with NFPA 105.

- a. Smoke "S" Label: Doors to bear "S" label, and include smoke and draft control gasketing applied to frame and on meeting stiles of pair doors.
- D. 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. Provide labeled glazing material.
- E. Pre-Submittal Conference: Conduct conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier, Installer, and Contractor to review proper methods and procedures for installing hollow metal doors and frames and to verify installation of electrical knockout boxes and conduit at frames with electrified or access control hardware.

1.5 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 non-vented plastic.
- 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 high wood blocking. Do not store in a manner that traps excess humidity.
 - 1. Provide minimum 1/4-inch space between each stacked door to permit air circulation. Door and frames to be stacked in a vertical upright position.

1.6 PROJECT CONDITIONS

- A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

1.7 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.

1.8 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.
- B. Warranty includes installation and finishing that may be required due to repair or replacement of defective doors.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide steel doors and frames from a SDI Certified manufacturer:
 - 1. CECO Door Products (C).
 - 2. Curries Company (CU).
 - 3. Pioneer Industries (PI).

2.2 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.
- B. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.
- C. Frame Anchors: ASTM A 653/A 653M, Commercial Steel (CS), Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.

2.3 HOLLOW METAL FRAMES

- A. General: Comply with ANSI/SDI A250.8 and with details indicated for type and profile.
- B. Interior Frames: Fabricated from cold-rolled steel sheet that complies with ASTM A 1008/A 1008M.
 - 1. Fabricate frames with mitered or coped corners. Profile as indicated on drawings.
 - 2. Frames: Minimum 16 gauge (0.053-inch -1.3-mm) thick steel sheet.
 - 3. Manufacturers Basis of Design:
 - a. Curries Company (CU) - CM Series.
- C. Fire rated frames: Fabricate frames in accordance with NFPA 80, listed and labeled by a qualified testing agency, for fire-protection ratings indicated.
- D. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 Table 4 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, formed from A60 metallic coated material, not less than 0.042 inch thick, with corrugated or perforated straps not less than 2 inches wide by 10 inches long; or wire anchors not less than 0.177 inch thick.
 - 2. Stud Wall Type: Designed to engage stud and not less than 0.042 inch thick.

- B. Floor Anchors: Floor anchors to be provided at each jamb, formed from A60 metallic coated material, not less than 0.042 inches thick.

2.5 ACCESSORIES

- A. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.
- B. Grout Guards: Formed from same material as frames, not less than 0.016 inches 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. When shipping limitations so dictate, frames for large openings are to be fabricated in sections for splicing or splining in the field by others.
- B. Tolerances: Fabricate hollow metal work to tolerances indicated in ANSI/SDI A250.8.
- C. Hollow Metal Frames:
 - 1. Shipping Limitations: 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.
 - 2. Welded Frames: Weld joints continuously through full throat width of frames, including rabbets, soffits, and stops; grind, fill, dress, and make smooth, flush, and invisible.
 - a. Welded frames are to be provided with two steel spreaders temporarily attached to the bottom of both jambs to serve as a brace during shipping and handling. Spreader bars are for bracing only and are not to be used to size the frame opening.
 - 3. Equal Rabbet Frames: Provide frames with equal rabbet dimensions unless glazing and removable stops require wider dimensions on glass side of frame.
 - 4. High Frequency Hinge Reinforcement: Provide high frequency hinge reinforcements at door openings 48-inches and wider with mortise butt type hinges at top hinge locations.
 - 5. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated for removable stops, provide security screws at exterior locations.
 - 6. Electrical Thru-Wiring: Provide hollow metal frames receiving electrified hardware with loose wiring harness (not attached to open throat components or installed in closed mullion tubes) and standardized Molex™ plug connectors on one end to accommodate up to twelve wires. Coordinate connectors on end of the wiring harness to plug directly into the electric through-wire transfer hardware or wiring harness specified in hardware sets in Division 08 Sections "Door Hardware" and "Access Control Hardware".
 - 7. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
 - 8. Jamb Anchors: Provide number and spacing of anchors as follows:
 - a. Stud Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
 - 1) Three anchors per jamb up to 60 inches high.
 - 2) Four anchors per jamb from 60 to 90 inches high.

- 3) Five anchors per jamb from 90 to 96 inches high.
 - 4) Five anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 96 inches high.
 - 5) Two anchors per head for frames above 42 inches wide and mounted in metal stud partitions.
- 9. Door Silencers: Except on weatherstripped or gasketed doors, drill stops to receive door silencers. Silencers to be supplied by frame manufacturer regardless if specified in Division 08 Section "Door Hardware".
- D. Hardware Preparation: Factory prepare hollow metal work to receive template 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 doors and frames to receive non-template, 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 Finishes: Doors and frames to be cleaned, and chemically treated to insure maximum finish paint adhesion. Surfaces of the door and frame exposed to view to receive a factory applied coat of rust inhibiting shop primer.
 - 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; and compatible with substrate and field-applied coatings.

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. General Contractor to verify the accuracy of dimensions given to the steel door and frame manufacturer for existing openings or existing frames (strike height, hinge spacing, hinge back set, etc.).
- C. 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 square, level, twist, and plumb condition.
- C. Tolerances shall comply with SDI-117 "Manufacturing Tolerances Standard Steel Doors and Frames."
- D. Drill and tap doors and frames to receive non-template, 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 and NFPA 80 at fire rated openings.
 - 1. Set frames accurately in position, plumbed, leveled, aligned, and braced securely until permanent anchors are set. After wall construction is complete and frames properly set and secured, remove temporary braces, leaving surfaces smooth and undamaged. Shim as necessary to comply with installation tolerances.
 - 2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with post-installed expansion anchors.
 - 3. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with mortar.
 - 4. Grout Requirements: Do not grout head of frames unless reinforcing has been installed in head of frame. Do not grout vertical or horizontal closed mullion members.
- C. Hollow Metal Doors: Fit hollow metal doors accurately in frames, within clearances specified below. Shim as necessary.
 - 1. Non-Fire-Rated Standard Steel Doors:
 - a. Jambs and Head: 1/8 inch plus or minus 1/16 inch.
 - b. Between Edges of Pairs of Doors: 1/8 inch plus or minus 1/16 inch.
 - c. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch.
 - d. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch.
 - 2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
- D. Field Glazing: Comply with installation requirements in Division 08 Section "Glazing" and with hollow metal manufacturer's written instructions.

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 and Painted Finish Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat, or painted finishes, and apply touchup of compatible air drying, rust-inhibitive primer, zinc rich primer (exterior and galvanized openings) or finish paint.

END OF SECTION 081113

SECTION 08 14 00 - WOOD DOORS

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. Section Includes:
 - 1. Solid core doors with wood veneer faces.
 - 2. Factory finishing wood doors.
 - 3. Factory fitting wood doors to frames and factory machining for hardware.
 - 4. Light frames and glazing installed in wood doors.
- B. Related Sections:
 - 1. Division 01.
 - 2. Division 08 Section "Hollow Metal Doors and Frames" for wood doors in steel frames.
 - 3. Division 08 Section "Glazing" for glass view panels in wood doors.
 - 4. Division 08 Section "Door Hardware" for door hardware for flush wood doors and wood frames and for electromechanical hardware for flush wood doors and wood frames.
- C. Standards and References: Comply with the version year adopted by the Authority Having Jurisdiction.
 - 1. ANSI A208.1 – Wood Particleboard.
 - 2. Forestry Stewardship Council (FSC) - Guidelines for environmentally certified wood doors.
 - 3. Intertek Testing Service (ITS Warnock Hersey) - Certification Listings for Fire Doors.
 - 4. NFPA 80 - Standard for Fire Doors and Fire Windows; National Fire Protection Association.
 - 5. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; National Fire Protection Association.
 - 6. UL 10C - Positive Pressure Fire Tests of Door Assemblies; UL 1784 - Standard for Air Leakage Tests of Door Assemblies.
 - 7. Window and Door Manufacturers Association - WDMA I.S.1-A Architectural Wood Flush Doors.

1.3 SUBMITTALS

- A. Product Data: For each type of door indicated. Include details of core and edge construction, louvers, trim for openings, and WDMA I.S.1-A or AWS classifications. Include factory finishing specifications.
- B. Door hardware supplier is to furnish templates, template reference number and/or physical hardware to the wood door supplier in order to prepare the doors and frames to receive the finish hardware items.

- C. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; location and extent of hardware blocking; and other pertinent data.
 - 1. Indicate dimensions and locations of mortises and holes for hardware.
 - 2. Indicate dimensions and locations of cutouts.
 - 3. Indicate requirements for veneer matching.
 - 4. Indicate doors to be factory finished and finish requirements.
 - 5. Indicate fire protection ratings for fire rated doors.
- D. Samples for Initial Selection: For factory finished doors.
 - 1. Factory finishes applied to actual door face materials, approximately 8 by 10 inches, 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 the finished work.
 - 2. Corner sections of doors, 8 by 10 inches, with door faces and edges representing actual materials to be used.
 - a. Provide samples for each species of veneer and solid lumber required.
 - b. Finish veneer faced door samples with same materials proposed for factory finished doors.
 - 3. Frames for light openings, 6 inches long, for each material, type, and finish required.
- E. Warranty: Sample of special warranties.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain flush wood doors through one source from a single manufacturer wherever possible.
- B. Quality Standard: In addition to requirements specified, comply with WDMA I.S.1-A, latest edition, "Industry Standard for Architectural Wood Flush Doors".
- C. Fire Rated Wood Doors: Doors complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing at positive pressure according to NFPA 252 (neutral pressure at 40" above sill) or UL 10C (neutral pressure testing according to UL 10B where specified).
 - 1. Oversize Fire Rated Door Assemblies: For units exceeding sizes of tested assemblies provide manufacturer's construction label, indicating compliance to independent 3rd party certification agency's procedure, except for size.
 - 2. Temperature Rise Limit: Where indicated and at vertical exit enclosures (stairwell openings) and exit passageways, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F (250 deg C) above ambient after 30 minutes of standard fire test exposure.
 - 3. Smoke Control Door Assemblies: Comply with NFPA 105.

- 1) Smoke "S" Label: Doors to bear "S" label, and include smoke and draft control gasketing applied to frame and on meeting stiles of pair doors.
4. Blocking: Through-bolts are not to be used, indicate size and location of blocking in 45, 60 and 90 minute mineral core doors.
- D. Environmental Certification: Provide Forestry Stewardship Council (FSC) authorized certificate for doors requiring environmental certification. Environmental certification ensures that wood components come from certified forests and are processed by certified chain-of-custody manufacturers.
- E. Pre-Submittal Conference: Conduct conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier, Installer, and Contractor to review proper methods and procedures for receiving, handling, and installing flush wood doors.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Comply with requirements of referenced standard and manufacturer's written instructions.
- B. Package pre-finished doors individually in plastic bags or cardboard cartons and wrap bundles of doors in plastic sheeting.
- C. Mark each door on top rail with opening number used on Shop Drawings.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weather tight, wet work in spaces is complete and dry, and HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

1.7 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which 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 in a 42-by-84-inch section.
 - b. Telegraphing of core construction in wood face veneers exceeding 0.01 inch in a 3-inch span.
 - c. Telegraphing of core construction and delaminating of face in decorative laminate-faced doors.
 2. Warranty includes 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 according to manufacturer's written warranty.

PART 2 - PRODUCTS

2.1 DOOR CONSTRUCTION – GENERAL

- A. WDMA I.S.1-A Performance Grade: Extra Heavy Duty; Aesthetic Grade: Premium.
- B. Fire Rated Doors: Provide construction and core as needed to provide fire ratings indicated.
 - 1. Category A Edge Construction: Provide 45, 60 and 90 minute fire rated doors edge construction with intumescent seals concealed by outer stile (Category A). Comply with specified requirements for exposed edges.
 - 2. Pairs: Provide fire retardant stiles that are listed and labeled for applications indicated without formed steel edges and astragals. Provide stiles with concealed intumescent seals. Comply with specified requirements for exposed edges.
 - a. Where required or specified, provide formed steel edges and astragals with intumescent seals. Finish steel edges and astragals with baked enamel.

2.2 CORE CONSTRUCTION

- A. Particleboard Core Doors:
 - 1. Particleboard: Wood fiber based materials complying with ANSI A208.1 Particleboard standard. Grade LD-2.
 - 2. Adhesive: Fully bonded construction using Polyurethane (PUR) glue.
 - 3. Blocking: Through-bolted hardware is not to be used, provide wood blocking in particleboard core doors as follows:
 - a. 5-inch (125-mm) top-rail blocking, in doors indicated to have closers.
 - b. 5-inch (125-mm) mid-rail blocking, in doors indicated to have exit devices.
 - 1) Optional Cores for Blocking: Provide doors with structural-composite-lumber core instead of particleboard core for doors indicated to receive closers and exit devices.
 - 4. Basis of Design:
 - a. Graham: PC

2.3 VENEERED DOORS FOR TRANSPARENT FINISH

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Eggers Industries: Premium
 - 2. Graham: GPD
 - 3. Marshfield: Signature
- B. Interior Solid Core Doors:

1. Grade: Premium. Refer to drawings for species.
2. Faces: Veneer grades as noted below; veneer minimum 1/50-inch (0.5mm) thickness at moisture content of 12% or less.
 - a. Veneer shall match existing building standard. Supplier shall visit project site and assess existing veneer types in each area in which doors are to be installed, procure samples and determine which most accurately matches existing veneer and finish. Submit samples to Architect for review and approval prior to submitting to hospital for acceptance.
3. Match between Veneer Leaves: Book match.
4. Assembly of Veneer Leaves on Door Faces:
 - a. Running Match.
5. Pair and Set Match: Provide for doors hung in same opening or separated only by mullions.
6. Transom Match: Continuous match.
7. Vertical Edges: Matching same species as faces. Wood or composite material, one piece, laminated, or veneered. Minimum requirements per WDMA section P-1, Performance Standards for Architectural Wood Flush Doors.
8. Horizontal Edges: Solid wood or structural composite material meeting the minimum requirements per WDMA section P-1, Performance Standards for Architectural Wood Flush Doors
9. Construction: Five plies. Stiles and rails are bonded to core, then entire unit sanded before applying face veneers.
10. At doors over 40% of the face cut-out for lights and or louvers, furnish engineered composite lumber core.

2.4 LIGHT FRAMES AND GLAZING

- A. Wood Beads for Light Openings in Wood Doors up to and including 20-minute rating:
 1. Wood Species: Same species as door faces.
 2. Profile: Manufacturer's standard lipped profile. At wood core doors with 20-minute fire protection ratings, provide wood beads and metal glazing clips approved for such use.
- B. Metal Frames for Light Openings in Fire Rated Doors over 20-minute rating: Manufacturer's standard frame formed of 0.048-inch-thick, cold rolled steel sheet; with baked enamel or powder coated finish; and approved for use in doors of fire protection rating indicated.
- C. Glazing: Comply with installation requirements in Division 08 Section "Glazing" and with the flush wood door manufacturer's written instructions.

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 requirements in NFPA 80 for fire rated doors.

- B. Factory machine doors for hardware that is not surface applied. Comply with final hardware schedules, door frame Shop Drawings, DHI A115-W series standards, and hardware templates.
 - 1. Coordinate with hardware mortises in metal frames to verify dimensions and alignment before factory machining.
 - 2. Metal Astragals: Factory machine astragals and formed steel edges for hardware for pairs of fire rated doors.
- C. Side Panels: Fabricate matching panels with same construction, exposed surfaces, and finish as specified for associated doors. Finish bottom edges of transoms and top edges of rabbeted doors same as door stiles.
- D. Openings: Cut and trim openings through doors in factory.
 - 1. Light Openings: Trim openings with moldings of material and profile indicated.
 - 2. Glazing: Comply with applicable requirements in Division 08 Section "Glazing."
 - 3. Louvers: Factory install louvers in prepared openings.
- E. Electrical Raceways: Provide flush wood doors receiving electrified hardware with concealed wiring harness and standardized Molex™ plug connectors on both ends to accommodate up to twelve wires. Coordinate connectors on end of the wiring harness to plug directly into the electrified hardware and the through wire transfer hardware or wiring harness specified in hardware sets in Division 08 "Door Hardware". Wire nut connections are not acceptable.

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. Transparent Finish: Provide a clear protective coating over the wood veneer allowing the natural color and grain of the selected wood species to provide the appearance specified. Stain is applied to the wood surface underneath the transparent finish to add color and design flexibility.
 - 1. Grade: Premium. Color by architect.
 - 2. Finish: Meet or exceed WDMA I.S. 1A TR6 Catalyzed Polyurethane finish performance requirements.
 - 3. Staining: As required from manufacturer's full range to match existing wood veneer doors already in use.
 - 4. Sheen: Satin.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine doors and installed doorframes before hanging doors.
 - 1. Verify that frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.

2. Reject doors with defects.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Hardware: For installation, see Division 8 Section "Door Hardware."

B. Installation Instructions: Install doors to comply with manufacturer's written instructions and the referenced quality standard, and as indicated.

1. Install fire rated doors in corresponding fire rated frames according to NFPA 80.

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: Re-hang or replace doors that do not swing or operate freely.

B. Finished Doors: Replace doors 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 08 14 00

SECTION 08 46 00 – GLAZED INTERIOR WALL AND DOOR ASSEMBLIES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A.** Aluminum-framed storefront, with vision glass, interior applications.
- B.** Aluminum doors and frames, interior applications.

1.2 RELATED REQUIREMENTS

- A.** Section 07 9005 - Joint Sealers: Perimeter sealant and back-up materials.
- B.** Section 08 8000 - Glazing: Glass and glazing accessories.

1.3 REFERENCE STANDARDS

- A.** AAMA CW-10 - Care and Handling of Architectural Aluminum From Shop to Site; American Architectural Manufacturers Association; 2012.
- B.** AAMA 501.2 - Field Check of Metal Storefronts, Curtain Walls, and Sloped Glazing Systems for Water Leakage; American Architectural Manufacturers Association; 2009 (part of AAMA 501).
- C.** AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels; 2013.
- D.** ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2013.
- E.** ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes [Metric]; 2013.
- F.** ASTM E283 - Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen; 2004 (Reapproved 2012).

1.4 ADMINISTRATIVE REQUIREMENTS

- A.** Coordinate with installation of other components that comprise the exterior enclosure.

1.5 SUBMITTALS

- A.** See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B.** Shop Drawings: Indicate system dimensions, framed opening requirements and tolerances, affected related Work, expansion and contraction joint location and details, and field welding required. Include anchorage, size and type of fasteners, and accessories.
- C.** Hardware Schedule: Complete itemization of each item of hardware to be provided for each door, cross-referenced to door identification numbers in Contract Documents.

- D. Samples: Submit two samples 12 x 12 inches in size illustrating finished aluminum surface, and glazing materials.

1.6 QUALITY ASSURANCE

- A. Manufacturer and Installer Qualifications: Company specializing in manufacturing aluminum glazing systems with minimum three years of documented experience.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Handle products of this section in accordance with AAMA CW-10.
- B. Protect finished aluminum surfaces with wrapping. Do not use adhesive papers or sprayed coatings that bond to aluminum when exposed to sunlight or weather.

1.8 FIELD CONDITIONS

- A. Do not install sealants when ambient temperature is less than 40 degrees F. Maintain this minimum temperature during and 48 hours after installation.

1.9 WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Provide five year manufacturer warranty against failure of glass seal on insulating glass units, including interpane dusting or misting. Include provision for replacement of failed units.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Aluminum-Framed Storefront and Doors:
 - 1. Kawneer North America: www.kawneer.com.
 - 2. Tubelite, Inc; MATCH 400 SERIES CURTAINWALL SYSTEM: www.tubeliteinc.com.
 - 3. YKK AP America Inc: www.ykkap.com.
 - 4. Substitutions: See Section 01 6000 - Product Requirements.

2.2 STOREFRONT

- A. Aluminum-Framed Storefront: Factory fabricated, factory finished aluminum framing members with infill, and related flashings, anchorage and attachment devices.
 - 1. Glazing Rabbet: For 1/4 inch monolithic glazing, for interior applications.
 - 2. Glazing Position: Centered (front to back).
 - 3. Vertical Mullion Dimensions: 2 inches wide by 4 inches deep.
 - 4. Finish: Pigmented organic coating.
 - a. Factory finish all surfaces that will be exposed in completed assemblies.
 - b. Touch-up surfaces cut during fabrication so that no natural aluminum is visible in completed assemblies, including joint edges.
 - c. Coat concealed metal surfaces that will be in contact with cementitious materials or dissimilar metals with bituminous paint.
 - 5. Finish Color: As selected by Architect from manufacturer's standards.

6. Fabrication: Joints and corners flush, hairline, accurately fitted and secured; prepared to receive anchors and hardware; fasteners and attachments concealed from view; reinforced as required for imposed loads.
Expansion/Contraction: Provide for expansion and contraction within system components caused by cycling temperature range of 170 degrees F over a 12 hour period without causing detrimental effect to system components, anchorages, and other building elements.
7. Movement: Allow for movement between storefront and adjacent construction, without damage to components or deterioration of seals.
8. Perimeter Clearance: Minimize space between framing members and adjacent construction while allowing expected movement.
9. Air and Vapor Seal: Maintain continuous air barrier and vapor retarder throughout assembly, primarily in line with inside pane of glazing and inner sheet of infill panel and heel bead of glazing compound.

23 COMPONENTS

- A. Aluminum Framing Members: Tubular aluminum sections, drainage holes and internal weep drainage system.
 1. Thickness: 2"
 2. Depth: 6"
 3. Glazing stops: Flush.
- B. Glazing: As specified in Section 08 8000 - Glazing.
 1. For Interior Framing: Type GL-1, GL-2, & GL-3.
- C. Swing Doors: Glazed aluminum.
 1. Thickness: 1-3/4 inches.
 2. Top Rail: 4 inches wide.
 3. Vertical Stiles: 4-1/2 inches wide.
 4. Bottom Rail: 10 inches wide.
 5. Glazing Stops: Square.
 6. Finish: Same as storefront.

24 MATERIALS

- A. Extruded Aluminum: ASTM B221 (ASTM B221M).
- B. Fasteners: Stainless steel.
- C. Glazing Gaskets: Type to suit application to achieve weather, moisture, and air infiltration requirements.

25 FINISHES

- A. High Performance Organic Finish: AAMA 2604; multiple coats, thermally cured fluoropolymer system.
- B. Color: To be selected by Architect from manufacturer's standard range.

26 HARDWARE

- A. Other Door Hardware: Storefront manufacturer's standard type to suit application.

1. Finish on Hand-Contacted Items: Polished chrome.
2. For each door, include butt hinges, push handle, pull handle, and closer.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify dimensions, tolerances, and method of attachment with other work.
- B. Verify that wall openings and adjoining air and vapor seal materials are ready to receive work of this section.

3.2 INSTALLATION

- A. Install wall system in accordance with manufacturer's instructions.
- B. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.
- C. Provide alignment attachments and shims to permanently fasten system to building structure.
- D. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances, aligning with adjacent work.
- E. Provide thermal isolation where components penetrate or disrupt building insulation.
- F. Coordinate attachment and seal of perimeter air and vapor barrier materials.
- G. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.
- H. Set thresholds in bed of mastic and secure.
- I. Install hardware using templates provided.
- J. Install perimeter sealant in accordance with Section 07 9005.
- K. Touch-up minor damage to factory applied finish; replace components that cannot be satisfactorily repaired.

3.3 FIELD QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements, for independent testing and inspection requirements. Inspection will monitor quality of installation and glazing.
- B. Test installed storefront for water leakage in accordance with AAMA 501.2.

3.4 ADJUSTING

- A. Adjust operating hardware for smooth operation.

3.5 CLEANING

- A. Remove protective material from pre-finished aluminum surfaces.

- B. Wash down surfaces with a solution of mild detergent in warm water, applied with soft, clean wiping cloths. Take care to remove dirt from corners. Wipe surfaces clean.
- C. Remove excess sealant by method acceptable to sealant manufacturer.

3.6 PROTECTION

- A. Protect installed products from damage during subsequent construction.

END OF SECTION 08 46 00

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 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes commercial door hardware for the following:
 - 1. Swinging doors.
- B. Door hardware includes, but is not necessarily limited to, the following:
 - 1. Mechanical door hardware.
 - 2. Electromechanical door hardware.
- C. Related Sections:
 - 1. Division 06 Section "Rough Carpentry".
 - 2. Division 08 Section "Door Hardware Schedule".
 - 3. Division 08 Section "Hollow Metal Doors and Frames".
 - 4. Division 08 Section "Interior Aluminum Doors and Frames".
 - 5. Division 08 Section "Flush Wood Doors".
 - 6. Division 08 Section "Automatic Entrances".
- D. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.
 - 1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
 - 2. ICC/IBC - International Building Code.
 - 3. NFPA 70 - National Electrical Code.
 - 4. NFPA 80 - Fire Doors and Windows.
 - 5. NFPA 101 - Life Safety Code.
 - 6. NFPA 105 - Installation of Smoke Door Assemblies.
 - 7. UL/ULC and CSA C22.2 – Standards for Automatic Door Operators Used on Fire and Smoke Barrier Doors and Systems of Doors.
 - 8. State Building Codes, Local Amendments.
- E. Standards: All hardware specified herein shall comply with the following industry standards:
 - 1. ANSI/BHMA Certified Product Standards - A156 Series
 - 2. UL10C – Positive Pressure Fire Tests of Door Assemblies

1.3 SUBMITTALS

- A. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, operational descriptions and finishes.
- B. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
 - 1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."
 - 2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening. Organize door hardware sets in same order as in the Door Hardware Sets at the end of Part 3. Submittals that do not follow the same format and order as the Door Hardware Sets will be rejected and subject to resubmission.
 - 3. Content: Include the following information:
 - a. Type, style, function, size, label, hand, and finish of each door hardware item.
 - b. Manufacturer of each item.
 - c. Fastenings and other pertinent information.
 - d. Location of door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
 - e. Explanation of abbreviations, symbols, and codes contained in schedule.
 - f. Mounting locations for door hardware.
 - g. Door and frame sizes and materials.
 - h. Warranty information for each product.
 - 4. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.
- C. Shop Drawings: Details of electrified access control hardware indicating the following:
 - 1. Wiring Diagrams: Upon receipt of approved schedules, submit detailed system wiring diagrams for power, signaling, monitoring, communication, and control of the access control system electrified hardware. Differentiate between manufacturer-installed and field-installed wiring. Include the following:
 - a. Elevation diagram of each unique access controlled opening showing location and interconnection of major system components with respect to their placement in the respective door openings.
 - b. Complete (risers, point-to-point) access control system block wiring diagrams.
 - c. Wiring instructions for each electronic component scheduled herein.

2. Electrical Coordination: Coordinate with related sections the voltages and wiring details required at electrically controlled and operated hardware openings.
- D. Keying Schedule: After a keying meeting with the owner has taken place prepare a separate keying schedule detailing final instructions. Submit the keying schedule in electronic format. Include keying system explanation, door numbers, key set symbols, hardware set numbers and special instructions. Owner must approve submitted keying schedule prior to the ordering of permanent cylinders/cores.
 - E. Informational Submittals:
 1. Product Test Reports: Indicating compliance with cycle testing requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified independent testing agency.
 - F. Operating and Maintenance Manuals: Provide manufacturers operating and maintenance manuals for each item comprising the complete door hardware installation in quantity as required in Division 01, Closeout Procedures.
- 1.4 QUALITY ASSURANCE
- A. Manufacturers Qualifications: Engage qualified manufacturers with a minimum 5 years of documented experience in producing hardware and equipment similar to that indicated for this Project and that have a proven record of successful in-service performance.
 - B. Installer Qualifications: A minimum 3 years documented experience installing both standard and electrified door hardware similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
 - C. Door Hardware Supplier Qualifications: Experienced commercial door hardware distributors with a minimum 5 years documented experience supplying both mechanical and electromechanical hardware installations comparable in material, design, and extent to that indicated for this Project. Supplier recognized as a factory direct distributor by the manufacturers of the primary materials with a warehousing facility in Project's vicinity. Supplier to have on staff a certified Architectural Hardware Consultant (AHC) available during the course of the Work to consult with Contractor, Architect, and Owner concerning both standard and electromechanical door hardware and keying.
 - D. Source Limitations: Obtain each type and variety of door hardware specified in this section from a single source unless otherwise indicated.
 1. Provide electromechanical door hardware from the same manufacturer as mechanical door hardware, unless otherwise indicated.
 - E. Each unit to bear third party permanent label demonstrating compliance with the referenced standards.
 - F. Keying Conference: Conduct conference to comply with requirements in Division 01 Section "Project Meetings." Keying conference to incorporate the following criteria into the final keying schedule document:
 1. Function of building, purpose of each area and degree of security required.

2. Plans for existing and future key system expansion.
3. Requirements for key control storage and software.
4. Installation of permanent keys, cylinder cores and software.
5. Address and requirements for delivery of keys.

G. Pre-Submittal Conference: Conduct coordination conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier(s), Installer(s), and Contractor(s) to review proper methods and the procedures for receiving, handling, and installing door hardware.

1. Prior to installation of door hardware, conduct a project specific training meeting to instruct the installing contractors' personnel on the proper installation and adjustment of their respective products. Product training to be attended by installers of door hardware (including electromechanical hardware) for aluminum, hollow metal and wood doors. Training will include the use of installation manuals, hardware schedules, templates and physical product samples as required.
2. Inspect and discuss electrical roughing-in, power supply connections, and other preparatory work performed by other trades.
3. Review sequence of operation narratives for each unique access controlled opening.
4. Review and finalize construction schedule and verify availability of materials.
5. Review the required inspecting, testing, commissioning, and demonstration procedures

H. At completion of installation, provide written documentation that components were applied to manufacturer's instructions and recommendations and according to approved schedule.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Inventory door hardware on receipt and provide secure lock-up and shelving for door hardware delivered to Project site. Do not store electronic access control hardware, software or accessories at Project site without prior authorization.
- B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.
- C. Deliver, as applicable, permanent keys, cylinders, cores, access control credentials, software and related accessories directly to Owner via registered mail or overnight package service. Instructions for delivery to the Owner shall be established at the "Keying Conference".

1.6 COORDINATION

- A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing standard and electrified hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing hardware to comply with indicated requirements.
- B. Door Hardware and Electrical Connections: Coordinate the layout and installation of scheduled electrified door hardware and related access control equipment with required connections to source power junction boxes, low voltage power supplies, detection and monitoring hardware, and fire and detection alarm systems.

- C. Door and Frame Preparation: Doors and corresponding frames are to be prepared, reinforced and pre-wired (if applicable) to receive the installation of the specified electrified, monitoring, signaling and access control system hardware without additional in-field modifications.

1.7 WARRANTY

- A. General Warranty: Reference Division 01, General Requirements. Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.
- B. Warranty Period: Written warranty, executed by manufacturer(s), agreeing to repair or replace components of standard and electrified door hardware that fails in materials or workmanship within specified warranty period after final acceptance by the Owner. Failures include, but are not limited to, the following:
 - 1. Structural failures including excessive deflection, cracking, or breakage.
 - 2. Faulty operation of the hardware.
 - 3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - 4. Electrical component defects and failures within the systems operation.
- C. Standard Warranty Period: One year from date of Substantial Completion, unless otherwise indicated.
- D. Special Warranty Periods:
 - 1. Ten years for mortise locks and latches.
 - 2. Seven years for heavy duty cylindrical (bored) locks and latches.
 - 3. Five years for exit hardware.
 - 4. Twenty five years for manual surface door closer bodies.
 - 5. Two years for electromechanical door hardware.

1.8 MAINTENANCE SERVICE

- A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

- A. General: Provide door hardware for each door to comply with requirements in Door Hardware Sets and each referenced section that products are to be supplied under.
- B. Designations: Requirements for quantity, item, size, finish or color, grade, function, and other distinctive qualities of each type of door hardware are indicated in the Door Hardware Sets at the end of Part 3. Products are identified by using door hardware designations, as follows:

1. Named Manufacturer's Products: Product designation and manufacturer are listed for each door hardware type required for the purpose of establishing requirements. Manufacturers' names are abbreviated in the Door Hardware Schedule.
- C. Substitutions: Requests for substitution and product approval for inclusive mechanical and electromechanical door hardware in compliance with the specifications must be submitted in writing and in accordance with the procedures and time frames outlined in Division 01, Substitution Procedures. Approval of requests is at the discretion of the architect, owner, and their designated consultants.

2.2 HANGING DEVICES

- A. Hinges: ANSI/BHMA A156.1 certified butt hinges with number of hinge knuckles and other options as specified in the Door Hardware Sets.
1. Quantity: Provide the following hinge quantity:
 - a. Two Hinges: For doors with heights up to 60 inches.
 - b. Three Hinges: For doors with heights 61 to 90 inches.
 - c. Four Hinges: For doors with heights 91 to 120 inches.
 - d. For doors with heights more than 120 inches, provide 4 hinges, plus 1 hinge for every 30 inches of door height greater than 120 inches.
 2. Hinge Size: Provide the following, unless otherwise indicated, with hinge widths sized for door thickness and clearances required:
 - a. Widths up to 3'0": 4-1/2" standard or heavy weight as specified.
 - b. Sizes from 3'1" to 4'0": 5" heavy weight.
 3. Hinge Weight and Base Material: Unless otherwise indicated, provide the following:
 - a. Interior Doors: Standard weight, steel, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate heavy weight.
 4. Hinge Options: Comply with the following:
 - a. Non-removable Pins: Provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for the all out-swinging lockable doors.
 5. Manufacturers:
 - a. McKinney Products; ASSA ABLOY Architectural Door Accessories (MK) - TA Series.
- B. Pin and Barrel Continuous Hinges: ANSI/BHMA A156.26 Grade 1-600 certified pin and barrel continuous hinges with minimum 14 gauge Type 304 stainless steel hinge leaves, concealed teflon coated stainless pin, and twin self-lubricated nylon bearings at each knuckle separation. Factory trim hinges to suit door height and prepare for electrical cut-outs.

1. Manufacturers:

- a. Markar Products; ASSA ABLOY Architectural Door Accessories (MR).
- b. Pemko Products; ASSA ABLOY Architectural Door Accessories (PE).

2.3 POWER TRANSFER DEVICES

- A. Concealed Quick Connect Electric Power Transfers: Provide concealed wiring pathway housing mortised into the door and frame for low voltage electrified door hardware. Furnish with Molex™ standardized plug connectors and sufficient number of concealed wires (up to 12) to accommodate the electrified functions specified in the Door Hardware Sets. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Wire nut connections are not acceptable.

1. Manufacturers:

- a. Pemko Products; ASSA ABLOY Architectural Door Accessories (PE) – EL-CEPT Series.
- b. Securitron (SU) - EL-CEPT Series.

- B. Electric Door Wire Harnesses: Provide electric/data transfer wiring harnesses with standardized plug connectors to accommodate up to twelve (12) wires. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Provide sufficient number and type of concealed wires to accommodate electric function of specified hardware. Provide a connector for through-door electronic locking devices and from hinge to junction box above the opening. Wire nut connections are not acceptable. Determine the length required for each electrified hardware component for the door type, size and construction, minimum of two per electrified opening.

1. Provide one each of the following tools as part of the base bid contract:

- a. McKinney Products; ASSA ABLOY Architectural Door Accessories (MK) - Electrical Connecting Kit: QC-R001.
- b. McKinney Products; ASSA ABLOY Architectural Door Accessories (MK) - Connector Hand Tool: QC-R003.

2. Manufacturers:

- a. McKinney Products; ASSA ABLOY Architectural Door Accessories (MK) – QC-C Series.

2.4 DOOR OPERATING TRIM

- A. Flush Bolts and Surface Bolts: ANSI/BHMA A156.3 and A156.16, Grade 1, certified.

- 1. Flush bolts to be furnished with top rod of sufficient length to allow bolt retraction device location approximately six feet from the floor.
- 2. Furnish dust proof strikes for bottom bolts.
- 3. Surface bolts to be minimum 8" in length and U.L. listed for labeled fire doors and U.L. listed for windstorm components where applicable.

4. Provide related accessories (mounting brackets, strikes, coordinators, etc.) as required for appropriate installation and operation.
 5. Manufacturers:
 - a. Door Controls International (DC).
 - b. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).
 - c. Trimco (TC).
- B. Coordinators: ANSI/BHMA A156.3 certified door coordinators consisting of active-leaf, hold-open lever and inactive-leaf release trigger. Model as indicated in hardware sets.
1. Manufacturers:
 - a. Door Controls International (DC).
 - b. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).
 - c. Trimco (TC).
- C. Door Push Plates and Pulls: ANSI/BHMA A156.6 certified door pushes and pulls of type and design specified in the Hardware Sets. Coordinate and provide proper width and height as required where conflicting hardware dictates.
1. Push/Pull Plates: Minimum .050 inch thick, size as indicated in hardware sets, with beveled edges, secured with exposed screws unless otherwise indicated.
 2. Door Pull and Push Bar Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door unless otherwise indicated.
 3. Offset Pull Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door and offset of 90 degrees unless otherwise indicated.
 4. Fasteners: Provide manufacturer's designated fastener type as indicated in Hardware Sets.
 5. Manufacturers:
 - a. Hiawatha, Inc. (HI).
 - b. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).
 - c. Trimco (TC).

2.5 CYLINDERS AND KEYING

- A. General: Cylinder manufacturer to have minimum (10) years experience designing secured master key systems and have on record a published security keying system policy.
- B. Source Limitations: Obtain each type of keyed cylinder and keys from the same source manufacturer as locksets and exit devices, unless otherwise indicated.
- C. Cylinders: Original manufacturer cylinders complying with the following:
 1. Mortise Type: Threaded cylinders with rings and cams to suit hardware application.
 2. Rim Type: Cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.

3. Bored-Lock Type: Cylinders with tailpieces to suit locks.
 4. Mortise and rim cylinder collars to be solid and recessed to allow the cylinder face to be flush and be free spinning with matching finishes.
 5. Keyway: Match Facility Standard.
- D. Permanent Cores: Manufacturer's standard; finish face to match lockset; complying with the following:
1. Interchangeable Cores: Core insert, removable by use of a special key; usable with other manufacturers' cylinders.
- E. Keying System: Each type of lock and cylinders to be factory keyed.
1. Conduct specified "Keying Conference" to define and document keying system instructions and requirements.
 2. Furnish factory cut, nickel-silver large bow permanently inscribed with a visual key control number as directed by Owner.
 3. Existing System: Field verify and key locks to match Owner's existing system.
- F. Key Quantity: Provide the following minimum number of keys:
1. Change Keys per Cylinder: Three (3).
 2. Master Keys (per Master Key Level/Group): Five (5).
 3. Construction Keys (where required): Ten (10).
 4. Construction Control Keys (where required): Two (2).
 5. Permanent Control Keys (where required): Two (2).
- G. Construction Keying: Provide temporary keyed construction cores.
- H. Key Registration List (Bitting List):
1. Provide keying transcript list to Owner's representative in the proper format for importing into key control software.
 2. Provide transcript list in writing or electronic file as directed by the Owner.
- I. Key Control Cabinet: Provide a key control system including envelopes, labels, and tags with self-locking key clips, receipt forms, 3-way visible card index, temporary markers, permanent markers, and standard metal cabinet. Key control cabinet shall have expansion capacity of 150% of the number of locks required for the project.
1. Manufacturers:
 - a. Lund Equipment (LU).
 - b. MMF Industries (MM).
 - c. Telkee (TK).

2.6 MECHANICAL LOCKS AND LATCHING DEVICES

- A. Mortise Locksets, Grade 1 (Heavy Duty): ANSI/BHMA A156.13, Series 1000, Operational Grade 1 certified. Locksets are to be manufactured with a corrosion resistant steel case and be field-reversible for handing without disassembly of the lock body.

1. Manufacturers:

- a. Corbin Russwin Hardware (RU) – ML2000 Series.
- b. No Substitution.

B. Cylindrical Locksets, Grade 1 (Heavy Duty): ANSI/BHMA A156.2, Series 4000, Grade 1 certified.

- 1. Furnish with solid cast levers, standard 2 3/4" backset, and 1/2" (3/4" at rated paired openings) throw brass or stainless steel latchbolt.
- 2. Locks are to be non-handed and fully field reversible.
- 3. Manufacturers:
 - a. Corbin Russwin Hardware (RU) – CL3300 Series.
 - b. No Substitution.

2.7 ELECTROMECHANICAL LOCKING DEVICES

A. Electromechanical Cylindrical Locksets, Grade 1 (Heavy Duty): Subject to same compliance standards and requirements as mechanical cylindrical locksets, electrified locksets to be of type and design as specified below.

- 1. Electrified Lock Options: Where indicated in the Hardware Sets, provide electrified options including: outside door lock/unlock trim control, latchbolt and lock/unlock status monitoring, and request-to-exit signaling. Unless otherwise indicated, provide electrified locksets standard as fail secure.
- 2. Manufacturers:
 - a. Corbin Russwin Hardware (RU) - CL33900 Series.
 - b. No Substitution.

2.8 LOCK AND LATCH STRIKES

A. Strikes: Provide manufacturer's standard strike with strike box for each latch or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, unless otherwise indicated, and as follows:

- 1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
- 2. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.
- 3. Aluminum-Frame Strike Box: Provide manufacturer's special strike box fabricated for aluminum framing.
- 4. Double-lipped strikes: For locks at double acting doors. Furnish with retractable stop for rescue hardware applications.

B. Standards: Comply with the following:

1. Strikes for Mortise Locks and Latches: BHMA A156.13.
2. Strikes for Bored Locks and Latches: BHMA A156.2.
3. Strikes for Auxiliary Deadlocks: BHMA A156.36.
4. Dustproof Strikes: BHMA A156.16.

2.9 ELECTRIC STRIKES

- A. Standard Electric Strikes: Heavy duty, cylindrical and mortise lock electric strikes conforming to ANSI/BHMA A156.31, Grade 1, UL listed for both Burglary Resistance and for use on fire rated door assemblies. Stainless steel construction tested for a minimum 1 million operating cycles. Provide strikes with 12 or 24 VDC capability and supplied standard as fail-secure unless otherwise specified. Provide latchbolt and latchbolt strike monitoring indicating both the position of the latchbolt and locked condition of the strike where specified.
 1. Manufacturers:
 - a. Folger Adam EDC (FO).
 - b. HES (HS).
- B. Provide electric strikes with in-line power controller and surge suppressor by the same manufacturer as the strike with the combined products having a five year warranty.

2.10 DOOR CLOSERS

- A. All door closers specified herein shall meet or exceed the following criteria:
 1. General: Door closers to be from one manufacturer, matching in design and style, with the same type door preparations and templates regardless of application or spring size. Closers to be non-handed with full sized covers including installation and adjusting information on inside of cover.
 2. Standards: Closers to comply with UL-10C for Positive Pressure Fire Test and be U.L. listed for use of fire rated doors.
 3. Cycle Testing: Provide closers which have surpassed 15 million cycles in a test witnessed and verified by UL.
 4. Size of Units: Comply with manufacturer's written recommendations for sizing of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Where closers are indicated for doors required to be accessible to the physically handicapped, provide units complying with ANSI ICC/A117.1.
 5. Closer Arms: Provide heavy duty, forged steel closer arms unless otherwise indicated in Hardware Sets.
 6. Closers shall not be installed on exterior or corridor side of doors; where possible install closers on door for optimum aesthetics.
 7. Closer Accessories: Provide door closer accessories including custom templates, special mounting brackets, spacers and drop plates as required for proper installation. Provide through-bolt and security type fasteners as specified in the hardware sets.

- B. Door Closers, Surface Mounted (Heavy Duty): ANSI/BHMA A156.4, Grade 1 surface mounted, heavy duty door closers with complete spring power adjustment, sizes 1 thru 6; and fully operational adjustable according to door size, frequency of use, and opening force. Closers to be rack and pinion type, one piece cast iron or aluminum alloy body construction, with adjustable backcheck and separate non-critical valves for closing sweep and latch speed control. Provide non-handed units standard.

1. Manufacturers:
 - a. Norton Door Controls (NO) - 7500 Series.
 - b. No Substitution.

2.11 ARCHITECTURAL TRIM

A. Door Protective Trim

1. General: Door protective trim units to be of type and design as specified below or in the Hardware Sets.
2. Size: Fabricate protection plates (kick, armor, or mop) not more than 2" less than door width (LDW) on stop side of single doors and 1" LDW on stop side of pairs of doors, and not more than 1" less than door width on pull side. Coordinate and provide proper width and height as required where conflicting hardware dictates. Height to be as specified in the Hardware Sets.
3. Where plates are applied to fire rated doors with the top of the plate more than 16" above the bottom of the door, provide plates complying with NFPA 80. Consult manufacturer's catalog and template book for specific requirements for size and applications.
4. Protection Plates: ANSI/BHMA A156.6 certified protection plates (kick, armor, or mop), fabricated from the following:
 - a. Stainless Steel: 300 grade, 050-inch thick.
5. Options and fasteners: Provide manufacturer's designated fastener type as specified in the Hardware Sets. Provide countersunk screw holes.
6. Manufacturers:
 - a. Hiawatha, Inc. (HI).
 - b. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).
 - c. Trimco (TC).

2.12 DOOR STOPS AND HOLDERS

- A. General: Door stops and holders to be of type and design as specified below or in the Hardware Sets.
- B. Door Stops and Bumpers: ANSI/BHMA A156.16, Grade 1 certified door stops and wall bumpers. Provide wall bumpers, either convex or concave types with anchorage as indicated,

unless floor or other types of door stops are specified in Hardware Sets. Do not mount floor stops where they will impede traffic. Where floor or wall bumpers are not appropriate, provide overhead type stops and holders.

1. Manufacturers:

- a. Hiawatha, Inc. (HI).
- b. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).
- c. Trimco (TC).

C. Overhead Door Stops and Holders: ANSI/BHMA A156.6, Grade 1 certified overhead stops and holders to be surface or concealed types as indicated in Hardware Sets. Track, slide, arm and jamb bracket to be constructed of extruded bronze and shock absorber spring of heavy tempered steel. Provide non-handed design with mounting brackets as required for proper operation and function.

1. Manufacturers:

- a. Rixson Door Controls (RF).

2.13 ARCHITECTURAL SEALS

A. General: Thresholds, weatherstripping, and gasket seals to be of type and design as specified below or in the Hardware Sets. Provide continuous weatherstrip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated. At exterior applications provide non-corrosive fasteners and elsewhere where indicated.

B. Smoke Labeled Gasketing: Assemblies complying with NFPA 105 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for smoke control ratings indicated, based on testing according to UL 1784.

1. Provide smoke labeled perimeter gasketing at all smoke labeled openings.

C. Fire Labeled Gasketing: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to UL-10C.

1. Provide intumescent seals as indicated to meet UL10C Standard for Positive Pressure Fire Tests of Door Assemblies, and NPFA 252, Standard Methods of Fire Tests of Door Assemblies.

D. Sound-Rated Gasketing: Assemblies that are listed and labeled by a testing and inspecting agency, for sound ratings indicated.

E. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.

F. Manufacturers:

1. Pemko Products; ASSA ABLOY Architectural Door Accessories (PE).

2.14 ELECTRONIC ACCESSORIES

- A. Energy Efficient Switching Power Supplies: Provide UL listed or recognized filtered and regulated power supplies. Provide single voltage units as shown in the hardware sets. Units must have one access control input and one fire alarm input. Standby power consumption of unit must be less than 10mW at 120VAC. Provide integral battery backup as standard for all units. Provide the least number of units, at the appropriate amperage level, sufficient to exceed the required total draw for the specified electrified hardware and access control equipment.

- 1. Manufacturers:

- a. Securitron (SU) – EPS Series.

2.15 FABRICATION

- A. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to manufacturers recognized installation standards for application intended.

2.16 FINISHES

- A. Standard: Designations used in the Hardware Sets and elsewhere indicate hardware finishes complying with ANSI/BHMA A156.18, including coordination with traditional U.S. finishes indicated by certain manufacturers for their products.
- B. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware
- C. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine scheduled openings, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.
- B. Notify architect of any discrepancies or conflicts between the door schedule, door types, drawings and scheduled hardware. Proceed only after such discrepancies or conflicts have been resolved in writing.

3.2 PREPARATION

- A. Hollow Metal Doors and Frames: Comply with ANSI/DHI A115 series.

- B. Wood Doors: Comply with ANSI/DHI A115-W series.

3.3 INSTALLATION

- A. Install each item of mechanical and electromechanical hardware and access control equipment to comply with manufacturer's written instructions and according to specifications.
 - 1. Installers are to be trained and certified by the manufacturer on the proper installation and adjustment of fire, life safety, and security products including: hanging devices; locking devices; closing devices; and seals.
- B. Mounting Heights: Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with governing regulations:
 - 1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
 - 2. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."
 - 3. Where indicated to comply with accessibility requirements, comply with ANSI A117.1 "Accessibility Guidelines for Buildings and Facilities."
 - 4. Provide blocking in drywall partitions where wall stops or other wall mounted hardware is located.
- C. Retrofitting: Install door hardware to comply with manufacturer's published templates and written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 9 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.
- D. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."
- E. Storage: Provide a secure lock up for hardware delivered to the project but not yet installed. Control the handling and installation of hardware items so that the completion of the work will not be delayed by hardware losses before and after installation.

3.4 FIELD QUALITY CONTROL

- A. Field Inspection (Punch-Out Report): Reference Division 01 Section "Closeout Procedures". Final inspect installed door hardware and state in report whether work complies with or deviates from specification requirements, including whether door hardware is properly installed, operating and adjusted.

3.5 ADJUSTING

- A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

3.6 CLEANING AND PROTECTION

- A. Protect all hardware stored on construction site in a covered and dry place. Protect exposed hardware installed on doors during the construction phase. Install any and all hardware at the latest possible time frame.
- B. Clean adjacent surfaces soiled by door hardware installation.
- C. Clean operating items as necessary to restore proper finish. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of owner occupancy.

3.7 DEMONSTRATION

- A. Instruct Owner's maintenance personnel to adjust, operate, and maintain mechanical and electromechanical door hardware.

3.8 DOOR HARDWARE SETS

- A. The hardware sets represent the design intent and direction of the owner and architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware and missing items should be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.
- B. The supplier is responsible for handing and sizing all products and providing the correct option for the appropriate door type and material where more than one is presented in the hardware sets. Quantities listed are for each pair of doors, or for each single door.
- C. Refer to Section 080671, Door Hardware Sets, for hardware sets.

END OF SECTION 087100

SECTION 08 71 13
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 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following types of automatic door operators:
 - 1. Exterior and interior, automatic door operators, low energy, with visible header mounting.
 - 2. Automatic door operators shall be configured for doors as follows: Single doors.
- B. Related Sections:
 - 1. Division 8 Section "Doors and Frames" for entrances furnished and installed separately in Division 8 Section.
 - 2. Division 8 Section "Aluminum-Framed Entrances and Storefronts" for entrances furnished and installed separately in Division 8 Section.
 - 3. Division 8 Section "Door Hardware" for hardware to the extent not specified in this Section.
 - 4. Division 26 Sections for electrical connections provided separately including conduit and wiring for power to, and control of, automatic door operators.

1.3 REFERENCES

- A. General: Standards listed by reference, including revisions by issuing authority, form a part of this specification section to extent indicated. Standards listed are identified by issuing authority, authority abbreviation, designation number, title or other designation established by issuing authority. Standards subsequently referenced herein are referred to by issuing authority abbreviation and standard designation.
- B. Underwriters Laboratories (UL):
 - 1. UL 325 – Standard for Door, Drapery, Gate, Louver, and Window Operators and Systems.
 - 2. UL 10C – Positive Pressure Fire Tests of Door Assemblies
- C. American National Standards Institute (ANSI)/Builders' Hardware Manufacturers Association (BHMA):
 - 1. ANSI/BHMA A156.10: Standard for Power Operated Pedestrian Doors.
 - 2. ANSI/BHMA A156.19: Standard for Power Assist and Low Energy Power Operated Doors.
- D. American Society for Testing and Materials (ASTM):
 - 1. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
 - 2. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
- E. American Association of Automatic Door Manufacturers (AAADM):
- F. National Fire Protection Association (NFPA):
 - 1. NFPA 101 – Life Safety Code.
 - 2. NFPA 70 – National Electric Code.

- G. International Code Council (ICC):
 - 1. IBC: International Building Code
- H. Building Officials and Code Administrators International (BOCA), 1999:
- I. International Standards Organization (ISO):
 - 1. ISO 9001 - Standard for Manufacturing Quality Management Systems
 - 2. ISO 14025 – Environmental Labels and Declarations -- Type III Environmental Declarations -- Principles and Procedures
 - 3. ISO14040 – Environmental Management -- Life Cycle Assessment -- Principles and Framework
 - 4. ISO 14044 – Environmental Management -- Life Cycle Assessment -- Requirements and Guidelines
 - 5. ISO 21930 – Sustainability in Buildings and Civil Engineering Works -- Core Rules For Environmental Product Declarations Of Construction Products And Services
- J. National Association of Architectural Metal Manufacturers (NAAMM):
 - 1. Metal Finishes Manual for Architectural and Metal Products.
- K. American Architectural Manufacturers Association (AAMA):
 - 1. AAMA 607.1 - Clear Anodic Finishes for Architectural Aluminum.
 - 2. AAMA 611 Voluntary Specification for Anodized Architectural Aluminum.
- L. United Nations Central Product Classification (UNCPC):
 - 1. UNCPC 4212 - Product Category Rules for Preparing an Environmental Product Declaration for Power-Operated Pedestrian Doors and Revolving Doors.

1.4 DEFINITIONS

- A. Activation Device: Device that, when actuated, sends an electrical signal to the door operator to open the door.
- B. Knowing act: Consciously initiating the opening of a power operated door using acceptable methods including wall mounted switches such as push plates and controlled access devices such as keypads, card readers and key switches.
- C. Safety Device: Device that prevents a door from opening or closing, as appropriate.

1.5 PERFORMANCE REQUIREMENTS

- A. General: Provide automatic door operators capable of withstanding loads and thermal movements based on testing manufacturer's standard units in assemblies similar to those indicated for this Project.
- B. Operating Range: Minus 30 deg F (Minus 34 deg C) to 130 deg F (54 deg C).
- C. Opening-Force Requirements for Egress Doors: In the event power failure to the operator, swinging automatic entrance doors shall open with a manual force, not to exceed 30 lbf (133 N) to set door in motion, and not more than 15 lbf to fully open the door. Forces shall be applied at 1" (25 mm) from the latch edge of the door.

1.6 SUBMITTALS

- A. General: Submit listed submittals in accordance with Conditions of the Contract and Division 01 submittal procedures.
- B. Shop Drawings: Include plans, elevations, sections, details, hardware mounting heights, and attachments to other work. Indicate wiring for electrical supply.
- C. Color Samples for selection of factory-applied color finishes.
- D. Closeout Submittals: Provide the following with project close-out documents.
 - 1. Owner's Manual.
 - 2. Warranties.
- E. Reports: Based on evaluation performed by a qualified agency, for automatic door operators.
 - 1. Environmental Product Declaration.
 - 2. Evaluation Report for compliance with IBC.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representative, with certificate issued by AAADM, who is trained for installation and maintenance of units required for this Project.
- B. Manufacturer Qualifications: A qualified manufacturer with a manufacturing facility certified under ISO 9001.
- C. Manufacturer shall have in place a national service dispatch center providing 24 hours a day, 7 days a week, emergency call back service.
- D. Certifications: Automatic door operators shall be certified by the manufacturer to meet performance design criteria in accordance with the following standards:
 - 1. ANSI/BHMA A156.10 and A156.19.
 - 2. NFPA 101.
 - 3. UL 325 Listed.
 - 4. UL 10C Listed.
 - 5. IBC 2012
 - 6. BOCA
- E. Environmental Product Declaration (EPD): EPD for automatic door operators shall be certified by the manufacturer to comply with the following:
 - 1. Prepared under Product Category Rule (PCR) UNCPC 4212.
 - 2. Conform to ISO standards 14025, 14040, 14044, 21930
 - 3. Life Cycle Assessment Basis: Cradle to Gate, minimum.
- F. Source Limitations: Obtain automatic door operators through one source from a single manufacturer.
- G. Product Options: Drawings indicate sizes, profiles, and dimensional requirements of swinging doors equipped with automatic door operators and are based on the specific system indicated. 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.
- H. Power Operated Door Standard: ANSI/BHMA A156.19.

- I. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- J. Emergency-Exit Door Requirements: Comply with requirements of authorities having jurisdiction for swinging automatic entrance doors serving as a required means of egress.

1.8 PROJECT CONDITIONS

- A. Field Measurements: General Contractor shall verify openings to receive automatic door operators by field measurements before fabrication and indicate measurements on Shop Drawings.
- B. Mounting Surfaces: General Contractor shall verify all surfaces to be plumb, straight and secure; substrates to be of proper dimension and material.
- C. Other trades: General Contractor Advise of any inadequate conditions or equipment.

1.9 COORDINATION

- A. Templates: 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. Electrical System Roughing-in: Coordinate layout and installation of automatic door operators with connections to, power supplies, remote activation devices, and electric door latching hardware.
- C. System Integration: Integrate automatic door operators with other systems as required for a complete working installation. Where required for proper operation, provide a time delay function to signal automatic door operator to activate only after electric lock system is released.

1.10 WARRANTY

- A. Automatic door operators shall be free of defects in material and workmanship for a period of one (1) year from the date of substantial completion.
- B. During the warranty period the Owner shall engage a factory-trained technician to perform service and affect repairs. A safety inspection shall be performed after each adjustment or repair and a completed inspection form shall be submitted to the Owner.
- C. During the warranty period all warranty work, including but not limited to emergency service, shall be performed during normal working hours.

PART 2 - PRODUCTS

2.1 AUTOMATIC DOOR OPERATORS

- A. Manufacturer: Stanley Access Technologies; M-Force™ Series automatic door operator.
 - 1. Contact: Stanley Access Technologies, 52 2nd Street, Beach Lake PA 18405; Attn: Aaron LeClere; Phone: 518-618-1999, Fax: 866-537-5171, Email: aaron.leclere@sbdinc.com.
- B. Substitutions: See Division 1, Section 01 25 00 Substitution Procedures.

2.2 MATERIALS

- A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
 - 1. Headers: 6063-T6.
 - 2. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221.
 - 3. Sheet and Plate: ASTM B 209.

2.3 COMPONENTS

- A. Header Case: Header case shall not exceed 6" (152 mm) square in section and shall be fabricated from extruded aluminum with structurally integrated end caps, designed to conceal door operators and controls. The operator shall be sealed against dust, dirt, and corrosion within the header case. Access to the operator and electronic control box shall be provided by a full-length removable cover, edge rabbetted to the header to ensure a flush fit. Removable cover shall be secured to prevent unauthorized access.
- B. Door Arms: A combination of door arms and linkage shall provide positive control of door through entire swing; units shall permit use of butt hung, center pivot, and offset pivot-hung doors.
- C. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, non-staining, non-bleeding fasteners and accessories compatible with adjacent materials.
- D. Signage: Provide signage in accordance with ANSI/BHMA A156.19.

2.4 SWINGING DOOR OPERATORS

- A. General: Provide door 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 type of occupancy indicated.
- B. Electromechanical Operators: Self-contained unit powered by a minimum 3/16 horsepower, permanent-magnet DC motor; through a high torque reduction gear system.
 - 1. Operation: Power opening and spring closing.
 - 2. Operator Type: Low energy; readily convertible to full energy; no tools required to change type.
 - 3. Handing: Non-handed; no tools required to change handing.
 - 4. Capacity: Rated for door panels weighing up to 700 lb (318 kg).
 - 5. Mounting: Visible
 - 6. Features:
 - a. Adjustable opening and closing speeds.
 - b. Adjustable opening and closing force.
 - c. Adjustable back-check.
 - d. Adjustable hold-open time between 0 and 30 seconds.
 - e. Reverse on obstruction.
 - a. Time delay for electric lock integration.
 - b. Force compensation and closed loop speed control with active braking and acceleration.
 - c. Power Close.
 - d. Slam Protection.
 - e. Power Assist.
 - f. Lock Release.
 - g. Stall Sensor Ignore.
 - h. Electronic Coordination.
 - i. Optional Switch to open/Switch to close operation.
 - j. Optional push to activate operation.

- k. Fire alarm interface, configurable to safely open or close doors on signal from fire alarm system.
- C. Field Adjustable Spring Closing Operation: The operator shall close the door by spring energy employing the motor, as a dynamic brake to provide closing speed control. The closing spring shall be a helical compression spring or clock spring, adjustable for positive closing action. The spring shall be adjustable, without removing the operator from the header, to accommodate a wide range of field conditions.
- D. Independent Adjustable Closing and Latching Speed Control: The operator shall employ a rheostat module to allow for independent field adjustment of closing and latching speeds using the motor as a dynamic brake.
- E. Field Adjustable Open Stop: The operator shall provide a field adjustable open stop to accommodate opening angles from 80 to 135 degrees without the need for additional components.
- F. Consistent Cycle: The operator shall deliver an even, consistent open manual push force across the entire transition from door fully closed to door fully open. Additionally, the force shall be field adjustable to accommodate a wide range of on-site conditions.
- G. Quiet Performance: The operator shall be designed to output audible noise ratios less than or equal to 50dba.
- H. Manual Use: The operator shall function as a manual door closer in the direction of swing with or without electrical power. The operator shall deliver an even, consistent open force across the entire transition from door fully closed to door fully open.
- I. Electrical service to door operators shall be provided under Division 26 Electrical. Minimum service to be 120 VAC, 5 amps.

2.5 ELECTRICAL CONTROLS

- A. Electrical Control System: Electrical control system shall include a microprocessor controller and a high-resolution position encoder. The encoder shall monitor revolutions of the operator shaft and send signals to microprocessor controller to define door position and speed.
 - 1. The high-resolution encoder shall have a resolution of not less than 1024 counts per revolution. Systems utilizing external magnets and magnetic switches are not acceptable.
 - 2. Electrical control system shall include a 24 VDC auxiliary output rated at 1 amp.
- B. Performance Data: The microprocessor shall collect, and store performance data as follows:
 - 1. Counter: A non-resettable counter to track operating cycles.
 - 2. Event Reporting: Unit shall include non-volatile event and error recording including number of occurrences of events and errors, and cycle count of most recent events and errors.
 - 3. LED Display: Display presenting the current operating state of the controller.
- C. Controller Protection: The microprocessor controller shall incorporate the following features to ensure trouble free operation:
 - 1. Automatic Reset Upon Power Up.
 - 2. Main Fuse Protection.
 - 3. Electronic Surge Protection.
 - 4. Internal Power Supply Protection.
 - 5. Resettable sensor supply fuse protection.
 - 6. Motor Protection, over-current protection.

- D. Power Close: When enabled, engages the operator to close a door that does not close completely at the end of a cycle.
- E. Force Compensation: Utilizing the closed loop speed control, the operator shall maintain constant opening and closing speeds when subjected to excessive outside forces, such as positive or negative stack pressures.
- F. Slam Protection: The operators speed control system prevents door from slamming at the full open or full closed position.
- G. Power Assist: Operator mode that lowers opening forces when the door is used manually. Power assist is active only while pushing or pulling the door. The door will close when an opening force is no longer applied.
- H. Lock Release: On doors with electric locking, operator shall include a closing function to release tension on a latch mechanism prior to opening the door.
- I. Stall Sensor Ignore: Adjustable setting to disable swing side safety sensors at a specific angle.
- J. Electronic Coordination: On pairs of doors, allows independent timing of opening and closing of each leaf as required for astragal coordination.
- K. Soft Start/Stop: A “soft-start” “soft-stop” motor driving circuit shall be provided for smooth normal opening and recycling.
- L. Obstruction Recycle: Provide system to recycle the swinging panels when an obstruction is encountered during the closing cycle.
- M. Programmable Controller: Microprocessor controller shall be field programmable.
 - 1. The following parameters may be adjusted:
 - a. Operating speeds and forces as required to meet specified ANSI/BHMA standard.
 - b. Adjustable and variable features specified.
 - 2. Manual programming shall be available through local interface which has a two-digit display with a selection control including three push buttons.
- N. Emergency Breakout Switch: A cam actuated emergency breakout switch shall be provided to disconnect power to the motor when an in-swinging door is manually pushed in the emergency out direction. The operator will then automatically reset, and power will be resumed.
- O. Control Switch: Automatic door operators shall be equipped with a three-position function switch to control the operation of the door. Control switch shall provide three modes of operation, Automatic, Off, and Hold-Open.
- P. Power Switch: Automatic door operators shall be equipped with a two position On/Off switch to control power to the door.

2.6 ACTIVATION AND SAFETY DEVICES

- A. Push Plates: Provide 4 ½ inch (114 mm) square push plates with UL recognized SPDT switch. Face plates and mounting studs shall be stainless steel. Face plates shall be engraved with the international symbol for accessibility and “Push To Open”. Push plates shall be wall mounted in single or double gang electrical boxes and hardwired to door operator controls.
- B. Presence Detection: Provide presence detection system designed to sense people in the swing zone when the swinging automatic entrance door is fully open, fully closed or in motion. System

provided shall consist of door mounted safety sensors and accessories required for a complete working system as follows:

1. Door Mounted Presence Detection Sensors: Door mounted presence detection sensors shall be reflective active infrared type designed specifically to sense moving or stationary objects in the swing zone on each side of a moving door leaf. Sensor housings shall be high impact shock resistant with tinted lenses suitable for door mounting. Door mounted presence detection sensors shall not be affected by ultrasonic, ambient light or radio frequencies, within the vicinity of the swing door.
2. Secondary Activation: Presence detection system shall satisfy the requirements for secondary activation; no additional sensors shall be required.
3. Supporting relays and controllers shall be provided for a complete working system.
4. Door mounted presence detection sensors shall be equal to or better than Stanley Access Technologies Swing-Guard.

2.7 ALUMINUM FINISHES

- A. General: Comply with NAAMM Metal Finishes Manual for Architectural and Metal Products for recommendations for applying and designing finishes. Finish designations prefixed by AA comply with system established by Aluminum Association for designing finishes.
- B. Class II, Clear Anodic Finish: AA-M12C22A31 Mechanical Finish: as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class II, clear coating 0.40 mils minimum complying with AAMA 611-98, and the following:
 1. AAMA 607.1
 2. Applicator must be fully compliant with all applicable environmental regulations and permits, including wastewater and heavy metal discharge.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances, header support, and other conditions affecting performance of swinging automatic entrance doors. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Do not install damaged components. Fit joints to produce hairline joints free of burrs and distortion. Rigidly secure non-movement joints.
- B. Mounting: Install automatic door operators/headers plumb and true in alignment with established lines and grades. Anchor securely in place.
 1. Install surface-mounted hardware using concealed fasteners to greatest extent possible.
 2. Set headers, arms and linkages level and true to location with anchorage for permanent support.
- C. Door Operators: Connect door operators to electrical power distribution system as specified in Division 26 Sections.

3.3 FIELD QUALITY CONTROL

- A. Testing Services: Factory Trained Installer shall test and inspect each swinging automatic entrance door to determine compliance of installed systems with applicable ANSI standards.

3.4 ADJUSTING

- A. Adjust door operators, controls, and hardware for smooth and safe operation, for tight closure, and complying with requirements in ANSI/BHMA A156.19 by AAADM Certified Technician.

3.5 CLEANING AND PROTECTION

- A. Clean surfaces promptly after installation. Remove excess sealant compounds, dirt, and other substances. Repair damaged finish to match original finish.

END OF SECTION 08 71 13

SECTION 08 80 00 – GLAZING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Glass.
- B. Glazing compounds and accessories.

1.2 RELATED REQUIREMENTS

- A. Section 08 11 00 – Metal Doors and Frames: Glazed lites in doors.
- B. Section 08 43 13 – Aluminum Framed Storefronts.

1.3 REFERENCE STANDARDS

- A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials; current edition.
- B. ASTM C864 - Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers; 2005 (Reapproved 2011).
- C. ASTM C1036 - Standard Specification for Flat Glass; 2011e1.
- D. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2012.
- E. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2013.
- F. GANA (SM) - GANA Sealant Manual; Glass Association of North America; 2008.

1.4 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data on Glass Types: Provide structural, physical and environmental characteristics, size limitations, and special handling or installation requirements.

PART 2 PRODUCTS

2.1 GLAZING TYPES

- A. Interior Single Vision Glazing:
 - 1. Application: All interior glazing unless otherwise indicated.
 - 2. Type: Laminated Safety Glass
 - 3. Tint: Clear.
 - 4. Thickness: 3/8 inch or 10.38mm Standard Nominal Thickness.
 - 5. Field apply film where indicated. Coordinate final selection with Architect.
- B. Fire-Rated Safety Glazing:
 - 1. Application: Provide this type of glazing Glazed lites in fire doors.
 - 2. Fire Rating: Firelite Plus.
 - 3. Type: Fire-Rated, Safety Glass Ceramic Panels
 - 4. Thickness: 1/4 inch
 - 5. Manufacture to print UL listing on all rated glass to be used in fire-rated assemblies.
- C. Single Safety Glazing: Non-fire-rated:
 - 1. Application: Provide this type of glazing in the following locations:
 - a. Glazed lites in doors, except fire doors.

- b. Glazed sidelights to doors, except in fire-rated walls and partitions.
- 2. Type: Fully tempered float glass as specified.
- 3. Tint: Clear.
- 4. Thickness: 1/4 inch
- D. Sealed Insulating Exterior Glass Units: Vision glazing.
 - 1. Application: All exterior glazing unless otherwise indicated.
 - 2. Outboard Lite: Annealed float glass, 1/4 inch thick, minimum.
 - a. Tint: As Selected by Architect
 - b. Coating: Self-cleaning type, on #1 surface.
 - c. Coating: Low-E (passive type), on #2 surface.
 - 3. Inboard Lite: Annealed float glass, 1/4 inch thick, minimum.
 - a. Tint: Clear.
 - b. Coating: Low-E (passive type), on #3 surface.
 - 4. Total Thickness: 1 inch.
 - 5. Total Visible Light Transmittance: 42% percent, nominal.
 - 6. Total Solar Heat Gain Coefficient: 0.28 percent, nominal.
 - 7. Total U-Value: .29 percent, nominal.
 - 8. Glazing Method: Gasket glazing.
 - 9. Basis of Design: PPG Industries, Inc: www.ppgideascape.com. Product: Solarban 60 (2) Solarbronze + Clear Glass Insulating Glass Unit

E. GLASS MATERIALS

- 1. Float Glass: Provide float glass glazing unless otherwise indicated.
 - a. Annealed Type: ASTM C1036, Type I, transparent flat, Class 1 clear, Quality Q3 (glazing select).
 - b. Heat-Strengthened and Fully Tempered Types: ASTM C1048
 - c. Tinted Types: Color and performance characteristics as indicated on drawings.
 - d. Thicknesses: As indicated; for exterior glazing comply with specified requirements for wind load design regardless of specified thickness.
- 2. Firelite.
- 3. Insulated Units.

2.3 GLAZING ACCESSORIES

- A. Setting Blocks: Neoprene, 80 to 90 Shore A durometer hardness; ASTM C864 Option II. Length of 0.1 inch for each square foot of glazing or minimum 4 inch x width of glazing rabbet space minus 1/16 inch x height to suit glazing method and pane weight and area.
- B. Spacer Shims: Neoprene, 50 to 60 Shore A durometer hardness; ASTM C864 Option II. Minimum 3 inch long x one half the height of the glazing stop x thickness to suit applications, self-adhesive on one face.
- C. Glazing Tape, Back Bedding Mastic Type: Preformed, butyl-based, 100 percent solids compound with integral resilient spacer rod applicable to application indicated; hardness range of 5 to 30 cured Shore A durometer, coiled on release paper; black color.
- D. Glazing Tape: Closed cell polyvinyl chloride foam, coiled on release paper over adhesive on two sides, maximum water absorption by volume of 2 percent, designed for compression of 25 percent to effect an air barrier and vapor retarder seat; x ___ inch size.

- E. Glazing Clips: Manufacture's standard type

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that openings for glazing are correctly sized and within tolerance.
- B. Verify that surfaces of glazing channels or recesses are clean, free of obstructions that may impede moisture movement, weeps are clear, and ready to receive glazing.

3.2 PREPARATION

- A. Clean contact surfaces with solvent and wipe dry.
- B. Seal porous glazing channels or recesses with substrate compatible primer or sealer.
- C. Prime surfaces scheduled to receive sealant.
- D. Install sealants in accordance with ASTM C1193 and GA NA Sealant Manual.
- E. Install sealants in accordance with manufacturer's instructions.

3.3 GLAZING METHODS

3.4 INSTALLATION – INTERIOR DRY METHOD (TAPE AND TAPE)

- A. Cut glazing tape to length and set against permanent stops, projecting 1/16 inch above sight line.
- B. Place setting blocks at ¼ pints with edge block no more than 6 inches from corners.
- C. Rest glazing on settling blocks and push against tape for full contact at perimeter of pane or unit.
- D. Place glazing tape on free perimeter of glazing in same manner described above.
- E. Install removable stop without displacement of tape Exert pressure on tape for full continuous contact.
- F. Knife trim protruding tape.

3.5 CLEANING

- A. Remove glazing materials from finish surfaces.
- B. Remove labels after Work is complete.
- C. Clean glass and adjacent surfaces.

END OF SECTION 08 80 00

SECTION 09 05 61
COMMON WORK RESULTS FOR FLOORING PREPARATION

PART 1 GENERAL

1.1 QUALITY ASSURANCE

- A. Moisture and pH testing shall be performed by an independent testing agency employed and paid by Contractor.

PART 2 EXECUTION

2.2 PREPARATION

- A. Perform following operations in order indicated:
1. Existing concrete slabs (on-grade and elevated) with existing floor coverings:
 - a. Visual observation of existing floor covering, for adhesion, water damage, alkaline deposits, and other defects.
 - b. Removal of existing floor covering.
 2. Existing concrete slabs with coatings or penetrating sealers/hardeners/dustproofers:
 - a. Do not attempt to remove coating or penetrating material.
 - b. Do not abrade surface.
 3. Primary Cleaning.
 4. Moisture vapor emission tests; 3 tests in the first 1000 square feet and one test in each additional 1000 square feet, unless otherwise indicated or required by flooring manufacturer.
 5. Internal relative humidity tests; in same locations as moisture vapor emission tests, unless otherwise indicated.
 6. pH test; in same locations as moisture vapor emission tests, unless otherwise indicated.
 7. Specified remediation, if required.
 8. Patching, smoothing, and leveling, as required.
 9. Other preparation specified.
 10. Adhesive bond and compatibility test.
 11. Protection.
- B. Remediations:
1. Active Water Leaks or Continuing Moisture Migration to Surface of Slab: Correct this condition before doing any other remediation; re-test after correction.
 2. Excessive Moisture Emission or Relative Humidity: If an adhesive that is resistant to the adhesive for installation of the flooring; if not, apply remedial floor coating over entire suspect floor area.
 3. Excessive pH: If remedial floor coating is necessary to address excessive moisture, no additional remediation is required; if not, if an adhesive that is resistant to level present is available and acceptable to the flooring manufacturer, use that adhesive for installation of the flooring; otherwise, apply a skim coat of specified patching compound over entire suspect floor area.

END OF SECTION 09 05 61

SECTION 09 05 62 – REMEDIAL FLOOR COATING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A.** Drawings, general provisions of the Contract, and other related construction documents such as Division 01 specifications apply to this Section.

1.2 REFERENCE STANDARDS

- A.** ASTM F2170, Relative Humidity in Concrete Floor Slabs Using in situ Probe
- B.** ASTM F710, Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring.

1.3 DELIVERY, STORAGE, AND HANDLING

- A.** Store products in manufacturer's unopened packaging until ready for installation.
- B.** Keep dry and protect from direct sun exposure, with temperatures maintained between 50° and 85° F.

PART 2 PRODUCTS

2.1 MATERIALS

- A.** Self-Drying, Cement Based Finish Underlayment
 - 1. Ardex Feather Finish XF by ARDEX Engineered Cements
 - 2. Primer as recommended by ARDEX.
 - 3. Substitutions: See Section 01 6000 - Product Requirements.

PART 3 EXECUTION

3.1 EXAMINATION

- A.** Verify that substrate surfaces are clean, dry, unfrozen, do not contain petroleum byproducts, or other compounds detrimental to underlayment material bond to substrate. Do not proceed with installation until unsatisfactory conditions are corrected.

3.2 PREPARATION

- A.** Concrete: Mechanically prepare steel troweled concrete to create a textured surface necessary to achieve the best bond; acceptable methods include bead blasting and scarifying. Do not use acid etching.
- B.** Prior to proceeding please refer to ASTM F710 Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring. All concrete subfloors must be sound, solid, clean, and free of all oil, grease, dirt, curing compounds and any substance that might act as a bond breaker before priming. Mechanically clean if necessary using shot blasting or other. Acid etching and the use of sweeping compounds and solvents are not acceptable.

- C. Substrates shall be inspected in accordance with ASTM F2170 and corrected for moisture or any other conditions that could affect the performance of the underlayment or the finished floor covering. For areas where moisture vapor emissions exceed the required limits refer to Section 09 05 61.13, Moisture Vapor Emission Control and install the appropriate ARDEX Moisture Control System.
- D. Remove substrate surface irregularities. Fill voids and deck joints with filler. Honor all moving joints and moving cracks through the installation. Finish smooth.
- E. Vacuum clean surfaces.
- F. Prime substrate in accordance with manufacturer's instructions. Allow to dry.
- G. Close floor openings.
- H. If there are any stair risers where leveling is required, coordinate final requirements with Architect so stair design criteria is maintained.
- G. If there is a floor drain present in the room, ensure water runs to the floor drain from all location in room. Review details with Architect.

3.3 APPLICATION

- A. Install underlayment in accordance with manufacturer's instructions for priming, mixing and application.
- B. Place to required thickness, with top surface level to 1/8 inch in 10 ft.
- C. For final thickness over 1-1/2 inches, place underlayment in layers. Allow initial layer to harden to the point where the material has lost its evaporative moisture. Immediately prime and begin application of the subsequent layer within 24 hours.
- D. If a fine, feathered edge is desired, steel trowel the edge after initial set, but before it is completely hard.

3.4 CURING

- A. Once underlayment starts to set, prohibit foot traffic until final set has been reached.
- B. Air cure in accordance with manufacturer's instructions.

3.5 PROTECTION

- A. Protect against direct sunlight, heat, and wind; prevent rapid drying to avoid shrinkage and cracking.
- B. Do not permit traffic over unprotected floor underlayment surfaces.

END OF SECTION 09 05 62

SECTION 09 20 00 – PLASTER AND GYPSUM BOARD

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

- A. General Contract Provisions and Sections of Division 1 apply to Work of this Section.

1.02 WORK SUMMARY:

- A. Work of this Section includes all required gypsum drywall partitions, shaft walls including duct shafts, chase partitions, ceilings, soffits including exterior soffits, furring, etc., including all required studs, boards, support systems, braces, accessories and finishing.
- B. Included are sound rated partitions and walls and sealing and soundproofing of all penetrations through these partitions and walls. Refer to the Contract Drawings for locations and types.

1.03 RELATED WORK SPECIFIED ELSEWHERE:

- A. Section 08 12 00: Furnishing jamb anchors for anchoring metal door frames to metal stud partitions.
- B. Section 09 53 00: Hangers and carrying channels for suspended gypsum board ceilings.
- C. Section 09 90 00: Painting and Coating.
- D. Section 10 44 16: Fire Extinguishers.

1.04 QUALITY ASSURANCE:

- A. Fire-Resistance Ratings: Comply with fire-resistance ratings as indicated and as required by governing authorities and codes. Provide materials, accessories and application procedures which have been listed by UL or tested in accordance with ASTM E119 for the type of construction shown.
- B. Acoustical Ratings: Comply with (STC) Acoustical ratings as required and based on types of construction as indicated on the Drawings. Provide materials, accessories, including fasteners, seals, resilient channels (if any), sealants and application procedures which have been listed by manufacturer or tested in accordance with ASTM E90 for the type of construction shown.
- C. Industry Standard: Comply with applicable requirements of GA-216 "Application and finishing of Gypsum Board" by the Gypsum Association, except where more detailed or more stringent requirements are indicated, including the recommendations of the manufacturer.
- D. Gypsum board materials and accessories shall comply with all local and state building codes. Gypsum board materials and system shall be by one of the following. Materials from more than one (1) manufacturer may not be used in a system or assembly:

1. Georgia-Pacific Corp.
 2. National Gypsum Co.
 3. U.S. Gypsum Co.
- E. Tolerances: Do not exceed a variation of 3/16" in 8'0", and 1/8" in 5'0" from plumb, level and flat (all directions); and do not exceed 1/16" offset of planes at joints between panels. Shim panels as necessary to comply with tolerances.
- F. Reference Standards:
1. United States Gypsum Folders SA805, SA922, SA923 and SA927 as applicable and related to Drywall System Constructions shall be followed for all work unless otherwise required.

1.05 SUBMITTALS:

- A. Manufacturer's Data: Submit Manufacturer's specifications and installation instructions for each type of gypsum wallboard system component, including other data as may be required to show compliance with the Specifications.

1.06 PRODUCT HANDLING:

- A. Coordinate delivery with installation to minimize storage periods at the Job Site. Deliver in manufacturer's unopened containers, bundles, or packages, fully identified with manufacturer's name, brand, type and grade. Protect from weather, soiling and damage, using handling equipment and storage techniques recommended by manufacturer.

1.07 JOB CONDITIONS:

- A. Examine the spaces in which, and the substrates to which, gypsum wallboard systems are to be applied and the conditions under which systems are to be installed. Remedy any conditions detrimental to the proper and timely completion of the Work. Do not proceed with installation until unsatisfactory conditions have been corrected in a manner acceptable to the Installer.
- B. Temperature and Humidity Conditions: Do not install joint treatment compounds unless installation areas comply with the minimum temperature and ventilation requirements recommended by manufacturer.

PART 2 - PRODUCTS

2.01 GYPSUM BOARD PRODUCTS:

- A. Exposed Gypsum Board: Comply with ASTM C36 for exposed gypsum board, hereby defined to include work indicated for painting finish and similar forms of decoration, as well as unfinished work.
 - 1. Type X: Provide Type X where indicated and where required to achieve indicated fire-resistance ratings.
 - 2. Water-Resistant Type: Comply with ASTM C 630. Provide standard taper long edge profile where indicated to receive paint or epoxy finish. Do not use for ceiling work. Use water-resistant type for all wet areas and as required by Drawings.
 - 3. Thickness: 5/8".
 - 4. Sheet Size: 4' wide x maximum length available (8'0" minimum) which shall minimize number of end joints in work.
 - 5. Long-Edge Profile: Standard taper.

2.02 CEILING SUPPORT MATERIALS:

- A. Furring Members: Screw type, hat shaped furring channels of 25-gauge zinc-coated steel; comply with ASTM C645.
- B. Soffit and Fascia Framing Members: Screw type "Cee" shaped studs of the depth indicated, of 25-gauge zinc-coated steel; comply with ASTM C645.
- C. Furring Anchorages: 16-gauge galvanized wire ties, manufacturer's standard wire type clips, bolts, or screws are recommended by manufacturer and complying with ANSI A42.4.

2.03 WALL/PARTITION SUPPORT MATERIALS:

- A. Studs: Screw type 20-gauge zinc coated "Cee" shaped steel studs; comply with ASTM C645.
 - 1. Depth of Section: 1-5/8", 2-1/2", 3-5/8", and 6" (See Drawings for locations.)
 - 2. Runners: Match studs; type recommended by stud manufacturer for floor and ceiling support of studs, and for vertical abutment of drywall work at other work.
 - 3. Stiffeners: 3/4" cold-rolled steel channels at 0.3 pounds per foot, rust inhibitive paint finish.

4. Stud system Accessories: Provide stud manufacturer's standard clip, shoes, ties, reinforcements, fasteners and other accessories as needed for a complete stud system.
- B. Furring Members: Screw type, hat shaped, furring channels, of 25-gauge zinc-coated steel; comply with ASTM C645. Where furring is applied vertically, provide special shaped units at external corners.
 1. Fasteners: Type and size recommended by manufacturer for the substrate and application indicated.
- C. Shaft wall framing members shall be 20-gauge zinc coated members of types required by Drawings and as necessary to satisfy design conditions and performance criteria.

2.04 TRIM ACCESSORIES:

- A. General: Provide manufacturer's standard metal trim accessories, of beaded type with face flanges for concealment in joint compound, except where semi-finishing or exposed type is indicated.
 1. Provide corner beads at external corners.
 2. Provide edge trim of shape indicated where edges of gypsum board would otherwise be exposed or semi-exposed; L-type for tight abutment at edges, otherwise U-type, except special kerfed type where kerf is provided in adjoining work.
 3. Provide resilient slip-on type PVC Edge trim (semi-finishing) where indicated and for juncture of walls and partitions with ceiling.
 4. Provide control joint units, of either metal or PVC, where control joints are indicated, or if not indicated, at door frames spaced as recommended by manufacturer. Control joints shall be provided in gypsum board ceilings and soffits not more than 30'0" o.c. in each direction or as recommended by System Manufacturer.
 5. Provide special J-type (semi-finishing) zinc-alloy edge trim at exposed edges of exterior gypsum board which are not concealed by applied moldings.

2.05 MISCELLANEOUS MATERIALS:

- A. Laminated Adhesive: Type and grade of adhesive or compound as recommended by manufacturer, for laminating boards in applications as indicated.
- B. Gypsum Board Fasteners: Comply with GA216, and with gypsum board manufacturer's recommendations.
- C. Water-Resistant Sealant: Type recommended by gypsum board manufacturer for sealing cut edges and holes in water-resistant gypsum board.

- D. Acoustical Sealant: Non-shrinking, non-migrating, non-staining sealant of either non-drying or permanently elastic type, as recommended by the gypsum board manufacturer. Where exposed to view, provide paintable type acoustical sealant, either latex or acrylic based type, or acrylic-latex type.
- E. Sound Attenuation Blankets: Semi-rigid (friction-fit) spun mineral fiber blanket without membrane covering, min. 2" thick; flame-spread; smoke and fuel rating of less than 25 (UL-723), FS HH-I-521, Type I; type recommended by manufacturer for maximum sound attenuation; minimum 2" thick.
- F. Joint Treatment Materials:
 - 1. Joint Tapes: Plain or perforated complying with ASTM C475.
 - 2. Joint Compound: Adhesive with or without fillers complying with ASTM C475. Provide in dry powder form or premixed form ready for application.

PART 3 - EXECUTION

3.01 INSTALLATION AND WORKMANSHIP:

- A. Installation of gypsum board materials and accessories shall comply with all Local and State Building Codes, and as specified herein.
- B. Installation of Framing: Install metal framing for all assemblies and accessories in accordance with design requirements or manufacturer's printed instructions, and applicable Code requirements.
- C. Ceiling Grillage: Erect metal furring channels at right angles to 1-1/2" main carrying channels or main support members. Space furring 16" o.c. and within 6" of walls. Provide 1" clearance between furring ends and abutting walls and partitions. Secure furring to carrying channels with clips or saddle-tie to supports with double strand 16-gauge tie wire. At splices, nest furring channels at least 8" and securely wire-tie each end with double strand 18-gauge tie wire. At light troffers or any openings that interrupt the furring channels, install additional cross-reinforcing to restore lateral stability of grillage.
- D. Drywall Soffit Erection:
 - 1. Attach steel runners 24" o.c. to concrete slabs with concrete stub nails or power-driven anchors; to steel decks with power driven fasteners; to suspended ceilings with toggle bolts or molly bolts. On stud walls, space fasteners to engage each stud. On ceilings, place fasteners close to outside face runner. Fasten vertical face panel to web of face corner runner and flange of ceiling runner with 1" screws spaced 12" o.c. for braced furring, insert steel studs between face corner runner and sidewall runner and attach alternate studs to runners with fasteners tool. Attach bottom face panel to steel studs and runners with 1" screws space 12" o.c. space screws in face corner runner at least 1" from edge of gypsum panel.

E. Partitions:

1. Isolation of Partitions: Where partitions abut ceiling or deck construction or vertical structural elements, provide slip or cushion type joint between metal framing and structure as recommended by manufacturer to prevent transfer of structural loads or movements to partitions, except as otherwise indicated.
2. Height of Partitions: Terminate top of wallboard partitions at structural deck, unless otherwise shown.
3. Floor and Ceiling Runner Tracks: Align and secure runner tracks to both floor and ceiling.
4. Studs: Use full-length studs between runner tracks. Friction-fit studs to runner tracks by positioning and rotating into place. Provide positive attachment to runner tracks for studs, particularly studs located at partition corners and intersections, and adjacent to openings. Use screws at jamb ceiling for hollow metal frames.
 - a. Stud Spacing: As shown on the Drawings. Do not exceed 16" o.c. Studs behind wall cabinets shall be 12" o.c.
 - b. Provide additional studs to inside corners at partitions intersections and corners, and to support outside corners, terminations of partitions and both sides of control joints.
 - c. Provide rough framing at opening consisting of full-length studs adjacent to jambs, and horizontal header and sill tracks.
 - d. Provide vertical control joints at all corners of any opening or archway. At vertical control joints provide additional intermediate studs, not less than 1/2" from jamb studs. Do not fasten such additional studs to tracks or jamb studs.
 - e. At door frames, comply with stud manufacturer's recommendations for the type of frames and weights of doors used in the project, except as otherwise indicated. Fasten jamb studs to metal frames as shown.
 - f. At all doors, provide two (2), 20-gauge studs at each jamb and provide one (1) additional vertical stiffener screw fastened onto each pair of jamb studs. One (1) additional stud shall be provided 6" from double studs and door openings.
 - g. Where required to support wall mounted items such as casework, cabinets, shelving standards, toilet accessories, fold down tables and other wall attached equipment, mirrors, etc., provide minimum 18 ga. 6" by length as required galvanized steel wall mounting plates for support of items. Secure plate to steel studs. Coordinate locations with installing trades involved.

F. Chase Wall Erection:

1. Align two parallel rows of floor and ceiling runners spaced apart as detailed. Attach to concrete floor slabs with concrete stub nails or power-driven anchors 24" o.c. and to suspended ceiling with toggle or molly bolts 16" o.c.
2. Position steel studs vertically in runners, 16" o.c. with flanges in the same direction, and with studs on opposite sides of chase directly across from each other. Anchor all studs to floor and ceiling runner flanges with fastener tool.
3. Cut cross bracing to be placed between rows of studs from gypsum panels, 12" high by chase wall width. Space braces 48" o.c. vertically and attach to stud webs with six 1" screws per brace. If larger braces are used, space screws 8" o.c. max. on each side.
4. Bracing of 2-1/2" steel studs may be used in place of gypsum panels. Anchor web at each end of steel brace to a stud web with two 3/8" pan head screws. When chase wall studs are not opposite, install steel stud cross brace 24" o.c. horizontally and securely anchor each end to a continuous horizontal 2-1/2" runner screw-attached to chase wall studs within the cavity.

G. Access Doors: Where metal access doors and frames thereto or grille openings occur in gypsum drywall walls, partitions and/or ceiling this contractor shall coordinate locations with those furnishing the access door and grilles.

H. Installation of Gypsum Wallboard.

1. General:
 - a. Standards: Comply with the requirements of ANSI A97.1 "Standard Specification for the Application and Finishing of Wallboard".
 - b. Provide wallboard of the thickness shown, or, if not shown, provide not less than the minimum thickness recommended by manufacturer for applications shown.
 - c. Form Control joints in wallboard construction as required.
 - d. Install shaft wall and vent shaft assemblies in accordance with details and manufacturer's instructions.
 - e. Treat edges of cutouts for plumbing pipes and other penetrations with a waterresistasnt compound as recommended by the Gypsum Board Manufacturer. Apply water resistant compound with exposed surface flush with gypsum board.
 - f. Gypsum wallboard shall extend from floor to underside of deck at all partitions, both sides.
2. Single Layer Applications:

- a. Ceilings: Apply 5/8" wallboard with long dimension at right angle to supports with end joints located over supports. Use maximum practical length boards to minimize end joints. Stagger end joints in alternate courses of boards and locate as far away from center of ceiling as possible.
 - b. Metal Wall Supports: Fasten gypsum wallboard vertically to metal studs with screws. In vertical application of gypsum board, panels shall be of length required to reach full height of vertical surfaces in one continuous piece. Comply with standards and manufacturer's instructions.
- I. Insulation: Partitions shall be insulated with sound-attenuating blankets where indicated on Drawings or required to achieve fire ratings.
- J. Finishing:
 - 1. Finish exposed wallboard surfaces with joints, corners and exposed edges reinforced or trimmed as required, and with all joints, fastener heads, trim accessory flanges and surface defects filled with at least three (3) coats of joint compound feathered out onto panel faces and sanded in accordance with manufacturer's recommendations for a smooth, flush surface. Form true, level or plumb lines, without joints, fastener heads, flanges or trim accessories, or defects visible after application of field-applied decoration.
 - 2. Use joint tape to reinforce joints formed by tapered edges or butt ends of drywall units and at interior corners and angles. Set tape in joint compound, then apply skim coat over tape in one application.
 - 3. Reinforce external vertical and horizontal corners with corner beads.
 - 4. Insert control joints strips into open joint and staple flanges to wallboard in accordance with manufacturer's instructions.
 - 5. Application of Joint compounds: After mixing, do not use joint compounds if recommended pot-life time has expired. Allow drying time between applications of joint compound in accordance with manufacturer's recommendations for the relative humidity and temperature levels at the time of application.

END OF SECTION 09 20 00.

SECTION 09 30 13 - CERAMIC TILING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

- A. General Contract Provisions and Sections of Division 1 supply to Work of this Section.

2.02 WORK SUMMARY:

- A. Work of this Section includes furnishing and installing Ceramic Tile and related work as required by the Contract Drawings, including:
 - 1. Ceramic floor tile.
 - 2. Ceramic glazed floor tile in main lobby.
 - 3. Glazed wall tile and tile bases.
 - 4. Grout.
 - 5. Divider Strips.
 - 6. Expansion/Isolation Joint Treatment.

1.03 RELATED WORK SPECIFIED ELSEWHERE:

- A. Section 09 20 00: Plaster and Gypsum Board
- B. Section 10 28 00: Toilet, Bath, & Laundry Accessories

1.04 QUALITY ASSURANCE:

- A. Ceramic Mosaic Floor Tile & Base Approved Manufacturer.
 - 1. Dal Tile.
 - 2. American Olean.
 - 3. Refer to drawings as indicated on Schedule of Finishes.
- B. Ceramic glazed floor tile and base approved manufacturer.
 - 1. Dal Tile.
 - 2. American Olean.
 - 3. Refer to drawings as indicated on Schedule of Finishes.
- C. Glazed Wall Tile Approved Manufacturer.
 - 1. American Olean
 - 2. Refer to drawings as indicated on Schedule of Finishes.
- D. Grout: Approved manufacturer.
 - 1. Laticrete.
 - 2. Hydroment by Bostik Construction Products
 - 3. Refer to drawings as indicated on Schedule of Finishes.

- E. Grout: Approved manufacturer.
 - 1. Hydroment by Bostik Construction Products
 - 2. Refer to drawings as indicated on Schedule of Finishes.
- F. Provide materials obtained from only one source for each type and color of tile.
- G. Handle, store, mix and apply setting and grouting materials in compliance with manufacturer's instructions.
- H. Deliver packaged materials and store in original containers with seals unbroken and labels and grade marks intact until time of use, in accordance with manufacturer's instructions.

1.05 SUBMITTALS:

- A. Certification - Tile Work: Furnish Master Grade certificate for each type of tile, signed by both Tile Manufacturer and Tile Subcontractor.
- B. Manufacturer's Data: Submit Manufacturer's technical information and installation instructions for all materials required, except bulk materials, including certification and other data required to show compliance with these Specifications.
- C. Samples: Submit samples of each type and color of tile required, not less than 12" square on plywood or hardboard backing, and grouted. Submit samples of bases, trim and other units if requested.
- D. Maintenance Stock: At time of substantial completion, deliver stock of maintenance material to the Owner. Furnish an amount equal to 3% of the amount installed for each color installed, including base and trim pieces.

1.06 DELIVERY AND STORAGE:

- A. Deliver all products to Job Site in manufacturer's unopened containers with grade seals unbroken and label intact.
- B. Keep tile cartons dry.

1.07 ENVIRONMENTAL CONDITIONS:

- A. Maintain temperature at 50 degrees F. minimum during tile work and for seven (7) days after completion. If temporary heaters are used, vent to outside to avoid carbon dioxide damage to new tile work.
- B. Provide adequate lighting for good grouting, sealing and clean-up.

PART 2 - PRODUCTS

2.01 MATERIALS:

A. Tile Materials:

1. General: Tiles shall be of domestic manufacture and shall meet or exceed the Standard Grade requirements of ANSI A137.1-1980.
2. Tile for floors and base shall be ceramic, not less than 1/4" thick, with cushion edges. Refer to drawings for sizes & additional requirements.
3. Tile for wall shall be glazed wall tile, matte or semi-gloss glazed not less than 5/16" thick, with cushion edges. Refer to drawings for sizes & additional requirements.
4. Provide trim of size, color and shade to match wall tile. Use straight top and trim pieces, cove throughout. For areas receiving wall tile, as specified by owner/interior. Base for areas not receiving wall tile shall be built-up base color & finish to match floor tile.

B. Setting Materials:

1. General: A latex additive shall be added to setting material in lieu of water, conforming to ANSI 118.4 similar to No. 3701 as mfg. by Laticrete or approved equal.
2. Floor tiles shall be set with a Dry Set mortar conforming to ANSI Standard A118.1.
3. Wall and base tiles:
 - a. On drywall or backer board use waterproof organic adhesive complying with ANSI A136.1 Type I.

C. Grouting Materials:

1. For floors and walls ceramic tile grout and joint filler shall meet CRD C-621-82 and ANSI A118.6-1985, a blended mixture of Portland Cement/Color Fast Pigments, high strength aggregates, including carefully graded quartz aggregate #7 on the M.O.H. scale. The color shall be as selected by the Architect. Prepare with multi-purpose acrylic latex mortar admixture and grout additive.
2. For walls of bath and shower areas: Dry Cure - mildew resistant unsanded grout with multi-purpose acrylic latex grout additive. Color shall be as selected by Architect.

D. Protective Materials: Heavy-duty, non-staining construction paper with compatible

masking tape.

- E. Divider Strips: Shall be "L" type of white metal alloy, 1/8" gauge, with the vertical leg having a depth setting the top of strip flush with floor tile.
- F. Isolation/Expansion joint sealant shall be Bostic #550 Urethane Sealant or approved equal.

PART 3 - EXECUTION

3.01 ACCEPTABILITY OF SURFACES:

- A. Prior to installing any tile, inspect all surfaces which are to receive tile covering, and do not proceed with installation until such defects or conditions which would be detrimental to the proper and timely completion of the work have been corrected. The starting of installation work in a room or space shall imply acceptance of the surfaces to receive the tile in that room or space.
- B. Before tiling walls, be sure variation of walls surfaces do not exceed 1/8" in 8'.
- C. Before tiling, be sure surfaces that are to be tiled are free from coating, oil, grease, wax and dust.

3.02 LAYOUT:

- A. Determine locations of all toilet and bath accessories before starting tile work.
- B. Layout all tile work so as to minimize cuts less than on-half tile in size.
- C. Locate cuts in both walls and floors so as to be least conspicuous.
- D. Align all floor joints to give straight uniform grout lines, parallel with walls.
- E. Make joints between tile sheets same width as joints within sheets so extent of each sheet is not apparent in finished work.
- F. Architect to approve layout of main lobby tile prior to commencement of work.

3.03 WORKMANSHIP - GENERAL:

- A. Supply first-class workmanship in all tile work.
- B. Use all products in strict accordance with recommendations and directions of manufacturers.
- C. Furnished surfaces shall be level and free from loose, broken or chipped tile.

- D. Cutting, fitting and setting of tile and all related materials shall be in accordance with setting methods and grouting systems specified.

3.04 SETTING METHODS:

- A. Setting methods shall conform to the following standards and the installation methods of the tile Council of America (TCA)
1. Floors: Concrete Subfloors:
 - a. Installation of floor tile shall be over concrete slabs including concrete slabs on grade.
 - b. Applying Mortar:
 1. Clean surface thoroughly. Dampen if very dry, but do not saturate.
 2. Apply mortar with flat side of trowel over an area no greater than can be covered with tile while mortar remains plastic. Within ten minutes before applying tile and using a notched trowel of type recommended by mortar manufacturer, comb mortar to obtain even setting bed without scraping backing material. Cover surface uniformly with no bare spots, with sufficient mortar to insure a minimum mortar thickness of 3/32 inch between tile and backing after tile has been beaten into place. Tile shall not be applied to skinned-over mortar.
 3. Insert temporary filler in expansion and control joints.
 - c. Setting Floor Tile:
 1. Press tile into freshly combed mortar, insuring mortar contact with tile while maintaining accurate joint alignment and spacing. Keep a minimum of 2/3 of joint depth open for grouting.
 2. Thoroughly beat all tile or tile assemblies into place with a beating block to obtain maximum contact of thin-set mortar on the back of each tile, or back of each tile and back mounting material. Average contact area shall be not less than 80 percent except on shower installations where contact area shall be 95% when no less than three tiles or tile assemblies are removed for inspection.
 3. Damp cure all tile installations.
 2. Walls:
 - a. Tile on Wallboard: ANSI A108.4; TCA Detail W242 with Organic Adhesive.

3.05 ISOLATION/EXPANSION JOINTS:

- A. Provide isolation/expansion joints 25'-0" o.c., and as directed by the Architect in the field.
- B. Apply 2-Part self-leveling Urethane Sealant in color to match grout, and as selected by the Architect.

3.06 PROTECTION FROM TRAFFIC:

- A. Prohibit all foot and wheel traffic from using newly tiled floors for at least three (3) days, preferably seven (7) days.

END OF SECTION 09 30 13.

SECTION 09 51 13 - ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

- A. General Contract Provisions and Sections of Division 1 apply to Work of this Section.

1.02 WORK SUMMARY:

- A. Work of this Section includes furnishing and installing all interior 2'x4' exposed spline acoustical panel ceilings. (see Contract Drawings for locations see finish schedule for ceiling types.)

1.03 RELATED WORK SPECIFIED ELSEWHERE:

- A. Section 09 20 00: Plaster and Gypsum Board
- B. Division 21/22/23: Mechanical diffusers, grilles and similar mechanical, plumbing, or sprinklering ceiling elements
- C. Division 26: Lighting fixtures.

1.04 COORDINATION:

- A. The installation of acoustical panel ceilings shall not proceed until all the work above the ceilings has been accepted (punch listed).
- B. Coordinate with all mechanical, electrical and other trades affected by the work and resolve all discrepancies and conflicts in an approved manner.

1.05 QUALITY ASSURANCE:

- A. Qualifications of Installer: Work under this Section shall be performed by an experienced specialty installer who is regularly engaged in the type of work required herein.
 - 1. Installer shall be acceptable to the manufacturer of both the suspension system and the acoustical units.
 - 2. Installer shall be capable of producing the modifications of standard components as shown.
- B. Flame Spread Rating: Acoustical ceiling panels shall be classified by Underwriter's Laboratories, Inc., under hazard classification for a flame spread of 0-25.

1.06 SUBMITTALS:

- A. Manufacturer's Data: Manufacturer's product specification and installation instructions for acoustical ceiling material, and for suspension system, including certified laboratory test reports and other data as required to show compliance with this Section.

1. Include manufacturer's recommendations for cleaning and refinishing acoustical units, including precautions against materials and methods which may be detrimental to finishes and acoustical performances.
 2. Indicate structural classification of suspension system.
- B. Shop Drawings: Submit shop drawings showing reflected ceiling plans indicating all diffusers, returns, exhausts, exit lights, lighting fixtures, speakers, sprinklers, smoke detectors, ceiling tracks, radiant heating panels, medical gas units, electrical outlets, ceiling supports, folding door tracks, etc. These drawings shall be coordinated with all trades prior to submission of said trades shop drawings. Trades shall not submit shop drawings until ceiling drawings have been signed off by each trade. Consult Architect as required for specific starting points of ceiling grid.
- C. Maintenance Stock: At time of substantial completion, deliver stock of maintenance material to the Owner. Furnish full size units matching the units installed, packaged with protective covering for storage, and identified with appropriate labels. Furnish an amount equal to 3% for each type of acoustic panel unit installed.

1.07 PRODUCT DELIVERY, STORAGE AND HANDLING:

- A. Deliver all acoustical units and suspension system components in manufacturer's original unopened packages fully identified with type, finish, performance data and compliance labels.
- B. Handle and store in accordance with manufacturer's instructions and recommendations. Store in a place protected from damage, exposure to the elements and high humidity.

1.08 COOPERATION:

- A. Cooperate with all others whose work affects or is affected by the work of this Section. Advise them of conditions necessary for proper installation of work under this Section.
- B. Resolve in writing any condition which may or will interfere with the proper installation of work of this Section. Otherwise proceeding with the work of this Section shall be construed as complete acceptance of conditions of prior work by others.

PART 2 - PRODUCTS

2.01 INTERIOR ACOUSTIC PANELS:

- A. Composition: Rigid boards of mineral fiber meeting the requirements of Fed. Spec, SS-S-118 B, Class 25.
- B. Pattern and Size: 2x2 See drawings for tile and grid types.

2.02 SUSPENSION SYSTEM MATERIALS:

ACOUSTICAL PANEL CEILINGS
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- A. Standard: Comply with requirements of applicable codes and ASTM C-635, as applicable to the suspended acoustical tile systems herein specified. Systems shall have intermediate duty structural classification unless otherwise noted.
- B. Coordination of Components: Provide suspension system which is coordinated with partitions, and which is coordinated with the indicated limitations and requirements for supporting light fixtures, HVAC components, hospital equipment, ceiling tracks and similar work indicated by the Contract Documents or shop drawings to be supported by or located in suspended ceilings. Include all necessary components for a complete system.
- C. Exposed tee grid systems as manufactured by Armstrong, or approved equal.
 - 1. Main and cross tees fabricated of cold-rolled steel, electro-zinc coated for interior ceilings and cold rolled aluminum and aluminum cap and factory painted manufacturer's low sheen satin white finish. See ceiling types for particular size and application.
 - 2. Edge molding, angle shaped, exposed flange; paint finish to match grid, size and coordinate with specific and type.
 - 3. Maximum deflection: 1/360 span.

2.03 HANGERS:

- A. 12 gauge galvanized hanger wire for interior ceilings and 8 gauge galvanized hanger wire for exterior ceilings.
 - 1. Exposed Steel Construction or Metal Deck:
 - a. Provide beam clamp or other approved fastening device at steel beams, not to exceed 4'-0" o.c. both ways.
 - b. At steel decks without hanger tabs anchor hangers by means of approved metal clips secured to deck with self tapping threaded tek head screws or toggle bolts. At steel decks with hanger tabs anchor hangers to approved tabs fastened to bottom of deck. All hangers not to exceed 4'-0" o.c. each way.

2.04 ACOUSTICAL SEALANT:

A heavy bodied, non-shrinking, non-drying, non-sag grade mastic compound.

PART 3 - EXECUTION

3.01 PRE-INSTALLATION CONFERENCE:

- A. Prior to the start of acoustical ceiling installation, meet at the Project Site with the installers of related work, including lighting, ductwork and similar work in the ceiling plenum. Review areas of potential interference and resolve conflicts before

proceeding with the work. Coordinate ceiling layout with the layout of other work which penetrates or is supported by the ceiling in each space or area.

3.02 ENVIRONMENTAL CONDITIONS:

- A. Space Enclosure: Do not install interior acoustical ceilings until wet work in the space has been completed and is nominally dry, and until work above ceiling has been completed, and until ambient conditions of temperature and humidity will be continuously maintained at values near those indicated for final occupancy.

3.03 INSPECTION AND PREPARATORY WORK:

- A. Examine metal ceiling suspension system previously installed by others and the conditions under which acoustical ceiling work is to be performed; remedy any unsatisfactory conditions.
- B. Plan each layout to balance border widths at opposite edges of each ceiling area unless otherwise noted. Avoid use of less-than-half width units wherever possible. Comply with reflected ceiling plans.

3.04 INSTALLATION - GENERAL:

- A. Codes and Standards: Install materials in accordance with manufacturer's printed instructions, and to comply with governing regulations, fire resistance rating requirements where indicated, and industry standards applicable to the work.
- B. Suspended Ceiling Installation: Comply with ASTM C-636 as applicable to acoustical panel ceilings, except to the extent more stringent requirements are indicated or required for compliance with governing regulations or fire resistance ratings.
- C. Install edge moulding of the type indicated at edges of acoustical ceilings and at locations where edge of tile would otherwise be exposed after completion of the work.
 - 1. Sealant Bed: Apply continuous ribbon of acoustical sealant on back of vertical leg before fastening to vertical surface. Locate so that sealant will not be exposed after installation is completed.
 - 2. Secure mouldings to building construction by fastening through holes drilled in vertical leg. Space holes not more than 3" from each end and not more than 16" o.c. between end holes. Draw-up fasteners for tight set against vertical surfaces.
 - a. Hollow Masonry or Stud Construction: Fasten with toggle bolts, or similar self-expanding screw anchors.
 - 3. Miter corners of mouldings accurately to provide hairline joints.
 - 4. Level mouldings with ceiling suspension system, to a level tolerance of 1/8" in 12'0".
- D. Install exposed spline acoustical panel systems in coordination with suspension system and according to ASTM C-636 "Recommended Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels".

3.05 CLEANING AND PROTECTION:

- A. Clean exposed surfaces of acoustical panels and edge mouldings; comply with manufacturer's instructions for cleaning and touch-up of minor finish damage. Remove and replace work which cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.
- B. Protect acoustical panel ceilings so that the work will be without damage and deterioration at the time of acceptance by the Owner.

END OF SECTION 09 51 13.

SECTION 09 53 00 – ACOUSTICAL CEILING SUSPENSION ASSEMBLIES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

- A. General Contract Provisions and Sections of Division 1 apply to Work of this Section.

1.02 WORK SUMMARY:

- A. Work of this Section includes furnishing and installing all metal ceiling suspension systems for suspended gypsum board ceilings and related work as required by Drawings, including:
 - 1. Hangers
 - 2. Running Bars
 - 3. Painting

1.03 RELATED WORK SPECIFIED ELSEWHERE:

- A. Section 09 20 00: PLASTER AND GYPSUM BOARD

1.04 CODES:

- A. Support systems shall be in accordance with requirements of all Local and State Building Codes.
 - 1. Each hanger shall be capable of carrying all loads suspended therefrom, plus an additional 200 lbs. located at midspan. The midspan deflection shall not exceed 1/360 of the span. The connections of the carrying channel to the hangers shall be adequate for the load supported by the carrying channel plus 200 lbs.
 - 2. The main runners shall be capable of carrying all loads suspended therefrom. The midspan deflection shall not exceed 1/360 of the span. Each connection of the main runner to the carrying channels shall be adequate for the load supported by the main runner plus 200 lbs. Where necessary for support of ceilings, bridging channels shall be installed to conform to deflection limits specified herein and as established by Building Code and construction requirements.

1.05 SUBMITTALS:

- A. Shop Drawings: Submit shop drawings for each type of hanger assembly, indicating placement for hangers under concrete arches and steel deck construction and including hangers, running bars, clips, knee braces, etc. Indicate details for special hangers for support of ceiling fixtures and supports for mechanical equipment as applicable.

- B. Samples: Submit samples of each type of hanger assembly required.

PART 2 - PRODUCTS

2.01 MATERIALS:

- A. See Plans & Sections for hanger details.
- B. 8 gauge galvanized hanger wire for interior ceilings.
 - 1. Exposed Steel Construction or Metal Deck:
 - a. Provide beam clamp or other approved fastening device at steel beams, not to exceed 4'-0" o.c. both ways.
 - b. At steel decks without hanger tabs anchor hangers by means of approved metal clips secured to deck with self tapping threaded tek head screws or toggle bolts. At steel decks with hanger tabs anchor hangers to approved tabs fastened to bottom of deck. All hangers not to exceed 4'-0" o.c. each way.

PART 3 - EXECUTION

3.01 INSTALLATION:

- A. Furnish and erect all hangers and running bars required to support ceiling suspension system for ceilings, together with all clips, clamps, bolts, etc., required to secure the members to the structural work. Drill all holes required for this work.
- B. All work shall be done in the most substantial and workmanlike manner, with horizontal members level and all true and even, so that the proper heights shall be provided for suspended ceilings.
- C. The heights of the suspended ceilings under ducts, etc., are figured on the Drawings, and may be subject to some variations to meet the requirements of ducts or other work when actually installed. Prior to the time when these ceilings are to be constructed, the Contractor shall coordinate and verify heights as to location and dimensions for framing as required.
 - 1. Hangers for furring about horizontal ducts shall be angles bolted to short, 1" x 1/8" flat hangers. This furring must be supported entirely by the hangers and shall not be put up until metal ducts are in place.
- D. Painting: All steel members such as flats, angles, channels, etc., unless galvanized, shall be dipped or painted one (1) coat of an approved asphaltum paint.

3.02 CEILING FIXTURES:

- A. Maximum Fixture Weights: Fixtures exceeding 80 pounds in weight shall be supported independently of ceiling suspension systems. Fixtures weighing 80 lbs. or less may be supported from the carrying channels. Fixtures weighing 50 lbs. or less may be supported from the main runners.

- B. Eccentric Loading: Fixtures shall be installed so that the carrying channels or main runners will not be eccentrically loaded unless suitable accessory devices are employed and the carrying channel or main runner design provides for the torsional stress.

END OF SECTION 09 53 00.

SECTION 09 65 00 - RESILIENT FLOORING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Resilient sheet flooring.
- B. Resilient tile flooring.
- C. Resilient base.
- D. Installation accessories.

1.2 RELATED REQUIREMENTS

- A. Section 03 5400 - Cast Underlayment.
- B. Section 09 0561 - Common Work Results for Flooring Prep

1.3 REFERENCE STANDARDS

- A. ASTM E648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source; 2014c.
- B. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2011.
- C. ASTM F1066 - Standard Specification for Vinyl Composition Floor Tile; 2004 (Reapproved 2010)e1.
- D. ASTM F1303 - Standard Specification for Sheet Vinyl Floor Covering with Backing; 2004 (Reapproved 2014).
- E. ASTM F1861 - Standard Specification for Resilient Wall Base; 2008 (Reapproved 2012)e1.
- F. ASTM F1913 - Standard Specification for Vinyl Sheet Floor Covering Without Backing; 2004 (Reapproved 2010).
- G. NFPA 253 - Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source; National Fire Protection Association; 2011.
- H. RFCI (RWP) - Recommended Work Practices for Removal of Resilient Floor Coverings; Resilient Floor Covering Institute; October 2011.

1.4 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Selection Samples: Submit 12" x 12" sample for Architect's review.
- C. Flooring contractor to provide Architect with seaming plan for all sheet-good flooring.
- D. Flooring contractor to provide Architect and Owner with 12" x 12" sample sheet-good flooring with welded seam along the diagonal for workmanship approval.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Protect roll materials from damage by storing on end.

1.6 FIELD CONDITIONS

- A. Maintain temperature in storage area between 55 degrees F and 90 degrees F.

- B. Store materials for not less than 48 hours prior to installation in area of installation at a temperature of 70 degrees F to achieve temperature stability. Thereafter, maintain conditions above 55 degrees F.

1.7 LIMITED WARRANTY

- A. Resilient Flooring: Submit a written warranty executed by the manufacturer, agreeing to repair or replace resilient flooring that fails within the warranty period.
- B. Limited Warranty Period: 5 years
- C. Limited Warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by the Contractor under the requirements of the Contract Documents.

PART 2 PRODUCTS

2.1 SHEET SAFETY / SLIP RESISTANT FLOORING

- A. Vinyl Slip Resistant Safety Flooring
- B. Vinyl Welding Rod: Solid vinyl/rubber bead produced by manufacturer of flooring for heat welding seams, in color matching field color.
- C. Cove Former: 38mm cove former produced by manufacture.
- D. Metal Edge Strips: Aluminum with mill finish. (No steel in wet locations)
- E. Adhesives: Two part polyurethane for areas prone to moisture produced by manufacture.
- F. Backing: Non-woven polyester/cellulose, glass fiber reinforcement.
- G. Approved Manufacturer:
 - 1. Refer to Drawings.

2.2 SHEET FLOORING

- A. Vinyl or Rubber Sheet Flooring – Type: Homogeneous without backing, with color and pattern throughout full thickness.
 - 1. Minimum Requirements: Comply with ASTM F1913.
 - 2. Critical Radiant Flux (CRF): Minimum 0.45 watt per square centimeter, when tested in accordance with ASTM E 648 or NFPA 253.
 - 3. Total Thickness and Wear Layer Thickness: 0.080 inch nominal.\
 - 4. Heat welded seams. Integral coved base with cap strip.
 - 5. Pattern: As selected by Architect.
- H. Vinyl or Rubber Welding Rod: Solid vinyl/rubber bead produced by manufacturer of flooring for heat welding seams, in color matching field color.
- I. Approve Manufacturer:
 - 1. Refer to Drawings.

2.3 TILE FLOORING

- A.** Vinyl Composition Tile: Homogeneous, with color extending throughout thickness.
 - 1. Minimum Requirements: Comply with ASTM F1066, of Class corresponding to type specified.
 - 2. Critical Radiant Flux (CRF): Minimum 0.45 watt per square centimeter, when tested in accordance with ASTM E 648 or NFPA 253.
 - 3. Size: 12 by 12 inch.
 - 4. Thickness: 0.125 inch.
 - 5. Pattern: As selected by Architect.
- B.** Approval Manufacturer:
 - 1. Refer to Drawings.

2.4 RESILIENT BASE

- A.** Resilient Base: ASTM F1861, Type TS rubber, vulcanized thermoset; top set Style B, Cove.
 - 1. Height: 4 inch.
 - 2. Thickness: 0.125 inch thick.
 - 3. Finish: Satin.
 - 4. Length: Roll / Coiled
 - 5. Color: Color as selected from manufacturer's standards.

2.5 ACCESSORIES

- A.** Primers, Adhesives, and Seaming Materials: Waterproof; types recommended by flooring manufacturer.
- B.** Moldings, Transition and Edge Strips: Same material as flooring.
- C.** Filler for Coved Base: Metal.

PART 3 EXECUTION

3.1 EXAMINATION

- A.** Verify that surfaces are flat to tolerances acceptable to flooring manufacturer, free of cracks that might telegraph through flooring, clean, dry, and free of curing compounds, surface hardeners, and other chemicals that might interfere with bonding of flooring to substrate.
- B.** Cementitious Sub-floor Surfaces: Verify that substrates are dry enough and ready for resilient flooring installation by testing for moisture and pH.
 - 1. Test in accordance with ASTM F710.
 - 2. Obtain instructions if test results are not within limits recommended by resilient flooring manufacturer and adhesive materials manufacture.
- C.** Verify that concrete sub-floor surfaces are dry enough and ready for resilient flooring installation by testing for moisture emission rate and alkalinity in accordance with ASTM F710; obtain instructions if test results are not within limits recommended by resilient flooring manufacturer and adhesive materials manufacturer.

3.2 PREPARATION

- A. All sheet flooring must acclimate to the interior environment of the project site for no less than 48-hours prior to installation. All material being installed must be acclimated or there is risk for welded seams to fail.
- B. Remove existing resilient flooring and flooring adhesives; follow the recommendations of RFCI Recommended Work Practices for Removal of Resilient Floor Coverings.
- C. Prepare floor substrates as recommended by flooring and adhesive manufacturers.
- D. Remove sub-floor ridges and bumps. Fill minor low spots, cracks, joints, holes, and other defects with sub-floor filler to achieve smooth, flat, hard surface.
- E. Prohibit traffic until filler is cured.
- F. Clear substrate.
- G. Apply primer as required to prevent "bleed-through" or interference with adhesion by substances that cannot be removed.

3.3 INSTALLATION

- A. Starting installation constitutes acceptance of sub-floor conditions.
- B. Install in accordance with manufacturer's instructions.
- C. Install flooring wall to wall before the installation of floor-set cabinets, casework, furniture, equipment, movable partitions, etc. Extend flooring into toe spaces, door recesses, closets, and similar openings as shown on the drawings.
- D. If required, install flooring on pan-type floor access covers. Maintain continuity of color and pattern within pieces of flooring installed on these covers. Adhere flooring to the subfloor around covers and to covers.
- E. Install flooring with adhesives, tools, and procedures in strict accordance with the manufacturer's written instructions. Observe the recommended adhesive trowel notching, open times, and working times.
- F. Spread only enough adhesive to permit installation of materials before initial set.
- G. Fit joints tightly.
- H. Set flooring in place, press with heavy roller to attain full adhesion.
- I. Where type of floor finish, pattern, or color is different on opposite sides of door, terminate flooring under centerline of door.
- J. Install edge strips at unprotected or exposed edges, where flooring terminates, and where indicated.
- K. Scribe flooring to walls, columns, cabinets, floor outlets, and other appurtenances to produce tight joints.

3.4 SHEET FLOORING

- A. Lay flooring with joints and seams parallel to longer room dimensions, to produce minimum number of seams. Lay out seams to avoid widths less than 1/3 of roll width; match patterns carefully at seams. Note: Floor must rest 48 hours after being glued prior to any heat welding. Submit seaming plan to Architect for approval.
- B. Double cut sheet at seams.
- C. Lay flooring with tightly butted seams, without any seam sealer unless otherwise indicated.

- D. Finish seams in sheet vinyl by heat welding – all material must be acclimated before heat welding can occur.
- E. Coved Base: Install as detailed on drawings, using coved base backer as backing at floor to wall junction. Extend sheet flooring vertically to height indicated, and cover top edge with metal cap strip. All outside corners shall have a “butterfly” cut along the corner for a clean finish.
- F. Provide a finish cap from manufacture along entire length of integral cove. If no color is specified, match the color of the welding rod.

3.5 TILE FLOORING

- A. Follow manufactures instructions for recommended adhesives and installation requirements.
- B. Lay flooring with joints and seams parallel to building lines to produce symmetrical tile pattern or in accordance with Architect’s Finish Plan.

3.6 INSTALLATION OF ACCESSORIES

- A. Apply top set wall base to walls, columns, casework, and other permanent fixtures in areas where top-set base is required. Install base in lengths as long as practical, with inside corners fabricated from base materials that are mitered or coped. Tightly bond base to vertical substrate with continuous contact at horizontal and vertical surfaces.
- B. Fill voids with plastic filler along the top edge of the resilient wall base or integral cove cap on masonry surfaces or other similar irregular substrates.
- C. Place resilient edge strips tightly butted to flooring, and secure with adhesive recommended by the edge strip manufacturer. Install edge strips at edges of flooring that would otherwise be exposed.

3.7 RESILIENT BASE

- A. Base installation should not be seamed along run unless length exceeds 25’-0” or if the base passes over a building expansion joint.
- B. Fit joints tightly and make vertical.
- C. Install base on solid backing. Bond tightly to wall and floor surfaces.
- D. Scribe and fit to door frames and other interruptions.

3.6 FLOORING TRANSITION

- A. Where there is a dissimilar flooring thickness; install an ADA compliant reducer strip between the two materials. Reducer strips can be one of the following:
 - 1. Vinyl Extruded Profile
 - 2. Chamfered Aluminum Extruded Profile
 - 3. Bar Aluminum Extruded Profile

The Architect will review each condition during shop drawing review and will provide specific manufactures, profiles and colors for each instance.

3.8 CLEANING

- A. Remove excess adhesive from floor, base, and wall surfaces without damage. Clean in accordance with manufacturer’s instructions.

3.9 PROTECTION

- A.** Protect installed flooring as recommended by the flooring manufacturer against damage from rolling loads, other trades, or the placement of fixtures and furnishings.

END OF SECTION 09 65 00

SECTION 09 68 13 – CARPET TILE

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Carpet tile.
- B. Removal of existing carpet.
- C. Accessories.

1.2 RELATED REQUIREMENTS

- A. Section 03 5400 - Cast Underlayment.

1.3 REFERENCE STANDARDS

- A. ASTM D2859 - Standard Test Method for Ignition Characteristics of Finished Textile Floor Covering Materials; 2006 (Reapproved 2011).
- B. ASTM E648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source; 2014c.
- C. CRI (CIS) - Carpet Installation Standard; Carpet and Rug Institute; 2009.
- D. CRI (GLA) - Green Label Testing Program - Approved Adhesive Products; Carpet and Rug Institute; Current Edition.
- E. NFPA 253 - Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source; National Fire Protection Association; 2011.
- F. ASTM F710 – Standard Preparation of Concrete Slabs. Testing for moisture emission rate and alkalinity.

1.4 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Samples: Submit two samples of each carpet tile selection, illustrating color and pattern for each carpet and cushion material specified.

1.5 FIELD CONDITIONS

- A. Store materials in area of installation for minimum period of 24 hours prior to installation and comply with all manufactures recommendations.
- B. Ventilate installation area during installation and for 72 hours after installation.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Carpet Tile:
 - 1. Shaw, Mannington.
 - 2. Mohawk Group.
 - 3. Substitutions: See Section 01 6000 - Product Requirements.

2.2 CARPET

- A.** Carpet, Type: Commercial Carpet Tile.
 - 1. Color: As selected by Architect.
 - 2. Pattern: As selected by Architect.

2.3 RESILIENT BASE

- A.** Resilient Base: ASTM F1861, Type TS rubber, vulcanized thermoset; top set Style B, Cove.
 - 1. Height: 4 inch.
 - 2. Thickness: 0.125 inch thick.
 - 3. Finish: Satin.
 - 4. Length: Roll.
 - 5. Color: Color as selected from manufacturer's standards.

2.4 ACCESSORIES

- A.** Adhesives - General: Compatible with materials being adhered; maximum VOC content of 50 g/L; CRI Green Label certified.
- B.** Seam Adhesive: Recommended by manufacturer.
- C.** Contact Adhesive: Compatible with carpet material and as recommended by the manufacture.
- D.** ADA compliant transition strips.

PART 3 EXECUTION

3.1 EXAMINATION

- A.** Verify that sub-floor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive carpet.
- B.** Verify that sub-floor surfaces are dust-free and free of substances that could impair bonding of adhesives to sub floor surfaces.
- C.** Verify that concrete sub-floor surfaces are dry enough and ready for adhesive installation by testing for moisture emission rate and alkalinity in accordance with ASTM F710; obtain instructions if test results are not within limits recommended by carpet manufacturer and adhesive materials manufacturer.

3.2 PREPARATION

- A.** Remove existing carpet and carpet cushion.
- A.** Remove sub-floor ridges and bumps. Fill minor or local low spots, cracks, joints, holes, and other defects with sub-floor filler.
- A.** Clean substrate.

3.3 INSTALLATION - GENERAL

- A. Starting installation constitutes acceptance of sub-floor conditions.
- A. Install carpet and cushion in accordance with manufacturer's instructions
- A. Verify carpet match before cutting to ensure minimal variation between dye lots.
- A. Lay out carpet and locate seams in accordance with shop drawings and Architect's finish plan.
 - 1. Do not locate seams perpendicular through door openings.
 - 2. Locate change of color or pattern between rooms under door centerline.
- A. Install carpet tight and flat on subfloor, well fastened at edges, with a uniform appearance.

3.4 DIRECT-GLUED CARPET

- A. Double cut carpet seams, with accurate pattern match. Make cuts straight, true, and unfrayed. Apply seam adhesive to cut edges of woven carpet immediately.
- A. Apply contact adhesive to floor uniformly at rate recommended by manufacturer. After sufficient open time, press carpet into adhesive.
- A. Apply seam adhesive to the base of the edge glued down. Lay adjoining piece with seam straight, not overlapped or peaked, and free of gaps.
- A. Roll with appropriate roller for complete contact of adhesive to carpet backing.
- A. Trim carpet neatly at walls and around interruptions.

3.5 RESILIENT BASE

- A. Base installation should not be seamed along run unless length exceeds 25'-0" or if the base passes over a building expansion joint.
- B. Fit joints tightly and make vertical.
- C. Install base on solid backing. Bond tightly to wall and floor surfaces.
- D. Scribe and fit to door frames and other interruptions.

3.6 FLOORING TRANSITION

- A. Where carpet tile abuts vinyl tile, ceramic tile, sheet goods flooring, terrazzo or similar flooring of different thickness than the carpet tile being installed; install ADA compliant reduction strip between materials. Architect to select color and profile of reduction strip during shop-drawing review.

3.7 CLEANING

- A. Remove excess adhesive from floor and wall surfaces without damage.
- B. Clean and vacuum carpet surfaces.

END OF SECTION 09 68 13

SECTION 09 90 00 - PAINTING AND COATING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Interior & Exterior paint and coatings systems including: paint, stains, transparent coatings, and opaque finishes

1.2 RELATED SECTIONS

1.3 REFERENCES

- A. SSPC-SP 1 - Solvent Cleaning
- B. SSPC-SP 2 - Hand Tool Cleaning
- C. SSPC-SP 3 - Power Tool Cleaning
- D. SSPC-SP 13 / NACE No. 6 Surface Preparation for Concrete

1.4 SUBMITTALS

- A. Submit under provisions of Section 01 33 00, Submittal Procedures.
- B. Submit physical paint swatch samples of each paint selection on 8.5"x11" card stock for approval.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Provide all paint and coating products used in any individual system from the same manufacturer; no exceptions.
- B. Paints:
 - 1. Benjamin Moore – Natura
 - 2. Sherwin-Williams Company
- C. Transparent Finishes:
 - 1. Base Manufacturer: Pratt and Lambert.
- D. Substitutions: See Section 01 6000 - Product Requirements.

2.2 PAINTS AND COATINGS - GENERAL

- A. Paints and Coatings: Ready mixed, unless intended to be a field-catalyzed coating.
 - 1.

2. Provide paints and coatings of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
 3. Supply each coating material in quantity required to complete entire project's work from a single production run.
 4. Do not reduce, thin, or dilute coatings or add materials to coatings unless such procedure is specifically described in manufacturer's product instructions.
- B.** Primers: As follows unless other primer is required or recommended by manufacturer of top coats; where the manufacturer offers options on primers for a particular substrate, use primer categorized as "best" by the manufacturer.
- C.** Volatile Organic Compound (VOC) Content:
1. Provide coatings that comply with the most stringent requirements specified in the following:
 - a. 40 CFR 59, Subpart D--National Volatile Organic Compound Emission Standards for Architectural Coatings.
 2. Determination of VOC Content: Testing and calculation in accordance with 40 CFR 59, Subpart D (EPA Method 24), exclusive of colorants added to a tint base and water added at project site; or other method acceptable to authorities having jurisdiction.
- D.** Colors: To be selected from manufacturer's full range of available colors.
1. Selection to be made by Architect after award of contract, see schedules for selections.

2.3 PAINT SYSTEMS - INTERIOR

All interior surfaces indicated to be painted, unless otherwise noted; including gypsum board, concrete, concrete masonry units, brick, wood, plaster, uncoated steel, shop primed steel, galvanized steel, aluminum and vinyl.

All Gypsum Board Surfaces to have Level 4 finish.

- A.** Paint WI-OP-2L - Wood, Opaque, Latex, 2 Coat:
 - B.** One coat of latex primer sealer.
- B.** Paint WI-TR-VS - Wood, Transparent, Varnish, Stain:
 - A.** One coat of stain.
 - B.** One coat sealer.
- C.** Paint CI-OP-2L - Concrete/Masonry, Opaque, Latex, 2 Coat:
 - A.** One coat of block filler.
- D.** Paint MI-OP-2A - Ferrous Metals, Primed, Alkyd, 2 Coat:
 - A.** Touch-up with alkyd primer.
- E.** Paint CI-OP-3Af - Concrete/Masonry, Alkyd Floor Enamel, 3 Coat:
 - A.** One coat of alkali resistant primer.
 - B.** Gloss: Two coats of alkyd floor enamel
- F.** Paint GI-OP-2LA - Gypsum Board/Plaster, Latex-Acrylic, 2 Coat:

- A. One coat of alkyd primer sealer.

PART 3 EXECUTION

3.1 PREPARATION

- A. Clean surfaces thoroughly and correct defects prior to coating application.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- C. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.
- D. Seal surfaces that might cause bleed through or staining of topcoat.
- E. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.
- F. Gypsum Board Surfaces to be Painted: Full minor defects with filler compound. Spot prime defects after repair.
- G. Concrete Floors: Remove contamination, acid etch if necessary and rinse floors with clear water. Verify required acid-alkali balance is achieved. Allow to dry.
- H. Galvanized Surface to be Painted: Remove surface contamination and oils and wash with solvent. Apply coat of etching primer.
- I. Shop Primed Steel Surfaces to be Painted: Sand and scrape loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Re-prime entire shop-primed item.

3.2 APPLICATION

- A. Apply products in accordance with manufacturer's instructions.
- B. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.
- C. Apply each coat to uniform appearance without runs, drips, or sags, without brush marks and consistent sheen.
- D. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.
- E. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.
- F. Regardless of number of coats specified, apply as many coats as necessary for complete hide, coverage and uniform appearance.

3.3 PROTECTION

- A. Protect finished coatings from damage until completion of project.
- B. Touch-up damaged coatings after substantial completion, following manufacturer's recommendation for touch up or repair of damaged coatings. Repair any defects that will hinder the performance of the coatings.

END OF SECTION 09 90 10

SECTION 09 91 23
INTERIOR, EXTERIOR AND INDUSTRIAL PAINTS AND COATINGS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Interior high-performance paint and coatings systems for application on metal substrates, including surface preparation.

1.2 RELATED SECTIONS

- A. Section 03 30 00 - Cast-in-Place Concrete.
- B. Section 04 20 00 - Unit Masonry: Concrete Masonry Units (CMU) and brick.
- C. Section 05 12 16 - Fabricated Fireproofed Steel Columns.
- D. Section 05 50 00 - Metal Fabrications.
- E. Section 06 20 00 - Finish Carpentry.
- F. Section 06 40 00 - Architectural Woodwork.
- G. Section 08 11 13.16 - Custom Hollow Metal Doors and Frames.
- H. Section 09 21 16.23 - Gypsum Board Shaft Wall Assemblies.
- I. Section 23 05 00 - Common Work Results for HVAC.
- J. Section 26 05 00 - Common Work Results for Electrical.

1.3 REFERENCES

- A. Steel Structures Painting Council (SSPC):
 - 1. SSPC-SP 1 - Solvent Cleaning.
 - 2. SSPC-SP 2 - Hand Tool Cleaning.
 - 3. SSPC-SP 3 - Power Tool Cleaning.
 - 4. SSPC-SP5/NACE No. 1, White Metal Blast Cleaning.
 - 5. SSPC-SP6/NACE No. 3, Commercial Blast Cleaning.
 - 6. SSPC-SP7/NACE No. 4, Brush-Off Blast Cleaning.
 - 7. SSPC-SP10/NACE No. 2, Near-White Blast Cleaning.
 - 8. SSPC-SP11, Power Tool Cleaning to Bare Metal.
 - 9. SSPC-SP12/NACE No. 5, Surface Preparation and Cleaning of Metals by Waterjetting Prior to Recoating.
 - 10. SSPC-SP 13 / NACE No. 6 Surface Preparation for Concrete.
- B. Material Safety Data Sheets / Environmental Data Sheets: Per manufacturer's MSDS/EDS for specific VOCs (calculated per 40 CFR 59.406). VOCs may vary by base and sheen.
- C. South Coast Air Quality Management District (SCAQMD): Rule 1113 - Architectural Coatings.
- D. Green Seal, Inc.:
 - 1. GS-11 Standard for Paints and Coatings (1st Edition, May 20,1993).
 - 2. GC-03 - Environmental Criteria for Anti-Corrosive Paints.

- E. United States Green Building Council (USGBC): LEED-09 NC/CI/CS.

1.4 SUBMITTALS

- A. Submit under provisions of Section 01 30 00 - Administrative Requirements.
- B. Product Data: For each paint system indicated, including.
 - 1. Product characteristics.
 - 2. Surface preparation instructions and recommendations.
 - 3. Primer requirements and finish specification.
 - 4. Storage and handling requirements and recommendations.
 - 5. Application methods.
 - 6. Cautions for storage, handling and installation.
- C. Selection Samples: Submit a complete set of color chips that represent the full range of manufacturer's products, colors and sheens available.
- D. Verification Samples: For each finish product specified, submit samples that represent actual product, color, and sheen.
- E. Only submit complying products based on project requirements (i.e. LEED). One must also comply with the regulations regarding VOCs (CARB, OTC, SCAQMD, LADCO). To ensure compliance with district regulations and other rules, businesses that perform coating activities should contact the local district in each area where the coating will be used.
- F. USGBC LEED V4 Submittals:
 - 1. MRc2 Environmental Product Declaration Product Language: Products shall be selected with a preference to products that have product-specific environmental product declaration documentation.
 - 2. EQc2 Low Emitting Materials: The VOC content of all adhesives, sealants, paints and coatings in this Section shall not exceed the VOC limits established in Division 01 Sustainable Design sections.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: A firm or individual experienced in applying paints and coatings similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance.
- B. Paint exposed surfaces. If a color of finish, or a surface is not specifically mentioned, Architect will select from standard products, colors and sheens available.
- C. Do not paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels unless indicated.
- D. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.
 - 1. Finish surfaces for verification of products, colors and sheens.
 - 2. Finish area designated by Architect.
 - 3. Provide samples that designate primer and finish coats.
 - 4. Do not proceed with remaining work until the Architect approves the mock-up.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Delivery: Deliver manufacturer's unopened containers to the work site. Packaging shall bear the manufacturer's name, label, and the following list of information.
 - 1. Product name, and type (description).
 - 2. Application and use instructions.

3. Surface preparation.
 4. VOC content.
 5. Environmental handling.
 6. Batch date.
 7. Color number.
- B. Storage: Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.
 - C. Store materials in an area that is within the acceptable temperature range, per manufacturer's instructions. Protect from freezing.
 - D. Handling: Maintain a clean, dry storage area, to prevent contamination or damage to the coatings.

1.7 PROJECT CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's recommended limits.

1.8 EXTRA MATERIALS

- A. Furnish extra paint materials from the same production run as the materials applied and in the quantities described below. Package with protective covering for storage and identify with labels describing contents. Deliver extra materials to Owner.
- B. Furnish Owner with an additional one percent of each material and color, but not less than 1 gal (3.8 l) or 1 case, as appropriate.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturer: Sherwin-Williams, which is located at: 101 Prospect Ave.; Cleveland, OH 44115; Toll Free Tel: 800-524-5979; Tel: 216-566-2000; Fax: 440-826-1989; Email: request info specifications@sherwin.com; Web: www.swspeccs.com.
- B. Requests for substitutions will be considered in accordance with provisions of Section 01 60 00 - Product Requirements.

2.2 APPLICATIONS/SCOPE

- A. Interior High Performance Paints and Coatings:
 1. Concrete: Poured, precast, tilt-up, cast-in-place, cement board.
 2. Concrete: Ceilings.
 3. Masonry: CMU - concrete, split face, scored, smooth, stucco.
 4. Non-Ferrous Metal: Galvanized steel and aluminum.
 5. Metal Ferrous: Ceilings, structural steel, joists, trusses, beams, and similar items including dryfall coatings.
 6. Wood: Walls, ceilings, doors, trim, cabinet work, and similar items.
 7. Drywall: Drywall board, Gypsum board
 8. Plaster: Walls, ceilings.

2.3 PAINT MATERIALS - GENERAL

- A. Paints and Coatings:
 1. Unless otherwise indicated, provide factory-mixed coatings. When required, mix

coatings to correct consistency in accordance with manufacturer's instructions before application. Do not reduce, thin, or dilute coatings or add materials to coatings unless such procedure is specifically described in manufacturer's product instructions.

2. For opaque finishes, tint each coat including primer coat and intermediate coats, one-half shade lighter than succeeding coat, with final finish coat as base color. Or follow manufacturer's product instructions for optimal color conformance.
- B. Primers: Where the manufacturer offers options on primers for a particular substrate, use primer categorized as "best" by the manufacturer.
 - C. Coating Application Accessories: Provide all primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials required, per manufacturer's specifications.
 - D. Color: Refer to Finish Schedule for paint colors, and as selected.
 - E. LEED Requirements: Products in compliance with requirements of IEQ Credit 4.2 USGBC LEED-09 NC/CI/CS.

2.4 HIGH PERFORMANCE INTERIOR PAINT SYSTEMS

- A. METAL - (Structural Steel Columns, Joists, Trusses, Beams, Miscellaneous and Ornamental Iron, Structural Iron, Ferrous Metal. Metal Doors and Frames).
 1. Alkyd Systems (Water based):
 - a. Semi-Gloss Finish:
 - 1) 1st Coat: S-W Pro Industrial Pro-Cryl Universal Primer, B66-1310 Series (5.0-10.0 mils wet, 1.8-3.6 mils dry).
 - 2) 2nd Coat: S-W Pro Industrial Water Based Alkyd Urethane Enamel Semi-Gloss, B53-1150 Series.
 - 3) 3rd Coat: S-W Pro Industrial Water Based Alkyd Urethane Enamel Semi-Gloss, B53-1150 Series (4.0-5.0 mils wet, 1.4 - 1.7 mils dry per coat).

PART 3 EXECUTION

3.1 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared; notify Architect of unsatisfactory conditions before proceeding. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding. On Interior hollow metal doors, if the factory primer is unsatisfactory, contractor must remediate substrate and apply new primer, prior to proceeding with the work.
- B. Proceed with work only after conditions have been corrected and approved by all parties, otherwise application of coatings will be considered as an acceptance of surface conditions.
- C. Previously Painted Surfaces: Verify that existing painted surfaces do not contain lead based paints, notify Architect immediately if lead based paints are encountered.

3.2 SURFACE PREPARATION

- A. General: Surfaces shall be dry and in sound condition. Remove oil, dust, dirt, loose rust, peeling paint or other contamination to ensure good adhesion.
 1. Prior to attempting to remove mildew, it is recommended to test any cleaner on a small, inconspicuous area prior to use. Bleach and bleaching type cleaners may damage or discolor existing paint films. Bleach alternative cleaning solutions are advised.
 2. Remove mildew before painting by washing with a solution of 1 part liquid household bleach and 3 parts of warm water. Apply the solution and scrub the mildewed area.

Allow the solution to remain on the surface for 10 minutes. Rinse thoroughly with clean water and allow the surface to dry before painting. Wear protective glasses or goggles, waterproof gloves, and protective clothing. Quickly wash off any of the mixture that comes in contact with your skin. Do not add detergents or ammonia to the bleach/water solution.

3. Remove items including but not limited to thermostats, electrical outlets, switch covers and similar items prior to painting. After completing painting operations in each space or area, reinstall items removed using workers skilled in the trades involved.
 4. No exterior painting should be done immediately after a rain, during foggy weather, when rain is predicted, or when the temperature is below 50 degrees F (10 degrees C), unless products are designed specifically for these conditions. On large expanses of metal siding, the air, surface and material temperatures must be 50 degrees F (10 degrees F) or higher to use low temperature products.
- B. Aluminum: Remove all oil, grease, dirt, oxide and other foreign material by cleaning per SSPC-SP1, Solvent Cleaning.
- C. Galvanized Metal: Clean per SSPC-SP1 using detergent and water or a degreasing cleaner to remove greases and oils. Apply a test area, priming as required. Allow the coating to dry at least one week before testing. If adhesion is poor, Brush Blast per SSPC-SP16 is necessary to remove these treatments.
- D. Steel: Structural, Plate, And Similar Items: Should be cleaned by one or more of the surface preparations described below. These methods are used throughout the world for describing methods for cleaning structural steel. Visual standards are available through the Society of Protective Coatings. A brief description of these standards together with numbers by which they can be specified follow.
1. Solvent Cleaning, SSPC-SP1: Solvent cleaning is a method for removing all visible oil, grease, soil, drawing and cutting compounds, and other soluble contaminants. Solvent cleaning does not remove rust or mill scale. Change rags and cleaning solution frequently so that deposits of oil and grease are not spread over additional areas in the cleaning process. Be sure to allow adequate ventilation.
 2. Hand Tool Cleaning, SSPC-SP2: Hand Tool Cleaning removes all loose mill scale, loose rust, and other detrimental foreign matter. It is not intended that adherent mill scale, rust, and paint be removed by this process. Before hand tool cleaning, remove visible oil, grease, soluble welding residues, and salts by the methods outlined in SSPC-SP1.
 3. Power Tool Cleaning, SSPC-SP3: Power Tool Cleaning removes all loose mill scale, loose rust, and other detrimental foreign matter. It is not intended that adherent mill scale, rust, and paint be removed by this process. Before power tool cleaning, remove visible oil, grease, soluble welding residues, and salts by the methods outlined in SSPC-SP1.
 4. White Metal Blast Cleaning, SSPC-SP5 or NACE 1: A White Metal Blast Cleaned surface, when viewed without magnification, shall be free of all visible oil, grease, dirt, dust, mill scale, rust, paint, oxides, corrosion products, and other foreign matter. Before blast cleaning, visible deposits of oil or grease shall be removed by any of the methods specified in SSPC-SP1 or other agreed upon methods.
 5. Commercial Blast Cleaning, SSPC-SP6 or NACE 3: A Commercial Blast Cleaned surface, when viewed without magnification, shall be free of all visible oil, grease, dirt, dust, mill scale, rust, paint, oxides, corrosion products, and other foreign matter, except for staining. Staining shall be limited to no more than 33 percent of each square inch of surface area and may consist of light shadows, slight streaks, or minor discoloration caused by stains of rust, stains of mill scale, or stains of previously applied paint. Before blast cleaning, visible deposits of oil or grease shall be removed by any of the methods specified in SSPC-SP1 or other agreed upon methods.
 6. Brush-Off Blast Cleaning, SSPC-SP7 or NACE 4: A Brush-Off Blast Cleaned surface,

when viewed without magnification, shall be free of all visible oil, grease, dirt, dust, loose mill scale, loose rust, and loose paint. Tightly adherent mill scale, rust, and paint may remain on the surface. Before blast cleaning, visible deposits of oil or grease shall be removed by any of the methods specified in SSPC-SP 1 or other agreed upon methods.

7. Power Tool Cleaning to Bare Metal, SSPC-SP11: Metallic surfaces that are prepared according to this specification, when viewed without magnification, shall be free of all visible oil, grease, dirt, dust, mill scale, rust, paint, oxide corrosion products, and other foreign matter. Slight residues of rust and paint may be left in the lower portions of pits if the original surface is pitted. Prior to power tool surface preparation, remove visible deposits of oil or grease by any of the methods specified in SSPC-SP1, Solvent Cleaning, or other agreed upon methods.
 8. Near-White Blast Cleaning, SSPC-SP10 or NACE 2: A Near White Blast Cleaned surface, when viewed without magnification, shall be free of all visible oil, grease, dirt, dust, mill scale, rust, paint, oxides, corrosion products, and other foreign matter, except for staining. Staining shall be limited to no more than 5 percent of each square inch of surface area and may consist of light shadows, slight streaks, or minor discoloration caused by stains of rust, stains of mill scale, or stains of previously applied paint. Before blast cleaning, visible deposits of oil or grease shall be removed by any of the methods specified in SSPC-SP1 or other agreed upon methods.
 9. High- and Ultra-High Pressure Water Jetting for Steel and Other Hard Materials: SSPC-SP12 or NACE 5: This standard provides requirements for the use of high- and ultra-high pressure water jetting to achieve various degrees of surface cleanliness. This standard is limited in scope to the use of water only without the addition of solid particles in the stream.
 10. Water Blasting, SSPC-SP12/NACE No. 5: Removal of oil grease dirt, loose rust, loose mill scale, and loose paint by water at pressures of 2,000 to 2,500 psi at a flow of 4 to 14 gallons per minute.
- E. Factory Primed Hollow Metal Doors and Frames: Must be clean, dry, and no visible sheen. Factory primers may be compromised during transport and or installation. Any exposed metal should be spot primed especially when top coats are water based. Any factory primed surfaces that exhibit a sheen should be dulled to ensure adequate adhesion of the top coat. Consideration should be taken when abrading factory primed surfaces not to expose any additional bare metal, if bare metal is exposed, spot prime. Once factory primed surface is dulled to ensure adequate adhesion and spot primed, prime entire door surface.

3.3 INSTALLATION

- A. Apply all coatings and materials with the manufacturer's specifications in mind. Mix and thin coatings according to manufacturer's recommendations.
- B. Do not apply to wet or damp surfaces. Wait at least 30 days before applying to new concrete or masonry. Or follow manufacturer's procedures to apply appropriate coatings prior to 30 days. Test new concrete for moisture content. Wait until wood is fully dry after rain or morning fog or dew.
- C. Apply coatings using methods recommended by manufacturer.
- D. Uniformly apply coatings without runs, drips, or sags, without brush marks, and with consistent sheen.
- E. Apply coatings at spreading rate required to achieve the manufacturers recommended dry film thickness.
- F. Regardless of number of coats specified, apply as many coats as necessary for complete hide, and uniform appearance.

- G. Inspection: The coated surface must be inspected and approved by the Architect just prior to the application of each coat.

3.4 PROTECTION

- A. Protect finished coatings from damage until completion of project.
- B. Touch-up damaged coatings after substantial completion, following manufacturer's recommendation for touch up or repair of damaged coatings. Repair any defects that will hinder the performance of the coatings.

END OF SECTION

SECTION 10 26 00 – WALL PROTECTION AND HANDRAILS

PART 1 GENERAL

1.1 RELATED DOCUMENTS:

- A. General Contract Provisions and Sections of Division 1 apply to Work of this Section.
- B. Architectural Drawings; Enlarged Plans and Equipment Manual

1.2 DESCRIPTION OF WORK:

- A. Review the Architectural Enlarged Plans or Equipment Plans for locations of corner guards, crash rails, sheet wall protection and handrails.

1.3 SUBMITTALS:

- A. Manufacturer's Data: Submit copies of manufacturer's detailed technical data for materials, fabrication and installation. Include catalog cuts of hardware, anchors, fastenings, and accessories.
- B. Samples: Submit samples of handrails and corner guards in color selected.
- C. Submit plan for approval showing all locations of wall protection; identifying all corner guards, wall guards and sheet wall protection to be used in each location.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING:

- A. Deliver handrails, corner guards, sheet wall protection, and crash rails in manufacturer's original unopened protective packaging.
- B. Store to prevent soiling and physical damage.
- C. Maintain protective covers on units until installation is complete.

1.5 COORDINATION:

- A. All work under this Section shall be coordinated with that of other trades or contracts whose work affects or is affected by work included herein
- B. Coordinate with Metal Framing and Interior Gypsum Board as blocking is required along entire length of handrails and crash rails.

1.6 MEASUREMENTS:

- A. Take all necessary measurements at the building to assure proper fitting and fabrication of all handrail, corner guard, and crash rail work. All variations of adjacent construction shall be taken into account and properly provided for.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. InPro Corporation.
- B. Construction Specialties, Acrovyn

2.2 PLASTIC CORNER GUARDS:

- A. Where indicated on the Architectural Enlarged Plans, provide corner guard or partition end-cap with 2" wing. Corner guard or partition end-cap can either be recessed or surface mounted. Review Wall Protection details in the Architectural Drawings for this information. Review with Architect if information is not available. Color and finish to be selected by Architect.
- B. Each corner guard shall provide the following:
 - 1. Self-extinguishing combustibility rating as per ASTM D635.
 - 2. Continuous Extruded aluminum retainers of .063" thickness including attachment hardware shall be furnished for attachment to wall and to complete the assembly.
 - 3. Structural, color-coordinated closures of high-impact nylon shall be furnished to close off top and bottom of surface mounted wall guards.
 - 4. Guards shall be securely locked in place and shall provide for free-floating action to absorb heavy impact without damage to guard, retainer or adjacent wall.
 - 5. Corner guards shall be straight and true over full length.

2.3 PLASTIC HANDRAILS:

- A. Where indicated on the Architectural Enlarged Plans, provide handrails. Review Wall Protection details in the Architectural Drawings for additional information. Color and texture to be selected by Architect.
- B. Plastic handrails shall be IPC model #1200 as manufactured by InPro Corporation or approved equal.
- C. Each handrail shall provide the following:
 - 1. Self-extinguishing combustibility rating as per ASTM D635.
 - 2. Handrail profile shall be designed to comply with all national building code requirements with respect to handgrip, size, wall setback, projection into corridor and point loading.

3. Handrails shall be securely snapped in place over retainer and provide for shock absorbing movement under impact. Color coordinated end caps and brackets shall be furnished to complete the assembly.
4. Each handrail system shall be permanently affixed to wall through mounting brackets with fasteners positioned maximum 32" o.c.

2.4 PLASTIC CRASH RAILS:

- A. Where indicated on the Architectural Enlarged Plans, provide handrails. Review Wall Protection details in the Architectural Drawings for additional information. Color and texture to be selected by Architect.
- B. Plastic crash rails shall be IPC model 1400 4" rails as manufactured by InPro Corporation or approved equal.
- C. Each crash rail shall provide the following:
 1. Self-extinguishing combustibility rating as per ASTM D635.
 2. Crash Rails shall be securely snapped in place over retainer and provide for shock absorbing movement under impact. Color coordinated end caps and brackets shall be furnished to complete the assembly.
 3. Each crash rail system shall be permanently affixed to wall through mounting brackets with fasteners positioned maximum 32" o.c.
 4. Crash Rails to be straight and true over entire length.

2.5 PLASTIC SHEET WALL PROTECTION:

- A. Where indicated on the Architectural Enlarged Plans, provide sheet wall protection. Review Wall Protection details in the Architectural Drawings for additional information. Color and finish to be selected by Architect.
- B. Install cap strip at all exposed edges. Color match to material being used.
- C. Use all manufactures approved trims for joining/trimming panels.
- D. Vertical seaming of panels is not permitted.

PART 3 - EXECUTION

3.1 INSTALLATION:

- A. Install all corner guards, crash rails and sheet wall protection plumb and level in strict accordance with manufacturer's data and installation recommendations. All handrails and crash rails shall be securely anchored in blocking in wall.
- B. Vertical seaming of sheet wall protection is not permitted, therefore contractor to verify lengths required prior to ordering product. For lengths exceeding standard sheet length, contractor to order "roll" or "coiled" product. The use of sheet products is permitted as long as it does not require vertical seaming.

END OF SECTION 10 26 00.

SECTION 10 28 00 – TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

- A. General Contract Provisions and Sections of Division 1 apply to Work of this Section.

1.02 DESCRIPTION OF WORK:

- A. Provide toilet accessories as scheduled and shown on the Drawings and generally as specified herein.
- B. See Drawings for locations and consult the Project Manual Section 'EQ A' for detailed description of items of work.

1.03 RELATED WORK SPECIFIED ELSEWHERE:

- A. Section 06 10 00: Rough Carpentry
- B. Section 09 20 00: Plaster and Gypsum Board
- C. Section 09 30 13: Ceramic Tiling
- D. Section 09 90 00: Painting and Coating
- E. Equipment Manual

1.04 QUALITY ASSURANCE:

- A. Products: Provide products of the same manufacturer for each type of accessory unit exposed in the same areas wherever possible. Coordinate with the Architect for acceptable design and finishes.
- B. Stamped names or labels on exposed faces of units will not be permitted.
- C. Provide locks where standard feature of specified accessory, with the same keying for all accessory units wherever possible.

1.05 SUBMITTALS:

- A. Submit copies of manufacturer's specifications and installation instructions for each toilet accessory. Indicate by transmittal form that copies of installation instructions have been distributed to the Installer.
- B. Samples: When requested, submit full-size samples of units to Architect.

PART 2 - PRODUCTS

2.01 MATERIALS:

- A. Stainless Steel: AISI, Type 302/304. Provide No. 4 polish finish, or as otherwise specified.
- B. Brass: Cast or forged quality alloy, FS WW-P-541.

- C. Sheet Steel: Cold rolled, commercial quality, ASTM A366. Surface preparation and metal pretreatment as required for applied finish.
- D. Chromium Plating: Nickel and chromium electro-deposited on metal, ASTM B456, Type SC 2.
- E. Galvanized Steel Mounting Devices: Hot-dip galvanized after fabrication ASTM A386.

2.02 MANUFACTURE:

- A. Accessories shall be as specified in the 'A' Section of the Equipment and Schedules Manual. Equal products of other manufacturers approved by the Architect will be acceptable.

PART 3 - EXECUTION

1.01 INSPECTION:

- A. Installer must examine the areas and conditions under which toilet accessories are to be installed. Notify the Contractor in writing of conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in an acceptable manner.

1.02 INSTALLATION:

- A. Use concealed fastenings wherever possible.
- B. Provide anchors, bolts and other necessary fasteners and attach specialties securely to walls and partitions in locations as shown or directed.
- C. Install concealed mounting devices and fasteners fabricated of the same materials as the specialties or of galvanized steel.
- D. Install exposed mounting devices and fasteners finished to match the specialties.
- E. Provide theft-resistant fasteners for all accessory mountings.
- F. Secure toilet and bath accessories to adjacent walls and partitions complying with the manufacturer's instructions for each item and each type of substrate construction.

END OF SECTION 10 28 00.

SECTION 10 44 16 - FIRE EXTINGUISHERS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

- A. General Contract Provisions and Sections of Division 1 apply to Work of this Section.

1.02 WORK SUMMARY:

- A. Furnish and install all fire extinguisher cabinets in locations indicated on the Drawings, and as specified herein.

1.03 RELATED WORK SPECIFIED ELSEWHERE:

- A. Sections 09 20 00: Recesses in gypsum wallboard walls for building in cabinets.

1.04 QUALITY ASSURANCE:

- A. Approved Manufacturers:
 - 1. Potter Roemer.
- B. Codes:
 - 1. All work shall conform to OSHA regulations.
- C. Standards:
 - 1. The National Fire Protection Association, Standard #10, latest edition.
 - 2. Underwriters Laboratories, Inc.

1.05 SUBMITTALS:

- A. Manufacturer's Data: Submit manufacturer's catalog cuts for fire extinguisher cabinets specified indicating type, cabinet material, door, trim and installation requirements.

PART 2 - PRODUCTS

2.01 FIRE EXTINGUISHER CABINETS:

- A. Potter Roemer "Loma" Series, Model No. 7320-BA-6-VR, or equal compatible with type ABC fire extinguisher specified below.

2.02 FIRE EXTINGUISHERS:

- B. Fire Extinguishers: Heavy duty steel cylinder, metal valve and siphon to be replaceable molded valve seal. Pull pin, upright squeeze grip operation. UL rating in accordance with the Underwriter's Laboratories Inc.. Provide 10lb, Type ABC

PART 3 - EXECUTION

3.01 GENERAL:

- 1. After extinguishers have been set in place this Contractor shall tag all extinguishers with date of installation and first inspection.

END OF SECTION 10 44 16.

SECTION 11 70 00 - HEALTHCARE EQUIPMENT

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

- A. General Contract Provisions and Sections of Division 1 apply to Work of this Section.

2.02 DESCRIPTION:

- A. Healthcare equipment includes but is not limited to the following items of work listed herein. Consult the Drawings and Equipment Specifications, where provided, for locations; description; and connectivity responsibilities of equipment items.
- B. It will be the responsibility of the Contractor to receive, set and connect-in-place the equipment at the required location.
- C. The Contractor shall protect the equipment after being set, cleared, tested and put into complete working order before final acceptance.
- D. During and upon completion of the installation the Contractor shall avail himself of the services of a competent representative provided by the manufacturer (s) to instruct in the installation, proper maintenance and operation of the equipment.

2.03 RELATED WORK SPECIFIED ELSEWHERE:

- A. Section 06 20 00: Finish Carpentry.
- B. Section 09 20 00: Plaster and Gypsum Board
- C. Section 09 51 13: Acoustical Panel Ceilings.
- D. Section 10 28 00: Toilet accessories.
- E. Division 22/23: Medical gas, HVAC, and plumbing systems.
- F. Division 26: Electrical systems.
- G. The plumbing, heating, ventilating and air conditioning and electrical trades shall provide the necessary roughing, installation, etc. and shall make all connections to the medical equipment, including the installation and connection of piping and control.
- H. Water, steam, waste, ventilation, shut-off valves, vents, lines, switches and wiring etc. shall be executed under the respective trade sections of the specification.

2.04 SUBMITTALS:

- A. Manufacturer's Data: Submit copies of manufacturer's data for materials, fabrication and installation. Include catalog cuts of hardware, anchors, fastenings, and accessories.

- B. Shop Drawings: Submit shop drawings for fabrication and erection of miscellaneous specialty items which are not fully described in manufacturer's data. Show all anchorage and accessory items.

A.

2.05 PRODUCT DELIVERY, STORAGE AND HANDLING:

- A. Deliver items in manufacturer's original unopened protective packaging.
- B. Store to prevent soiling and physical damage.
- C. Maintain protective covers on units until installation is complete.

A.

2.06 COORDINATION AND MEASUREMENTS:

- A. Take all necessary measurements at the building to assure proper fitting and fabrication of all work. All variations of adjacent construction shall be taken into account and properly provided for. All work under this Section shall be closely coordinated with that of other trades whose work affects or is affected by the work included herein to assure complete assemblies and installations with clear understanding of separations of contract responsibilities.
- B. Coordinate locations of all required embedded items.

2.07 GENERAL REQUIREMENTS:

- A. The Contractor shall assume all responsibility for the equipment, its handling , distribution to its proper location, and allocation to trade, protection and setting in place, and assume the cost of handling if claimed by any of his contractors having jurisdiction. After each piece of equipment is delivered to its proper room location, the required connecting shall be performed by the respective mechanical and electrical contractors, so that all equipment is completely installed and ready to use.
- B. The Contractor shall be responsible for setting and installing all filler panels, closure panel's grilles, etc, which will be furnished together with the equipment.
- C. Colors and finishes shall be as selected by the Architect.
- D. Contractor shall furnish the following for all items of equipment included in this Section:
 - 1. Manufacturer's Warranty.
 - 2. Furnish owner with maintenance, assembly, operations and instruction manuals.

PART 2 - PRODUCTS

SEE DRAWINGS AND EQUIPMENT MANUAL

END OF SECTION 11 70 00.

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RAYMOND/RAYMOND ASSOCIATES
SECTION 11 40 00 - FOOD SERVICE EQUIPMENT

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

- A. Work of this Section shall conform to the requirements of the Contract Documents including drawings and general provisions of the Contract, General and Supplementary Conditions and Division 01 Specification Sections.

1.02 BIDS

- A. Unless otherwise noted, Kitchen Equipment Contractor (KEC) is a sub-contractor to the General Contractor (GC) and is to provide and install all items listed in this section and as detailed on food service drawings.
- B. Any denotation to specific trade responsibility (ie: Kitchen Equipment Contractor (KEC), Electrical Contractor (EC), Plumbing Contractor (PC), etc.) mentioned shall fall under the scope of the General Contractor (GC). The GC is responsible to hire all necessary sub-contractors.
- C. Raymond/ Raymond Associates is herein identified as the Food Service Consultant.
- D. Bids must be based on equipment of manufacturers specified; no substitution will be accepted after award of Contract.
- E. Substitutions: When a product or material is specified by name and or model number, as noted in these specifications, such specifications establishes the standard type and quality considered most satisfactory for the particular purpose in the building. The bid proposal therefore should be based thereon, so that all bidders bid under the same conditions. Another product or material of the same type that meets the requirements

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may be submitted for consideration as a substitute only under the following conditions:

1. Requests for substitution must be submitted in writing at least ten (10) days before the date set for the receipt of bids for review and approval by the design professional. If the substitution is found to be equivalent, all bidders will be notified prior to the receipt of bids.
 2. In providing substitution requests, the bidder must prove equivalence of the substitution and furnish detailed specifications and catalog cuts or drawings. Failure to identify exceptions or deviations from equipment specified must be interpreted to indicate that the product offered complies with the specification in every respect.
- F. Owner, Architect and Food Service Consultant reserves right to waive any informality, or reject any or all bids and any parts thereof, or to accept that bid as a whole or part that in his judgment is for the best interest of Owner. All bids to have on Contractor's letterhead itemized cost of each item of equipment, otherwise bid will be rejected.
- G. Custom fabrication, millwork, equipment, etc. must be built by a company continually in business for at least a 5-year period.
- H. Contract documents convey a method of construction for custom fabrication; however this may or may not be the appropriate method based on selected fabricators industry knowledge and standards. It will be the responsibility of the selected fabricator to interpret and apply appropriate methods of construction for full functionality of custom fabrication.

1.03 WORK INCLUDED

- A. KEC shall coordinate with other trades or sub-contractors in order that whole installation may result in the highest grade possible.

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- B. KEC shall provide and install only such valves, traps, faucets, shut-offs, reducing pressure valves, relief valves and other specialty items required within equipment and as hereinafter specified.
- C. KEC shall make all necessary cut-outs and knock-outs where required on equipment to accommodate electrical receptacles, switches or other electrical outlets and equipment, together with such cut-outs as required for passage of gas or plumbing piping, etc.
- D. KEC shall stack and remove rubbish waste material, crating, etc., resulting from work and keep the premises clean at all times. Upon completion of the installation, thoroughly and finally clean all equipment ready for use.

1.04 POWER AVAILABLE

- A. Electric Voltage: 120/208/480 volt, 60 cycle, 1 & 3 ph.
- B. Water Pressure: Typical Food Service Equipment range 25 to 90 PSI, if required, pressure reducing valves provided by Plumbing Contractor.
- C. Water Temperature(s):
 - 1. 110°-120° Fahrenheit max at hand washing sinks, work sinks and preparation sinks.
 - 2. 120°-140° Fahrenheit max at 3-compartment pot sink, dishwashers and hose reel assembly.
 - 3. 110°-120° Fahrenheit max at cooking equipment with faucet assembly.
- D. Gas Pressure: Typical Food Service Equipment range 5" W.C. to 10" W.C., if required, a gas pressure reducing valve at main feed, prior to equipment connection, to be provided by Plumbing Contractor.

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1.05 GENERAL CHARACTERISTICS OF EQUIPMENT

A. Electrically Operated

1. Electrically operated equipment to be listed by Underwriters Labs., Inc.
2. Motors: Up to and including 3/4 horsepower, shall be 120/60/1.
3. Motors: Over 3/4 horsepower, 208/60/3, unless otherwise indicated.
4. Ranges, food warmers, etc., over 2.0 kW, 208/60/1 or 208/60/3, unless otherwise indicated.
5. Electrically heated equipment, etc., 2.0 kW and under, 120/60/1.
6. 1 ph. electrical plug-in units with 3 wire cords; 3 wire cap.
7. 3 ph. electrical plug-in units with 4 wire cords; 4 wire cap.
8. Motor driven equipment: equipped with starting switch.
9. Motors: equipped with overload protection.
10. Wiring on fixtures, including operating switches and pilots, furnished by Kitchen Equipment Contractor.

B. Submit in writing to Architect and Food Service Consultant for approval, schedule showing proposed electrical characteristics of each piece of equipment and disconnect means provided.

C. Punch holes for, and install hood and walk-in cooler/freezer lights and concealed conduits. The interconnection of same, including control switch, wiring, inter-wiring between sections, etc., by Electrical Contractor.

1.06 WORK EXCLUDED FROM THIS DIVISION

A. The following work is to be performed by other trades or sub-contractors and is not the responsibility of the Kitchen Equipment Contractor. The GC is responsible to hire all necessary sub-contractors.

1. Electrical Contractor

- a. Make connections to all food service equipment as shown.
- b. Furnish disconnect switches.

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- c. Interconnecting of all exhaust hood lights, switches, control packages, interfaces, etc. including inter-wiring between sections of exhaust hoods.
- d. Interconnecting of control switches as required on equipment shown, and all other components which come as part of any equipment shown on plan.
- e. Interconnecting of any equipment, including, but not limited to, walk-in coolers/ freezers monitoring, exhaust hood monitoring and/ or fire protection monitoring with building management systems.
- f. Review all manufacturer approved installation methods/ diagrams and comply for proper installation of equipment being furnished.

2. Plumbing Contractor

- a. Make hot and cold water, waste and gas connections to all kitchen equipment shown, furnishing all necessary shut-offs, traps, backflow preventers, vacuum breakers, grease traps, drain line runs, etc.
- b. Install all faucets, pot fillers, filters and pressure regulators as furnished by Kitchen Equipment Contractor.
- c. Interconnecting of any and all other components that come as part of any other equipment shown.
- d. Provide floor drains and floor sinks where shown and indirect piping to floor drains and floor sinks as indicated on drawings.
- e. Review all manufacturer approved installation methods/ diagrams and comply for proper installation of equipment being furnished.

3. Ventilation Contractor

- a. Furnish size, shape and location of vent collars for exhaust hood and make connections to these collars.

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4. General Contractor

- a. Provide and/or coordinate all work to the floors, walls and ceilings of the space.
- b. Provide wall blocking where required and as indicated on food service drawings.

1.07 SUB-CONTRACTORS TO KITCHEN EQUIPMENT CONTRACTOR

- A. Fire Protection Contractor for the wet chemical protection system within exhaust hood systems only and Refrigeration Contractor for the remote refrigeration packages for walk-in coolers/ freezers, rack systems, etc. are typical sub-contractors to the Kitchen Equipment Contractor.
- B. KEC to provide the name and addresses of all sub-contractors furnished to Architect/Owner and Food Service Consultant at time of submitting shop drawings. Selection of sub-contractors must be approved by them; and if in their judgment any fail to prosecute work in strict accordance with drawings and contract, after due notice from Owner or his agent, shall discharge same, but this in no way releases Kitchen Equipment Contractor from his obligations and responsibility under the contract.
- C. Every sub-contractor bound by terms and provisions of the contract so far as applicable to his work. Nothing contained herein shall create any contractual relations between any sub-contractor and Owner.
- D. Kitchen Equipment Contractor fully responsible to Owner for acts and omissions of his/ her sub-contractors.

1.08 SHOP DRAWINGS, ETC.

- A. Immediately upon award of Contract and within 4 weeks, submit to Architect/Owner and Food Service Consultant, drawings for approval. Submit 1/4" scale rough-in drawings showing locations of plumbing and electrical connections with all requirements indicated at point of

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connection; use of a legend or numbered connection plan will be cause for drawing rejection. Prior to fabrication, submit to Architect for approval 1/2" scale shop drawings showing plan, elevations and isometric views covering all items of work. Drawings to show dimensions and details of construction, installation and relations to adjoining and related work where same requires cutting or close fitting. Show reinforcement, anchorage, etc., required for complete installation. After correction and approval of above, submit sets for record, then afterwards as many additional copies as required by client.

- B. Submit in same manner as above, drawings showing masonry bases, depressed floors, positions of walls, requirements for ceiling hangers, wall blocking, and any other special conditions necessary for complete and correct correlation of various trades for satisfactory installation of all equipment shown on drawings.
- C. Manufacturer's names, cuts, descriptive data, analysis of tests, rated capacities and other information necessary for approval of standard manufactured articles and equipment furnished to Architect/Owner and Food Service Consultant for approval before ordering or purchasing. This submission made in same manner as above. All cuts marked with item number, mechanical characteristics, accessories furnished and bound in folders.

1.09 GENERAL

- A. No machine or equipment acceptable from any manufacturer not having had equipment of approximately the same type and design as that specified operating successfully for at least 5 years. Machines installed for test purposes shall not come within the category of successful commercial operation.
- B. Architect/Owner and/or Food Service Consultant privileged to inspect material and fabrication at Kitchen Equipment Contractor's or its sub-contractors factory at any time.

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- C. Before proceeding with shop work, Kitchen Equipment Contractor to verify all measurements at premises. Where required dimensions are not immediately obtainable and delay in waiting for these dimensions would cause work to be seriously delayed, the matter shall be referred to Architect for a decision. In obtaining measurements, Kitchen Equipment Contractor shall consider work requirements of other trades and equipment designed and fabricated to provide necessary clearance for surrounding and adjoining work.
- D. Kitchen Equipment Contractor responsible for making any and all necessary adjustments to complete his work in a workmanlike manner, as approved by Architect/Owner.
- E. Dimensions as indicated on drawings and specifications are approximate, and are to be adjusted if and where necessary to suit job conditions and field measurements.
- F. Tops of tables, shelves, tops and exterior panels of cabinets, counters, doors, drainboards, etc., to be constructed of a single sheet of metal. Where size of equipment requires more than 1 sheet of metal, sheets butt joined with joints continuously welded full length. No joints less than 18" from an edge or end of a piece of equipment. In addition, all joints shall have battens or stiffeners welded to jointed material, ground smooth and polished.
- G. Appliances of rigid construction free from objectionable vibration and quiet in operation.
- H. Electrical heating elements shall conform to latest standards of National Electrical Manufacturer's Association and Underwriters Labs., Inc., where applicable standards have been set up by such agencies.
- I. Motors of ample power to operate machines for which designated under full load operating conditions without exceeding nameplate ratings.

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Horsepower requirements on driven equipment determined by manufacturer, based on normal operation of maximum capacity.

- J. Motors drip-proof, splash-proof or totally enclosed type, having two-hour duty cycle and ball bearings (except small timing motors which may have sleeve bearings). All motors shall have windings impregnated to resist moisture. Motors located where adjacent to deposits of dust, lint, etc., totally enclosed type.
- K. It is the responsibility of the Kitchen Equipment Contractor to supply and mount all electrical outlets, switches, controls, etc. within table/counter back splashes, aprons, panels, etc. and to provide stainless steel cover plates as required. Furthermore, it is the responsibility of the Electrical Contractor, in coordination with the Kitchen Equipment Contractor, to make final interconnections within table/counter interior to junction boxes, outlets, switches, controls, etc. for equipment indicated.

1.10 STAINLESS STEEL (S.S.)

- A. Where S.S. is specified, it shall be Type 304, nickel bearing iron alloy, containing approximately 17.0% to 19% chromium, 8% to 10% nickel, not more than 0.2% carbon, and not more than 2.0% of other alloying elements; designed being austenitic (non-magnetic).
- B. S.S. free from scale with all surfaces polished to a high commercial finish. All welding and exposed welds hereinafter specified, must be ground down and polished smooth to a #4 finish so that no evidence of welding will appear. Unexposed welds on underside of counter or tables ground smooth and treated with an acid solution to remove weld discoloration and oxidization and to arrest corrosion.
- C. Undersides of all counters, work tables, sinks, drain boards, etc., after fabrication, to have one (1) heavy coat of sound deadening material applied as allowed by local codes.

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- D. Gauges for sheet iron and sheet metal, U.S. Standard.
- E. Rivets, welds, bolts, screws, nuts and washers to be steel except where brass or S.S. is fastened, in which case they shall be brass or S.S., respectively. Where dissimilar metals are fastened, welds, bolts, rivets, screws, nuts and washers, highest grade metal. Spacing and extent of welds, rivets, bolts and screws such as to insure suitable fastening and prevent bulging of metals fastened.

1.11 SANITATION

- A. All custom built equipment constructed in accordance with standard No. 2, 4 & 7 of National Sanitation Foundation Testing Laboratory, manufactured by a company approved by N.S.F. and carry their stamp of approval. Kitchen Equipment Contractor must have "Registered" numbered seal of N.S.F. approval.

1.12 OPERATING INSTRUCTIONS

- A. Kitchen Equipment Contractor shall leave all items of equipment in good, operating condition and furnish the services of a "qualified" competent manufacturer's representative to instruct Owner's employees in proper use and care of equipment. Representative on call for as long a period as is necessary to assure Owner that such instruction is thoroughly understood.
- B. Kitchen Equipment Contractor shall be responsible for scheduling of equipment demonstrations and/or training and shall provide a detailed list of expected dates, times and manufacturer's representative to be present (in attendance) for each piece of equipment.
- C. Kitchen Equipment Contractor or his qualified manufacturer's representative, thereafter, shall make all necessary calls during warranty period.

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1.13 SAMPLES

- A. After Award of Contract, when requested, Kitchen Equipment Contractor shall supply Architect with samples of fabricated equipment, such as corner of table with a rolled or inverted "V" edge, corner of dish table, overshef, drawer assembly, table leg with foot and gusset, or as specifically requested.

1.14 GUARANTEE

- A. Kitchen Equipment Contractor shall guarantee, as part of the bid and/or contract, workmanship, material and equipment for a period of 1 year from date of equipment final install and project turnover to Owner, and shall remedy any defect due to faulty workmanship or materials which may appear within guarantee period.
- B. Manufacturer's operation and maintenance manuals on equipment, etc., turned over to the Owner in duplicate, bound in a folder and marked accordingly.

1.15 EQUIPMENT CONSTRUCTION AND STANDARDS

- A. Where initials S.S. are used, they refer to "stainless steel;" C.P. refers to "chrome plated;" N.I.C. refers to "not in contract;" G.I. refers to "galvanized iron;" F.D. refers to "floor drain", and F.S. refers to "floor sink."

1.16 WASTES AND OVERFLOWS

- A. Sinks to have the following waste and overflow assemblies:
 - 1. For 1-1/2" NPT: Fisher model 74043 or approved alternate. Lever handle waste outlet with overflow assembly, 3-1/2" sink opening, self-centering stainless steel face flange with flat strainer, 12 gpm max flow rate, stainless steel lever handle with ball, overflow head

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with stainless steel faceplate and chrome plated cast red brass drain body.

2. For 2" NPT: Fisher model 74043 or approved alternate. Lever handle waste outlet with overflow assembly, 3-1/2" sink opening, self-centering stainless steel face flange with flat strainer, 12 gpm max flow rate, stainless steel lever handle with ball, overflow head with stainless steel faceplate and chrome plated cast red brass drain body.

1.17 WATER INLET LOCATION

- A. Located in all cases above the positive water level to prevent siphoning of liquid into water system. Wherever conditions require water inlet below such level, a suitable type of vacuum breaker shall be placed on fixture and form part of same to prevent such siphoning.
- B. All faucets furnished by Kitchen Equipment Contractor as specified. Traps furnished by Plumbing Contractor.

1.18 PITCH AND DRAINAGE

- A. Wherever a fixture is used with waste or drain outlet, surface shall have distinct pitch towards outlet. Drainboards and tables that contain or adjoin sinks shall have a definite pitch towards sinks. Where necessary, surfaces creased and grooved to give a definite pitch.

1.19 SINKS

- A. #14 gauge S.S. interior corners rounded to 1" radius horizontally and vertically, forming a cove in bottom. All joints butt edged. Sink sizes given, inside measurements.
- B. Bottom of each compartment creased to center and fitted with a rotary drain as described in section 1.16, hereinbefore specified. Waste lever

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not to protrude beyond body of sink. Sinks to have overflows installed by Kitchen Equipment Contractor.

- C. Overflow to consist of 1-1/2" chrome plated brass strainer plate, fitted in back of each compartment at proper level directly connected to waste outlet with 1-1/2" chrome plated brass pipe.
- D. Back of sink extended integrally approximately 12" above working level, back 2-1/4" on 45° angle towards rear and then flanged down 1" and punched to accommodate faucets.
- E. Front and both ends, unless otherwise specified and shown, finished on top edge, 3" above working level, with 1-1/2" diameter, 180° welded integral roll. Exterior corners rounded to a 2-1/2" radius, all integrally welded.
- F. Sinks and drainboards finished on front and back edges only and left with straight edge on ends, so that drainboards may be welded thereto, forming integral units with top edge of rolled rim curbing formed on one horizontal plane across front to unit though surfaces of drainboards pitched to sinks.
- G. Multiple compartment sinks divided with double wall #14 gauge S.S. partitions, all corners rounded same as corners in sinks, continuously welded in place.
- H. Back, bottom and front of one continuous piece with no overlapping joints or open spaces between compartments.

1.20 SINK BOWL BUILT INTO TABLE TOP

- A. Sink constructed integral with table top #14 gauge S.S. having all interior corners coved vertically and horizontally forming a cove in bottom. To have overflow, lever waste outlet, etc..., as hereinbefore specified for sinks in spec section 1.19.

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- B. All joints butt edged and welded, ground and polished, so that no evidence of welding will appear. All sink sizes inside measurements. Table top where shown, punched to receive deck type combination faucets, provided by Kitchen Equipment Contractor.

1.21 FAUCET AND BASKET DRAIN ASSEMBLY

- A. Sinks to have the following faucet assemblies:

- 1. 3-Compartment Sink, Potwash:

- a. 1 ea. Fisher model 74306 or approved alternate. Pre-Rinse assembly with 1.3 gpm flow rate or less, splash/ wall mount, 8" centers, add-on faucet 12" stainless steel tubular swing spout with 4" wrist blade handles, 36" flexible gooseneck hose with spray head, stainless steel spring with wall bracket, compression valves, 1/2" NPT female inlets, ADA compliant, NO LEAD and NSF approved. Deck mount assembly model 75485.
- b. 1 ea. Fisher model 60798 or approved alternate. Faucet with 2.2 gpm flow rate or less, splash/ wall mount with 4" wrist blade handles, 8" centers, 12" stainless steel tubular swing spout, compression valves, 1/2" NPT female inlets, ADA compliant, NO LEAD and NSF approved. Deck mount assembly model 57665.

- 2. 2-Compartment Sink, Preparation:

- a. 1 ea. Fisher model 57665 or approved alternate. Faucet with 2.2 gpm flow rate or less, deck mount with 4" wrist blade handles, 8" centers, 12" stainless steel tubular swing spout, compression valves, 1/2" NPT female inlets, ADA compliant, NO LEAD and NSF approved. Splash/ wall mount assembly model 60798.

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3. Work Sink (Built-in, Welded-In):

- a. 1 ea. Fisher model 57665 or approved alternate. Faucet with 2.2 gpm flow rate or less, deck mount with 4" wrist blade handles, 8" centers, 12" stainless steel tubular swing spout, compression valves, 1/2" NPT female inlets, ADA compliant, NO LEAD and NSF approved. Splash/ wall mount assembly model 60798.

4. Hand Sink:

- a. 1 ea. Fisher model 58696 or approved alternate. Faucet with 2.2 gpm flow rate or less, deck mount with 4" wrist blade handles, 4" centers, 6" stainless steel swivel gooseneck spout, compression valves, 1/2" NPT female inlets, ADA compliant, NO LEAD and NSF approved. Splash/ wall mount assembly model 62650.

- B. All plumbing fixtures shall be certified CSA, ASME A112.18.1/CSA B125.1, AB1953/HSC 116875, Vermont Bill S152, NSF/ANSI 61 sec 9, annex F and G, NSF/ANSI 372 low lead content, ASTM F2324.

1.22 NOT USED

1.23 TABLES WITH S.S. TOPS

- A. Tops of #14 gauge S.S. 1 piece construction with all edges turned down into 2" integral 180° roll with all corners rounded to 2" radius forming a bullnosed corner. Corner welded and polished smooth.
- B. Table tops thoroughly cross braced with 4" x 1" S.S. channel stiffeners #14 gauge welded to underside. All cross braces spaced not over 24" on center.

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- C. Table tops adjoining walls or adjacent equipment carried up approximately 6" and returned 1", down 1" at top and ends. Intersections of table top and raised edge coved to 1" radius. Where backsplash is exposed, it shall have finished S.S. back.
- D. It is the responsibility of the K.E.C. to supply and mount all electrical outlets, switches, controls, etc. within table/counter back splashes, aprons, panels, etc. and to provide S.S. cover plates as required. Furthermore, it is the responsibility of the Electrical Contractor, in coordination with the Kitchen Equipment Contractor, to make final interconnections within table/counter interior to junction boxes, outlets, switches, controls, etc. for equipment indicated, if required.

1.24 LEGS AND CROSSRAILS

- A. 1-5/8" O.D. #14 gauge S.S. tubular-type with S.S. bullet shaped feet having minimum vertical adjustment of 1-1/2" without showing threading or adjusting bolts. Feet fully enclosed on bottom. Adjustment of feet by means of a threaded shank attached to foot and screwed into a properly secured threaded member inside of leg. Construction of leg such that it shall fit over shank of foot so no liquid or other material can work their way into legs or foot.
- B. Tops of legs attached to enclosed conical gussets of heavy gauge S.S. Gussets welded to #14 gauge S.S. 4" x 1" channels to underside on which they appear. Crossrails 1-1/2" O.D. #14 gauge S.S. coped and welded to legs approximately 10" A.F.F. or as specified.

1.25 NOT USED

1.26 NOT USED

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1.27 UNDERSHELVES

- A. #16 gauge polished S.S. full length and width of table with all edges turned down into 2" wide channel. In way of table legs, shelf notched to fit contour of legs and fitted to same in neat, workmanlike manner to eliminate unsanitary crevices, fully welded, ground and polished.
- B. Undershelves reinforced on underside with welded 4" x 1" longitudinal channels of #14 gauge S.S. where applicable. All signs of welding on shelf surface removed.

1.28 DRAWERS

- A. Of #18 gauge S.S. all interior corners coved to a 1" radius both vertically and horizontally. All welds ground and polished to a uniform finish.
- B. Front of #14 gauge polished S.S. and will extend on both sides of drawer body to conceal slides, corners welded, ground and polished. Space between drawer front and body fully enclosed at bottom, back and both sides by means of a #20 gauge S.S. filler, spot welded to drawer front and body, to provide a fully sealed, vermin-proof enclosure. Drawer front provided with a 5" C.H.G. # P46-1010 S.S. pull handle fastened in place by means of a concealed screws.
- C. Drawer slides of #14 gauge S.S. fitted with 4 case hardened ball bearing rollers. Track attached to drawer is to have upper edge channel shaped to fit contour of roller rim to provide a positive drawer guide and prevent jarring. This drawer track firmly spot-welded to body. Outer track provided with auto stops to lock without the use of tools.
- D. Where specified, drawer provided with removable synthetic carving board. Carving board is to slide into enclosure under drawer made of #14 gauge S.S. and extending across underside of carving board, with both sides turned up and welded to slide assembly. The 2 sides provided with #14 gauge S.S. angles with stops at rear fastened in place 1/8" above top

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surface of carving board to provide guide and storage compartment when carving board is not in use. Carving board is to measure approximately 21" x 21" x 1" thick.

- E. Tool drawer 20" x 20" x 5" deep, bread drawer 20" x 20" x 10" deep. All drawers to have 4 pin paracentric keyed-alike built-in locks same as sliding and hinged doors. C.P. where exposed.

1.29 NOT USED

1.30 EXHAUST HOOD

- A. Exhaust Hood material, construction, etc. to be in conformance with IMC section 507.
- B. Dimensions approximately as shown on contract drawings and mounted at 80" A.F.F. to underside of hood. Final dimensions to be determined in field by Kitchen Equipment Contractor.
- C. Proper anchorages, etc..., installed in ceiling joists, slab, etc..., by Kitchen Equipment Contractor prior to final finish of ceiling.
- D. Body of #18 gauge stainless steel front, back and sides; straight as indicated on contract drawings. All joints to be flush welded. Where field joints occur, provide a pair of transverse frames, butted together and securely fastened following contour of hood structure.
- E. Bottom rim of hood attached to channel of #14 gauge STAINLESS STEEL with mitered welded corners and butted field joints. Cross section inside of channel to measure approximately 2-1/2" horizontally, flanged upward tightly against interior lining of hood.
- F. Above dishwashing machine, kettles and steamers or non-grease producing equipment, hood provided with sloped baffle at back arranged at 45° angle of #18 gauge stainless steel. Baffles to have sliding dampers

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of #16 gauge stainless steel mounted in #14 gauge stainless steel channel tracks. Each damper to have stainless steel handle fastened with concealed bolts.

- G. Above ranges, ovens, fryers, griddles, etc. or grease producing equipment, hood provided with built-in filters at back extending full length and arranged at an angle of 45° easily removable without use of tools. Filters to be approximately 20" x 20" x 2" thick, of STAINLESS STEEL and expanded metal construction or as further indicated on contract drawings. Filters set into #14 gauge STAINLESS STEEL filter frame, bottom of which is integrally installed with back of hood and grease gutter for easy cleaning. Quantity and size of openings in plenum chamber as indicated in contract documents.
- H. Hood(s) provided with STAINLESS STEEL hanger brackets, welded to top of hood, spaced not more than 36" on center.
- I. Section of hood below ceiling or soffit, enclosed with vertical facing of #18 gauge STAINLESS STEEL. Panels not to exceed 36" in width, easily removable where required, provided with recessed finger grip or similar. Where panels meet at vertical joints flanged inward 1" to form a hairline joint. Channel extended 2" beyond perimeter of hood and provided with concealed full length angle member of 2" x 2" x 3/16" G.I. with clips for bolting to hanger angles, spaced approximately 36" on center. Hanger angles attached to 2" x 2" x 3/16" angle frame fastened to ceiling slab. Panels held in place at ceiling with 2" x 2" x 1/8" STAINLESS STEEL angle trim all around.
- J. Hood(s) provided with recessed or flush vapor-proof LED light fixtures, approximately 12" X 12" style or 48" strip style, pre-mounted by manufacturer. Light fixture with bulb(s), as provided by specified exhaust hood manufacturer, refer to Part 2 Products. All wiring and interconnections by Electrical Contractor.

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- K. All exhaust hood controls, switches, etc... to be mounted @ 48" AFF. This is to be the maximum height allowed.
- L. All wiring and interconnections for controls, switches, fans, solenoid, shunt trips, etc... by Electrical Contractor. This includes any requirements to and from remote panels, switches and control packages.
- M. Must be tested and comply with the most current codes (or per local jurisdiction) UL-710, International Mechanical Code (IMC), and NFPA 96.

1.31 NOT USED

1.32 FIRE PROTECTION SYSTEM

- A. The system shall be a pre-engineered cartridge-operated type R-102 system utilizing Liquid Ansul agent, with a Fixed Nozzle distribution network. It shall be furnished and installed in compliance with UL Standard 1254, UL Standard 300, NFPA 96-2008 and any prevailing statutes or codes including automatic shut-down of all cooking appliances per code section 44 of NFPA 17A-27-2002.
- B. System to provide connection to building Fire Alarm System per NFPA 17A; Section 3-2.1.5.
- C. Fire protection remote pull stations mounted @ 48" AFF, located 10 ft. minimum to 20 ft. maximum from exhaust hood(s).
- D. The extinguishing agent shall be a specifically formulated aqueous solution of organic salts contained in a S.S. tank with 3 gallons minimum capacity, and able to withstand test pressure of 330 PSI. A welded S.S. bracket shall be provided for mounting the tank.
- E. The regulator releases mechanism shall be capable of providing sufficient expellant gas to discharge enough agent to meet the minimum nozzle discharge requirements. The mechanism shall have a visual indicator of

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"fired" condition. This mechanism shall be capable of being operated by fusible link detection, remote manual release and local manual release. The mechanism should be housed in a S.S. enclosure with cover containing identifications thereon.

- F. Each discharge nozzle to be listed with UL approval for placement and size. Each nozzle shall have a rubber blow-off cap to keep the nozzle tip orifice free of cooking grease build-up. All exposed piping to be chrome plated finish, and there shall be no exposed threads.
- G. Kitchen Equipment Contractor to furnish mechanical (electrical) gas valve, up to 3" in size and coordinate the install/provisions to shut-off all fuel supplies to all cooking appliances beneath Type I exhaust hood upon activation of system. If electrical gas valve is to be utilized, Kitchen Equipment Contractor to furnish reset relay push button.

It is the responsibility of the Plumbing Contractor to install, coordinate and make any provisions necessary for complete operation of gas valve.

It is the responsibility of the Electrical Contractor to furnish and install electrical wiring, relays, etc... and make any provisions necessary for complete operation of gas valve. In addition, Electrical Contractor to furnish and install automatic equipment necessary to shut-off all electric beneath Type I exhaust hood upon activation of system.

- H. Kitchen Equipment Contractor to furnish and install a Class K Fire Extinguisher, dedicated to each room where a Type I exhaust hood is installed.
- I. Upon completion of installation, the installer to perform a wet chemical test or at the time of the test, the authority having jurisdiction may allow the Contractor to use flushing concentrate and water solution. However, whichever is permitted, it must be in compliance with Code. This test shall activate the entire system, except the agent supply tank, which will be substituted by the test tank of like pressure and size. Following a

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satisfactory test, the original tank shall be replaced. The system shall then be certified to be in working order and all authorities shall be so advised in writing. Provide Owner with copies of all satisfaction/acceptance tests.

- J. The system to be furnished and installed by a factory distributor in accordance with the manufacturer's instructions. This shall include mounting of the system units, manual releases, nozzles, actuating devices, and the running of all pipe and control tubing applicable to the R-102 system. If and when requested, submittal drawings concerning the fire system shall have affixed the seal and signature of a licensed engineer for the State in which they are to be installed. A 1-year service contract and maintenance program to be provided.
- K. Kitchen Equipment Contractor is required to submit a copy of the hood suppression system shop drawing to the local authority having jurisdiction for approval, as well as submission to the Architect. In addition, shop drawings when submitted, must be signed and sealed by an engineer licensed to practice in the State where the system is to be installed.

1.33 NOT USED

1.34 NOT USED

1.35 NOT USED

1.36 NOT USED

1.37 NOT USED

1.38 NOT USED

1.39 SERVING COUNTER

- A. Of size and shape as shown. Top of #14 gauge polished S.S. rolled down in a 2" diameter 180° roll on all exposed edges with corners bullnosed,

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welded. Top secured to counter base by means of concealed S.S. studs, nuts and washers. Angle frame under top sheathed with sound deadening material.

- B. Base constructed with interior framing of 1-1/2" x 1 1/2" x 1/8" galvanized steel angle with all joints welded.
- C. Angle framework concealed on the interior with #18 gauge polished S.S. sheathing. Exterior facing of base cabinet and ends to have sheathing of Plastic Laminate paneling laminated to 3/4" thick solid core, exterior grade marine plywood, panel length not to exceed 36". Color and style of paneling selected by Architect. Each panel of length as indicated, full height of counter and splined hairline joints. Panels and trim secured to interior framing by means of concealed welded studs, nuts and washers. Or constructed of alternate materials as detailed on drawings.
- D. Interior of all available space provided with bottom and intermediate shelf of #16 gauge S.S. turned up approximately 2" at rear and ends, and down 1-1/2", and in 1/2" channel shape at front.
- E. Mounted on masonry base, height as indicated on drawings or 6" high 14 gauge S.S. legs with S.S. removable toe base, where indicated. All openings in top flanged downward approximately 1" around their entire perimeter. Top cut out for and provided with equipment as hereafter specified.
- F. It is the responsibility of the K.E.C. to supply and mount all electrical outlets, switches, controls, etc. within table/counter back splashes, aprons, panels, etc. and to provide S.S. cover plates as required. Furthermore, it is the responsibility of the Electrical Contractor, in coordination with the Kitchen Equipment Contractor, to make final interconnections within serving counter interior to junction boxes, outlets, switches, controls, etc. for equipment indicated, if required.

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1.40 SOLID SURFACE SERVING COUNTER

- A. Of size and shape as shown. Top of minimum 1/2" thick solid surface, silicone mounted to minimum 1/2" thick exterior grade plywood with ten year installation warranty. Solid Surface type, fabricated to comply with Solid Surface commercial specifications. Color and style of solid surface as selected by Architect. Top secured to counter base by means of concealed S.S. studs, nuts and washers. Angle frame under top sheathed with sound deadening material.
- B. Constructed identical to that as hereinbefore described in section 1.39.

1.41 NOT USED

1.42 NOT USED

1.43 NOT USED

1.44 NOT USED

1.45 NOT USED

1.46 NOT USED

1.47 COUNTER AND CABINETS WITH SEMI-ENCLOSED BASE

- A. Top of #14 gauge polished S.S. finished 1/2" above working level with 2" diameter 180° roll, bullnosed corners on all exposed sides. Where adjacent to wall, top carried up approximately 6" (or as specified hereinafter and shown) and returned 1" at top and ends towards wall with corners welded forming a continuous unit. Top fastened to cabinet by means of welded and concealed studs.
- B. Cabinet below top to have #18 gauge S.S. enclosure. Front stiles of cabinet channel shaped. This channel fully enclosed inside of cabinet.

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Top reinforced by means of horizontal framework of S.S. 1-1/2" x 1-1/2" x 1/8" angle with cross braces not more than 18" on center. Framework of all welded construction and intermediate shelves in cabinet of #16 gauge S.S. turned up on all sides to eliminate crevices at shelf surface. Front edge of shelf channel shaped. Shelf surface reinforced by means of #16 gauge S.S. channel stiffeners spaced on not more than 24" on center. Mounted on 6" S.S. adjustable legs, or as hereinbefore shown and specified.

1.48 NOT USED

1.49 DOORS

- A. Whether sliding or hinged type, not less than 1/2" thick overall, double paneled having 3/8" sound-deadening material between #16 gauge S.S. front and #18 gauge S.S. back, reinforced between panels by wide channels, running height of door and made of same material. Panels jointed with continuous welding. Doors and vent openings to have back panel boxed around vent opening and welded to front panel. Doors dust proof and entire front face without seams or joints.
- B. Sliding doors mounted on ball bearing type rollers, sliding in dust proof #14 gauge S.S. tracks overhead, fastened so as to eliminate vibration and jarring when doors are rolled. Doors fitted with limit stops. Bottom guide of #14 gauge S.S. for doors, open and flat, lining up with lower shelf of cabinet - slots so arranged that crumbs or dirt accumulating in the cabinet will drop to the floor when cabinet is cleaned. Recessed handles solid material, not stamped, of S.S. welded to front panel. Finger grips of ample depth to comfortably pull the door. Doors provided with keyed-alike S.S. faced cylinder locks, built-in flush.
- C. Hinged type doors flush fitting, unless otherwise specified, resting tightly against rabbetted frame. Hinged doors provided with Klein Model #Y-48 (or approved equal) keyed-alike S.S. faced cylinder locks with Model

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#12230-SM (or approved equal) handles. In case of pair of doors, each individually controlled as outlined and is to close against rubber bumpers.

- D. Outer edges smooth, free from burrs, projections and fins. Excess welded metal removed by precision grinding and polishing.

1.50 REFRIGERATORS AND REFRIGERATION UNITS

- A. Reach-in refrigerators, freezers, and refrigerated units, as shown unless otherwise specified, furnished by Kitchen Equipment Contractor. They shall meet all requirements as set forth for individual item number and complete with self-contained or remote compressors and motors. Cooling coils blower type, unless otherwise called for, provided with initial charge of approved CFC free refrigerant. Plumbing Contractor responsible for extending refrigerator drain line, where required, to spill into adjacent floor drain in approved manner. Extended drain line not less than 3/4" I.D. and C.P. or S.S. tubing.
- B. All refrigerated equipment, refrigerators and freezers, whether walk-in or reach-in, started and adjusted to maintain required temperatures, charged with approved refrigerant as required.
- C. All reach-in refrigerators, freezers, hot food warmers, etc., to have keyed-alike locks. Kitchen Equipment Contractor must request this at time of placing order to avoid correction at a later date at Kitchen Equipment Contractor's expense.
- D. Kitchen Equipment Contractor to provide 1 year's free service for all types of refrigerators and refrigeration equipment. Service to include all compressors, unit coolers, controls, etc., to include adjustments and repairs, irrespective of cause, whether mechanical, operational or manufacturing at no additional cost to Owner. Additionally, five (5) year warranty provided on all compressors, parts only or replacement.

1.51 NOT USED

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1.52 MILLWORK EQUIPMENT

- A. General Description: Woodwork to be minimum 3/4" marine grade plywood throughout. Woodwork counters shall be constructed to support the full weight of operating appliances without any deflection of the counter top. Where cut-outs are required in counter tops, appropriate framing needs to be provided around the cut-out to fully support the top in level position.

All miter joints shall be tight with no gaps or open spaces. Filling of miter joints with crack filler prior to finishing is not acceptable. Loose joints shall be hairline, flat, in single plane, with no exposed screws, nails or other fasteners. All dimensions, reveals and joints shall be held exact.

All fixtures shall be assembled in single and complete units as the dimensions will permit shipment to and installation at the building. Large pieces requiring sections construction shall have their parts accurately fitted and aligned with each other, and provided with ample screws, glue and bolt blocks, tongues, grooves and splines, dowels, mortises and tenons, screws, bolts or suitable means of concealed fastening, as required to render the work of substantial, rigid and permanently secured in proper position.

Sufficient additional material shall be allowed to permit accurate scribing to walls, floors and related work, and due allowance made wherever possible for such shrinkage as may develop after installation. Single and sectional units shall be provided with adequate cleating, blocking, crating and other forms of protection as required to prevent damage, soiling and deterioration during transit, delivery, storage and handling.

Framing and blocking members shall be assembled with bolted and screwed connection and should be secured to the structural backing with cinch, expansion screws or toggle bolts, as required; spaced and installed to ensure ample strength and rigidity. Rails and stiles shall be mortised and tenoned, work neatly mitered and membered, all butt joints made

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flush and smooth, and all permanent joints made up with water resistant glue. All fixtures shall be assembled without face screws or nails, except where it may be necessary to attach trim items. All face screws or nails that are necessary shall be countersunk and plastic wood or wood plugs used to cover head and the plug neatly touched up. The heads of all screws used in any assembly shall be countersunk below the surface.

- B. Joints: Mortise and tenon, spline, dowel and/or pin block and glue work to avoid use of nails wherever practical. Make butt joints with an approved device of prevention of separation of members. Blind nail and conceal.
- C. Plastic Laminate (HDPL): Plastic laminate shall be bonded to all exposed surfaces with contact cement fast bond #30, as manufactured by 3-M Products Company, or equal, to minimum 3/4" fir faced plywood applied under high pressure. Reject plastic laminate or plastic backing shall be used to prevent warping, unless otherwise specified. All edges shall be carefully sanded to smooth finish, removing burns, nicks and cut marks.
 - 1. Plastic laminate joints shall be finished without wavy and unsightly joints. Joints need not be mitered except if specified. Hand sand edges to a slight chamfer.
- D. Doors, Hinged: Hinged doors shall be fabricated of 3/4" thick plywood with plywood full perimeter edging with plastic laminate on face and self-edging on exposed sides. Door hinges, pulls and catches shall be supplied and installed as detailed. All doors to have minimum of 3 concealed, heavy duty, European hinges per section.
 - 1. Provide S.S. channel trim on the perimeter of the door to guard plastic laminate from chipping.
- E. Doors, Sliding: Sliding doors shall be fabricated of solid core plywood with hardwood edges and constructed similar to hinged doors. Doors shall be mounted on E-Z Glides track. Doors shall be removable without the use of tools. Rubber stops shall be provided concealed in end stile or mullion.

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- F. Doors, Tambour Sliding: Tambour sliding doors shall be fabricated of individual hardwood slats, 3/8" by 3/4" round on 2 edges and glued to 20 ounce duck canvas or reject elastic vinyl plastic or equal and shall be provided with hardwood end stile with integral door pull. Track shall be lined with laminated plastic or equally smooth surface and guides at top and bottom shall be fabricated hardwood. Provide lock-pin for sliding doors.
- G. Access Panels/Louver Panels:
 - 1. Access Panels: Shall be fabricated of 3/4" thick marine grade plywood and shall be fabricated to be removable for access. Each access panel shall be provided with 2 magnetic catches at top and (2) 3/16" positioning pins at bottom (unless otherwise specified or detailed on drawings).
 - 2. Louvered Panels: Are required in woodwork at all locations where proper ventilation is necessary for the efficient performance and operation (exhaust and/or supply) of the food service equipment compressor.

Types (when specified):

- a. Louvered panel spaced to conceal equipment yet provide adequate ventilation.
 - b. Kitchen Equipment Contractor to coordinate size, quantity and location of louvered opening for sufficient ventilation of food service equipment. Refer to drawing details for cut-outs and spacing.
 - 3. Unless otherwise directed, panels shall be powder coated to match laminate selection.
- H. Louvered Doors: Must have concealed hardware to resemble access panels. Doors to have nylon roller friction type heavy duty catch and heavy duty concealed S.S. adjustable hinge.

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1. Plastic laminate fronts: provide kiln dried pine shutter type slats. Wood to be free of knots with smooth grain, epoxy painted to match laminate selection. No raw wood surfaces will be acceptable. Paint or laminate as needed between slats.
 2. Slats to be fixed, positioned to conceal equipment from sight.
 3. Provide black color screening/mesh on rear of door with protective edges to prevent tearing.
- I. Drawers: Drawers shall have dovetail construction, well glued and blocked. Fronts shall be not less than 3/4" thick marine grade plywood. Sides and back shall be 1/2" thick fabricated of Birch, Maple or Sycamore except where extension slides are used, in which case the side shall be 5/8" thick. Bottom shall be milled into fronts and sides. Drawers shall be provided with suitable stops. Provide pulls as detailed or specified.
1. The inside surfaces of all drawers shall receive one coat of Penetrating Primer and one coat of glass lacquer.
- J. Painted Finishes: Painted finishes shall have exposed surfaces free from defects and blemishes that would show after being finished, regardless of grade specific. All surfaces specified to receive paint or enamel finish shall receive one crosscoat of lacquer type undercoat. The undercoat shall be of appreciable different color than that of the finish coat, and of proper ground color with relation to the finish coat. After the undercoat has been thoroughly dried, surfaces shall be sanded smooth and two coats of enamel shall be applied. Back painting shall be provided for all cabinet and woodwork prior to installation.
- K. Interior and Wall Shelves: Cabinet interiors and wall shelves shall be laminated as specified under Section C, Plastic Laminate.

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L. Granite Tops:

1. Size, shape and installed where shown on drawings. These are fabricated items and are to be constructed as per manufacturer's requirements and as further detailed on contract drawings.
2. Color and finish shall be selected by the Architect, and physical properties shall confirm to manufacturer's standard specifications for foodservice application. The material shall be homogenous; and not of a composite construction.
3. Granite shall be 3/4" thick with 1-1/4" face for counter tops unless otherwise specified.
4. Angle frame under top sheathed with sound deadening material.
5. General installed to conform to manufacturers standard details in order to maintain product warranty, i.e. cut outs for drop-in equipment.

M. Solid Surface:

1. Size, shape and installed where shown on drawings. These are fabricated items and are to be constructed as per manufacturer's requirements and as further detailed on contract drawings.
2. Color and finish shall be selected by the Architect, and physical properties shall confirm to manufacturer's standard specifications for foodservice application. The material shall be homogenous; and not of a composite construction.
3. Solid Surface to be minimum 1/2" thick silicone mounted to 3/4" thick grade plywood if required as per manufacturer's recommendations.
4. Top secured to counter construction by means of concealed S.S. studs, nuts and washers.
5. Angle frame under top sheathed with sound deadening material.
6. General installed to conform to manufacturers standard details in order to maintain product warranty, i.e. cut outs for drop-in equipment.

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PART 2 – PRODUCTS

ITEM #1 STORAGE SHELVING, PORTABLE – QTY. AS PER PLAN & SCHEDULE

Focus Model FMPS1842695. Unit to be installed where shown on drawings. Provided with all features, options and accessories, per quantity required, as indicated:

- Shelving to be sized to fit
- 5 ea. 21" x 48" Shelves with removable, vented inserts
- 4 ea. 74" High uprights
- Mounted on heavy-duty casters, front two with brakes

Or as manufactured by Eagle Group/Metal Masters or Metro.

ITEM #2 FIRE EXTINGUISHER, WALL MNTD. – QTY. AS PER PLAN & SCHEDULE

Captive Aire Model K-CLASS. Unit to be installed where shown on drawings. Provided with all features, options and accessories, per quantity required, as indicated:

- 1 ea. Wet chemical type, Ansulex low pH agent
- 1 ea. 2.5 Gallon tank
- 1 ea. Wall bracket
- 1 ea. Rechargeable
- Wall backing by General Contractor

Or as manufactured by Caddy or Accurex.

ITEM #3 BUILT-IN HANDSINK – QTY. AS PER PLAN & SCHEDULE

Carts Model Custom. Size, shape and installed where shown on drawing. This is a fabricated item and is to be constructed as described in General Specifications and as further detailed on contract drawings. Provided with all features, options and accessories, per quantity required, as indicated:

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- Electrical: 120/1, NEMA 5-15P
- 1 ea. Electronic faucet, 6" swing spout
- 1 ea. Built-in hand sink, 12" L x 10" W x 7" D, tapered
- 1 ea. Soap dispenser, Component Hardware Model KS10-1000
- 1 ea. Integral towel dispenser, C-fold
- 1 ea. Integral raised stainless steel splashes, perimeter
- 1 ea. Left and right splash guards

Or as manufactured by Aero Mfg. or EMI New Jersey.

ITEM #4 WORK COUNTER W/ SINK – QTY. AS PER PLAN & SCHEDULE

Carts Model Custom. Size, shape and installed where shown on drawing. This is a fabricated item and is to be constructed as described in General Specifications and as further detailed on contract drawings. Provided with all features, options and accessories, per quantity required, as indicated:

- Counter Top Material: Stainless Steel, 14 Gauge
- 1 ea. Built-in work sink, 16" L x 12" W x 12" D
- 1 ea. S.S. Removable sink bowl cover
 - Stainless steel, 14 Gauge
 - Finger holes, lift-off
 - Flush inlay with work sink/top
 - Integral bracket, under counter, to hold when not in use
- 1 ea. Waste valve with lever
- 1 ea. Tail piece
- 1 ea. Waste overflow
- 1 ea. Stainless steel faucet with 12" swing spout and wrist action handles, 1/2" connections
- Cabinet/Door to be flush frame design
- Stainless steel integrated handles, horizontal orientation
- Cylinder locks, keyed alike, as required
- Intermediate stainless steel solid shelves, adjustable
- Stainless steel legs, 6" adjustable

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Or as manufactured by Aero Mfg. or EMI New Jersey.

ITEM #5 WAREWASHER, UNDERCOUNTER – QTY. AS PER PLAN & SCHEDULE

Jackson WWS Model DISHSTAR HT-E-SEER. Unit to be installed where shown on drawings. Provided with all features, options and accessories, per quantity required, as indicated:

- Electrical: 208/1, Hardwired
- 1 ea. Single point electrical connection
- 1 ea. Pressure regulator
- 3 ea. Sets of peg racks
- 3 ea. Sets of combination racks
- 1 ea. Built-in hot water booster, 70° rise
- 1 ea. Detergent/rinse aid pumps
- 1 ea. Drain tempering kit
- 1 ea. Energy recovery system

Or as manufactured by Meiko or Hobart.

ITEM #6 EXHAUST HOOD, CONTROL PANEL – QTY. AS PER PLAN & SCHEDULE

Captive Aire Model Custom. Unit to be installed where shown on drawings. Provided with all features, options and accessories, per quantity required, as indicated:

- Included as part of Item #15, Exhaust Hood

Or as manufactured by Caddy or Accurex.

ITEM #7 SPARE NUMBER

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ITEM #8 FIRE PROTECTION SYSTEM – QTY. AS PER PLAN & SCHEDULE

Ansul Model UL-300 (R-102). Unit to be installed where shown on drawing in strict accordance to that described in General Specifications. Provided with all features, options and accessories, per quantity required, as indicated:

- Electrical: 120/1, Hardwired
- Provide connection to building Fire Alarm System
- 1 ea. Mechanical Gas valve, up to 3", size to be verified
 - Provide add/ alternate for electric gas valve
- 1 ea. Reset Relay Push Button
 - Only required with use of electric gas valve
- For the protection of equipment beneath Exhaust Hood, Item #15

Or as manufactured by Caddy or Accurex.

ITEM #9 HOT PLATE, GAS – QTY. AS PER PLAN & SCHEDULE

Garland Model GTOG24-4. Unit to be installed where shown on drawings. Provided with all features, options and accessories, per quantity required, as indicated:

- Gas: 3/4" Rear Connection, 120 MBtuh
- 1 ea. Flush rear gas inlet
- 1 ea. Pressure regulator
- 1 ea. 48" Quick disconnect with flexible hose
- 1 ea. Restraint cable
- Mounted on top of Item #11, Refrigerated Equipment Stand

Or as manufactured by Star Mfg. or Vulcan.

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ITEM #10 CHAR BROILER, HEAVY DUTY, GAS – QTY. AS PER PLAN & SCHEDULE

Garland Model GTBG24-AR24. Unit to be installed where shown on drawings. Provided with all features, options and accessories, per quantity required, as indicated:

- Gas: 3/4" Rear Connection, 72 MBtuh
- 1 ea. Flush rear gas inlet
- 1 ea. Pressure regulator
- 1 ea. 48" Quick disconnect with flexible hose
- 1 ea. Restraint cable
- Mounted on top of Item #11, Refrigerated Equipment Stand

Or as manufactured by Star Mfg. or Vulcan.

ITEM #11 EQUIPMENT STAND, REFRIGERATED – QTY. AS PER PLAN & SCHEDULE

Beverage Air Model WTRCS72HC. Unit to be installed where shown on drawings. Provided with all features, options and accessories, per quantity required, as indicated:

- Electrical: 120/1, NEMA 5-15P
- Exterior Finish: Stainless Steel
- Interior Finish: Stainless Steel
- 1 ea. Self-contained refrigeration, right side housing
- 1 ea. Expansion valve
- 1 ea. Stainless steel top, flat, 16 Gauge
- 1 ea. Insulated top
- 1 ea. Automatic electric condensate evaporator
- 1 ea. Digital temperature control system
- Cylinder locks, keyed alike, as required
- Mounted on heavy duty casters, front two with brakes

Or as manufactured by Continental Refrigerator or True Mfg.

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ITEM #12 GRIDDLE, HEAVY DUTY, GAS – QTY. AS PER PLAN & SCHEDULE

Garland Model GTGG24-GT24M. Unit to be installed where shown on drawings. Provided with all features, options and accessories, per quantity required, as indicated:

- Electrical: 120/1, NEMA 5-15P
- Gas: 3/4" Rear connection, 64 MBtuh
- 1 ea. Battery/electronic spark ignition
- 1 ea. Flush rear gas inlet
- 1 ea. Pressure regulator
- 1 ea. Thermostatic controls
- 1 ea. 48" Quick disconnect with flexible hose
- 1 ea. Restraint cable

Or as manufactured by Star Mfg. or Vulcan.

ITEM #13 FRYER, GAS – QTY. AS PER PLAN & SCHEDULE

Keating Model 14IFM. Unit to be installed where shown on drawings. Provided with all features, options and accessories, per quantity required, as indicated:

- Electrical: 120/1, NEMA 5-15P
- Gas: 3/4" Rear Connection, 79 MBtuh
- 1 ea. Manifold gas line for double unit
- 1 ea. Pressure regulator
- 1 ea. Electronic spark ignition
- 2 ea. Fryer, full pot
- 4 ea. Half size baskets
- 2 ea. Full size baskets
- 2 ea. Stainless steel frypot covers
- 2 ea. Standard controls
- 1 ea. 48" Quick disconnect with flexible hose
- 1 ea. Restraint cable

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- Mounted on heavy duty casters, front two with brakes

Or as manufactured by Pitco or Frymaster.

ITEM #14 SPARE NUMBER

ITEM #15 EXHAUST HOOD, TYPE I, BACKSHELF – QTY. AS PER PLAN & SCHEDULE

Captive Aire Model Custom. Size, shape and installed where shown on drawing. This is a fabricated item and is to be constructed as described in General Specifications and as further detailed on contract drawings. Provided with all features, options and accessories, per quantity required, as indicated:

- Construction: 100% 304 stainless steel
- Filters: Stainless steel captrate solo with hook
- Insulation: Integral air / insulation barriers at perimeter and top, 0" clearance to combustibles
- Structural front panel, insulated
- Wall / Island canopy hood, length / size as per contract documents
- 1 ea. Front perforated supply plenum (PSP) with built-in 3" back standoff
- Insulation for PSP housing, as required
- 3 ea. LED lights with bulbs
- Stainless steel field wrap, approximately 18" high on all exposed sides
- Adjustable exhaust air volume control damper
- Hood Control Panel Package:
 - EMSplus11 modulating energy management system with smart controls
 - Built-in VFDs
 - Duct Temperature Sensors in all risers
 - Room Temperature Sensor
 - Configurable through Touch Screen Interface
 - EMS Duct Thermostat
 - INVERTER DUTY THREE PHASE MOTORS REQUIRED

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Or as manufactured by Caddy or Accurex.

ITEM #16 SUPPLY PLENUM, MAKE-UP AIR – QTY. AS PER PLAN & SCHEDULE

Captive Aire Model Custom. Unit to be installed where shown on drawings. Provided with all features, options and accessories, per quantity required, as indicated:

- Included as part of Item #15, Exhaust Hood

Or as manufactured by Caddy or Accurex.

ITEM #17 FREEZER, UNDERCOUNTER – QTY. AS PER PLAN & SCHEDULE

Beverage Air Model UCF27AHC. Unit to be installed where shown on drawings. Provided with all features, options and accessories, per quantity required, as indicated:

- Electrical: 120/1, NEMA 5-15P
- Verify door hinging
- Exterior Finish: Stainless Steel
- Interior Finish: Stainless Steel
- 1 ea. Self-contained refrigeration
- 1 ea. Stainless steel top, 16 Gauge
- 1 ea. Stainless steel finished back
- 1 ea. Digital thermometer, external
- 1 ea. Three year parts warranty
- 1 ea. Three year labor warranty
- Mounted on heavy duty casters, front two with brakes

Or as manufactured by Continental Refrigerator or True Mfg.

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ITEM #18 REFRIGERATOR, SANDWICH/SALAD PREP – QTY. AS PER PLAN & SCHEDULE

Beverage Air Model SPE36HC-10. Unit to be installed where shown on drawings. Provided with all features, options and accessories, per quantity required, as indicated:

- Electrical: 120/1, NEMA 5-15P
- Verify door hinging
- Exterior Finish: Stainless Steel
- Interior Finish: Stainless Steel
- 1 ea. Self-contained refrigeration, front breathing
- 1 ea. Composite cutting board
- 1 ea. Stainless steel flat cover, removable
- 1 ea. Stainless steel finished back
- 1 ea. Digital temperature control system
- Cylinder locks as required
- Mounted on heavy duty casters, front two with brakes

Or as manufactured by Continental Refrigerator or True Mfg.

ITEM #19 S.S. WALL PANEL(S) – QTY. AS PER PLAN & SCHEDULE

Captive Aire Model Custom. Size, shape and installed where shown on drawing. This is a fabricated item and is to be constructed as described in General Specifications and as further detailed on contract drawings. Provided with all features, options and accessories, per quantity required, as indicated:

- Stainless steel panels, evenly sized, 20 Gauge
- Installed from top of coved base to underside of hood, entire length
- Hairline joints sealed with S.S. trim strips
- Secured to wall with heat resistant mastic

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It is the responsibility of the Kitchen Equipment Contractor to coordinate and make all appropriate cut-outs in paneling based on utility requirements in this location and apply appropriate stainless steel trim strips, caps, gussets, etc...

Or as manufactured by Caddy or Accurex.

ITEM #20 DROP-IN, HOT WELLS, INSULATED – QTY. AS PER PLAN & SCHEDULE

Hatco Model HWBI-2. Unit to be installed where shown on drawings. Provided with all features, options and accessories, per quantity required, as indicated:

- Electrical: 208/1, Hardwired
- 1 ea. Insulated wells
- 1 ea. Individual well controls
- 1 ea. Controls remote mounted in apron
- 1 ea. Manifolded drain lines to gate/shut-off valve
- Adaptor bars to hold combination of 1/1, 1/2, 1/3 and 1/6 sized pans

Or as manufactured by Delfield or Piper Products.

ITEM #21 SPARE NUMBER

ITEM #22 CASHIER SECTION, BUILT-IN – QTY. AS PER PLAN & SCHEDULE

Carts Model Custom. Size, shape and installed where shown on drawing. This is a fabricated item and is to be constructed as described in General Specifications and as further detailed on contract drawings. Provided with all features, options and accessories, per quantity required, as indicated:

- Included as part of Item #26, Serving Counter
- Working Side:
 - Stainless steel finished interior
 - Stainless steel tubular foot rest, 2" diameter
 - Quad receptacle mounted in rear panel

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- Cord/Plug assembly
- Locking cash drawer
- Counter Heights: 34" Counter Top

Or as manufactured by Aero Mfg. or EMI New Jersey.

ITEM #23 COFFEE MAKER, AUTOMATIC – QTY. AS PER PLAN & SCHEDULE

Grindmaster Model PBC-2VS. Unit to be installed where shown on drawings. Provided with all features, options and accessories, per quantity required, as indicated:

- Electrical: 240/1, Hardwired
- 1 ea. (3) Brew volumes
- 4 ea. Vacuum shuttle with stand, VS15
- 1 ea. Brew basket, stainless steel
- Cold water connection piped from undercounter filter
- 6 ea. Replacement cartridges

Or as manufactured by Fetco or Bunn-O-Matic.

ITEM #24 DISPLAY CASE, REFRIGERATED – QTY. AS PER PLAN & SCHEDULE

Vendor Supplied. Unit to be installed where shown on drawings. Provided with all features, options and accessories, per quantity required, as indicated:

- Electrical: 120/1, NEMA 5-15P

ITEM #25 DISPLAY CASE, REFRIGERATED – QTY. AS PER PLAN & SCHEDULE

Vendor Supplied. Unit to be installed where shown on drawings. Provided with all features, options and accessories, per quantity required, as indicated:

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- Electrical: 120/1, NEMA 5-15P

ITEM #26 SERVING COUNTER – QTY. AS PER PLAN & SCHEDULE

Carts Model Custom. Size, shape and installed where shown on drawing. This is a fabricated item and is to be constructed as described in General Specifications and as further detailed on contract drawings. Provided with all features, options and accessories, per quantity required, as indicated:

- Counter Components: Outlets/Junction boxes for drop-in or built-in equipment mounted in counter by K.E.C., wired by E.C.
- Counter Construction: 1" Stainless steel square tubing fully welded with integral chase wall attachment or 3/4" Marine grade millwork
- Counter Top Material: Quartz Surface, Premium Collection, as selected by Architect
- Front Panels: WilsonArt, Premium Collection, as selected by Architect
- End Panels: WilsonArt, Premium Collection, as selected by Architect
- Working Side:
 - Stainless steel open leg construction
 - Removable undershelf, stainless steel
 - Stainless steel apron to mount switches, controls, etc.
- Counter Heights: 34" Counter Top
- Counter Base: Integral chase extended to floor.

Or as manufactured by Aero Mfg. or EMI New Jersey.

ITEM #27 POS SYSTEM(S) – QTY. AS PER PLAN & SCHEDULE

Vendor Supplied. Unit to be installed where shown on drawings. Provided with all features, options and accessories, per quantity required, as indicated:

- Electrical: 120/1, NEMA 5-15P

ITEM #28 SPARE NUMBER

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ITEM #29 FOOD PROTECTOR(S), FIXED – QTY. AS PER PLAN & SCHEDULE

Premier Metal & Glass Model TM2N. Size, shape and installed where shown on drawing. This is a fabricated item and is to be constructed as described in General Specifications and as further detailed on contract drawings. Provided with all features, options and accessories, per quantity required, as indicated:

- Electrical: 120/1, Hardwired
- LED Strip lights mounted to posts, concealed wiring
- LED Light mounting clips for extended lengths, as required
- 1" Tubular stainless steel posts
- Extend 20" above counter top, overall height
- Anchored below to counter frame for rigidity
- Stainless steel sleeve post extends thru counter top
- 3/8" Tempered glass, horizontal/vertical surfaces

Or as manufactured by Versa-Gard or English Mfg. Viper.

ITEM #30 CONDIMENT/REFUSE COUNTER – QTY. AS PER PLAN & SCHEDULE

By Millwork Contractor. Unit to be installed where shown on drawings. Provided with all features, options and accessories, per quantity required, as indicated:

- Refer to Architectural Drawings for details

PART 3 - EXECUTION

3.01 GENERAL RELATED CONDITIONS

- A. In each item of equipment hereinafter specified under the "Equipment Schedule," these specifications shall only identify each respective item by name and model number, as well as list various component parts/accessories provided for same.

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- B. Therefore, it shall be intended that these respective items and their component parts shall be of material (mounted where applicable) constructed and furnished in strict accordance to that described in the general specifications for these items and integrally constructed where applicable.
- C. It shall also be intended that where buy-out (pre-fabricated) items are specified, same shall be definitely furnished with all the accessories as normally furnished by manufacturer for these items. Also in strict accordance with current manufacturer's engineering data sheet for each respective item.
- D. Should no list or description be provided for various component parts/ accessories, the Kitchen Equipment Contractor is responsible to provide required components for full and proper operation of said equipment.

3.02 EXAMINATION OF PLANS AND SPECIFICATIONS

- A. Prospective bidders for this work must examine these plans and specifications carefully before bidding, and must request from Architect and/or Food Service Consultant in writing for an interpretation or correction of every apparent ambiguity, inconsistency or error therein. If necessary, such interpretation or correction shall be issued in writing as an addendum.

3.03 SPECIAL NOTES

- A. It shall be the responsibility of Kitchen Equipment Contractor to make as many visits to the job site as is necessary and to keep up to date with progress made in field on the installation of all necessary rough-in to adequately and properly operate and accommodate all equipment furnished by said Contractor and as shown on drawings. Include this service in bid.

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- B. Kitchen Equipment Contractor to cooperate with all trades so that the end results of his/her work will be a satisfactory, approved and accepted installation. Written reports of each visit shall be sent promptly to the Architect and/or Food Service Consultant.

3.04 COORDINATION

- A. Procedure of construction is of paramount importance in executions of this project. Kitchen Equipment Contractor to carry on his/her work so that no delay in his/her operations or those of any other contractors occurs at any time.
- B. Kitchen Equipment Contractor to verify with Architect and/or Food Service Consultant as to opening date of the food service area(s), and schedule his/her fabrication and purchasing of equipment so that all will be in readiness, installed, connected, tested, demonstrated, etc., in ample time prior to the scheduled opening date.

3.05 DELIVERY AND INSTALLATION

- A. Shall mean and intend that Kitchen Equipment Contractor shall deliver and assemble all equipment of contract in 1 piece in required locations in building, ready for water, waste, gas, electric and ventilating connections required by other trades.
- B. Any pieces of equipment may be delivered sectionally, but all working surfaces butt-welded, ground and polished on premises so that upon completion, such item of equipment will have true, smooth, even and continuous surfaces. Butt joining and filling with solder not permitted.
- C. Kitchen Equipment Contractor must verify door sizes, delivery platform, elevator size, etc., effecting delivery to food service area(s) for all items of equipment.

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3.06 RESERVATIONS AND CONDITIONS

- A. It is the intent of this specification to complete the installation of all equipment covered herein in all phases ready for operation. Contractor shall carefully examine the plans and specifications for building construction contracts and determine therefrom the extent of his operations in all respects. All labor and materials not included in building construction contracts necessary to accomplish this intent are hereby included in this contract.
- B. Kitchen Equipment Contractor shall attend job meetings when required for purpose of coordinating his/her work with other trades.
- C. All equipment shall be received at the building fully protected. It will be the responsibility of the Kitchen Equipment Contractor to protect the equipment until completely installed and accepted.

3.07 NOT USED

END OF SECTION

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SECTION 21 05 00 - BASIC FIRE SUPPRESSION REQUIREMENTS

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Provide all labor, tools, materials, accessories, parts, transportation, taxes, and related items, essential for installation of the work and necessary to make work, complete, and operational. Provide new equipment and material unless otherwise called for. References to codes, specifications and standards called for in the specification sections and on the drawings mean, the latest edition, amendment and revision of such referenced standard in effect on the date of these contract documents. All materials and equipment shall be installed in accordance with the manufacturer's recommendations.

1.2 LICENSING

- A. The Contractor shall hold a license to perform the work as issued by the authority having jurisdiction.
- B. Plumbing contract work shall be performed by, or under, the direct supervision of a licensed master plumber.
- C. Electrical contract work shall be performed by, or under, the direct supervision of a licensed electrician.

1.3 PERMITS

- A. Apply for and obtain all required permits and inspections, pay all fees and charges including all service charges. Provide certificate of approval from the Authorities Having Jurisdiction prior to request for final payment.
- B. Provide electrical inspection certificate of approval from Middle Department Inspection Agency, Commonwealth Inspection Agency, or an Engineer approved Inspection Agency prior to request for final payment.

1.4 CODE COMPLIANCE

- A. Provide work in compliance with the following:
 - 1. 2020 Building Code of New York State.
 - 2. 2020 Existing Building Code of New York State.
 - 3. 2020 Fire Code of New York State.
 - 4. 2020 Plumbing Code of New York State.

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5. 2020 Mechanical Code of New York State.
6. 2020 Fuel Gas Code of New York State.
7. 2020 Property Maintenance Code of New York State.
8. 2020 Energy Conservation Code of New York State
9. Accessible and Usable Buildings and Facilities, ICC A117.1 (2009).
10. New York State Department of Labor Rules and Regulations.
11. New York State Department of Health.
12. 2017 National Electrical Code (NEC)
13. Occupational Safety and Health Administration (OSHA).
14. Local Codes and Ordinances.
15. Life Safety Code, NFPA 101.

1.5 GLOSSARY

ACI	American Concrete Institute
AGA	American Gas Association
AGCA	Associated General Contractors of America, Inc.
AIA	American Institute of Architects
AISC	American Institute of Steel Construction
AFBMA	Anti-Friction Bearing Manufacturer's Association
AMCA	Air Moving and Conditioning Association, Inc.
ANSI	American National Standards Institute
ARI	Air Conditioning and Refrigeration Institute
ASHRAE	American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc.
ASME	American Society of Mechanical Engineers
ASPE	American Society of Plumbing Engineers
ASTM	American Society for Testing Materials
AWSC	American Welding Society Code
AWWA	American Water Works Association

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FM	Factory Mutual Insurance Company
IBR	Institute of Boiler & Radiation Manufacturers
IEEE	Institute of Electrical and Electronics Engineers
IRI	Industrial Risk Insurers
NEC	National Electrical Code
NEMA	National Electrical Manufacturer's Association
NESC	National Electrical Safety Code
NFPA	National Fire Protection Association
NYS/DEC	New York State Department of Environmental Conservation
SBI	Steel Boiler Institute
SMACNA	Sheet Metal and Air Conditioning Contractors National Association
UFPO	Underground Facilities Protective Organization
UL	Underwriter's Laboratories, Inc.
OSHA	Occupational Safety and Health Administration
XL - GAP	XL Global Asset Protection Services

1.6 DEFINITIONS

Acceptance	Owner acceptance of the project from Contractor upon certification by Owner's Representative.
As Specified	Materials, equipment including the execution specified/shown in the contract documents.
Basis of Design	Equipment, materials, installation, etc. on which the design is based. (Refer to the article, Equipment Arrangements, and the article, Substitutions.)
Code Requirements	Minimum requirements.
Concealed	Work installed in pipe and duct shafts, chases or recesses, inside walls, above ceilings, in slabs or below grade.
Coordination Drawings	Show the relationship and integration of different construction elements and trades that require careful coordination during fabrication or installation, to fit in the space provided or to function as intended.
Delegated-Design Services	Performance and Design criteria for Contractor provided professional services. Where professional design services or certifications by a design professional are specifically required of a Contractor, by the

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	Contract Documents. Provide products and systems with the specific design criteria indicated. If criteria indicated is insufficient to perform services or certification required, submit a written request for additional information to the Engineer. Submit wet signed and sealed certification by the licensed design professional for each product and system specifically assigned to the Contractor to be designed or certified by a design professional. Examples: structural maintenance ladders, stairs and platforms, pipe anchors, seismic compliant system, wind, structural supports for material equipment, sprinkler hydraulic calculations.
Equal, Equivalent, Equal To, Equivalent To, As Directed and As Required	Shall all be interpreted and should be taken to mean "to the satisfaction of the Engineer".
Exposed	Work not identified as concealed.
Extract	Carefully dismantle and store where directed by Owner's Representative and/or reinstall as indicated on drawings or as described in specifications.
Furnish	Purchase and deliver to job site, location as directed by the Owner's Representative.
Inspection	Visual observations by Owner's site Representative.
Install	Store at job site if required, proper placement within building construction including miscellaneous items needed to affect placement as required and protect during construction. Take responsibility to mount, connect, start-up and make fully functional.
Labeled	Refers to classification by a standards agency.
Manufacturers	Refer to the article, Equipment Arrangements, and the article, Substitutions.
Prime Professional	Architect or Engineer having a contract directly with the Owner for professional services.
Product Data	Illustrations, standard schedules, performance charts, instructions, brochures, wiring diagrams, finishes, or other information furnished by the Contractor to illustrate materials or equipment for some portion of the work.
Provide (Furnish and Install)	Contractor shall furnish all labor, materials, equipment and supplies necessary to install and place in operating condition, unless otherwise specifically stated.
Relocate	Disassemble, disconnect, and transport equipment to new locations,

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	then clean, test, and install ready for use.
Remove	Dismantle and take away from premises without added cost to Owner, and dispose of in a legal manner.
Review and Reviewed	Should be taken to mean to be followed by "for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents".
Roughing	Pipe, duct, conduit, equipment layout and installation.
Samples	Physical full scale examples which illustrate materials, finishes, coatings, equipment or workmanship, and establishes standards by which work will be judged.
Satisfactory	As specified in contract documents.
Shop Drawings	Fabrication drawings, diagrams, schedules and other instruments, specifically prepared for the work by the Contractor or a Sub-contractor, manufacturer, supplier or distributor to illustrate some portion of the work.
Site Representative	Owner's Inspector or "Clerk of Works" at the work site.
Submittals Defined (Technical)	Any item required to be delivered to the Engineer for review as requirement of the Contract Documents. The purpose of technical submittals is to demonstrate for those portions of the work for which a submittal is required, the manner in which the Contractor proposes to conform to the information given and design concepts expressed and required by the Contract Documents.

1.7 EXISTING CONDITIONS

- A. Contractor shall review all available record documents of existing construction or other existing conditions and hazardous material information. Owner does not guarantee that existing conditions are the same as those indicated in these documents. Contractor shall record existing conditions via measured drawings and preconstruction photographs or video. Inventory and record the condition of items to be removed and salvaged. Provide photographs or video of conditions that might be misconstrued as damage caused by salvage, removal or construction operations.
- B. Owner will occupy portions of the building immediately adjacent to the area(s) of removals. Conduct removals so Owner's operations are not disrupted. Contractor shall locate, identify, disconnect and seal or cap mechanical, plumbing, fire protection and/or electrical systems serving areas of removals, unless noted otherwise in the contract documents. Contractor shall arrange shut-down of systems with the Construction Manager. Piping and ductwork indicated to be removed shall be removed and capped or plugged with compatible materials. If services/systems are required to be removed, relocated

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or abandoned, provide temporary services/systems the bypass area(s) of removals to maintain continuity of services/systems to other parts of the building, as required.

1.8 SHOP DRAWINGS/PRODUCT DATA/SAMPLES

- A. Provide submittals on all items of equipment and materials to be furnished and installed. Submittals shall be accompanied by a transmittal letter, stating name of project and contractor, name of vendor supplying equipment, number of drawings, titles, specification sections (name and number) and other pertinent data called for in individual sections. Submittals shall have individual cover sheets that shall be dated and contain: Name of project; name of prime professional; name of prime contractor; description or names of equipment, materials and items; and complete identification of locations at which materials or equipment are to be installed. Individual piecemeal or incomplete submittals will not be accepted. Similar items, (all types specified) shall be submitted at under one cover sheet per specification section (e.g. lighting fixtures, valves, plumbing fixtures, etc.). Submittals shall include all required documentation for each product listed in the specification section at the same time as a complete package. Number each submittal by trade. Indicate deviations from contract requirements on Letter of Transmittal. Submittals will be given a general review only. Corrections or comments made on the Submittals during the review do not relieve Contractor from compliance with requirements of the drawings and specifications. The Contractor is responsible for: confirming and correcting all quantities; checking electrical characteristics and dimensions; selecting fabrication processes and techniques of construction; coordinating his work with that of all other trades; and performing his work in a safe and satisfactory manner. If submitting hard copies, submit four (4) copies for review.
- B. The Engineer will review up to two (2) submissions of any single submittal. The Contractor will be invoiced on an hourly rate basis for the time spent reviewing the same shop drawing in excess of twice.
- C. If submittals are to be submitted electronically, all requirements in Item A apply. Submittals shall be emailed in PDF format to specific email address provided by the Construction Manager, General Contractor, Architect or Project Manager. Name of project shall be in subject line of email. Send emails to mealbasubmittalclerk@meengineering.com.
- D. Refer to Division 01 for additional requirements.

1.9 PROTECTION OF PERSONS AND PROPERTY

- A. Contractor shall assume responsibility for construction safety at all times and provide, as part of contract, all trench or building shoring, scaffolding, shielding, dust/fume protection, mechanical/electrical protection, special grounding, safety

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railings, barriers, and other safety feature required to provide safe conditions for all workmen and site visitors.

1.10 EQUIPMENT ARRANGEMENTS

- A. The contract documents are prepared using one manufacturer as the Basis of Design, even though other manufacturers' names are listed. If Contractor elects to use one of the listed manufacturers other than Basis of Design, submit detailed drawings, indicating proposed installation of equipment. Show maintenance clearances, service removal space required, and other pertinent revisions to the design arrangement. Make required changes in the work of other trades, at no increase in any contract. Provide larger motors, feeders, breakers, and equipment, additional control devices, valves, fittings and other miscellaneous equipment required for proper operation, and assume responsibility for proper location of roughing and connections by other trades. Remove and replace doorframes, access doors, walls, ceilings, or floors required to install other than Basis of Design. If revised arrangement submittal is rejected, revise and resubmit specified Basis of Design item which conforms to Contract Documents.

1.11 SUBSTITUTIONS

- A. If Contractor desires to bid on any other kind, type, brand, or manufacture of material or equipment than those named in specifications, secure prior approval. To request such approval, Contractor shall submit complete information comparing (item-for-item) material or equipment offered with design material or equipment. Include sufficient information to permit quick and thorough comparison, and include performance curves on same basis, capacities, power requirements, controls, materials, metal gauges, finishes, dimensions, weights, etc., of major parts. If accepted, an addendum will be issued to this effect ahead of bid date. Unless such addendum is issued, substitution offered may not be used.
- B. Refer to Division 01 for additional requirements.

1.12 CONTINUITY OF SERVICES

- A. The building will be in use during construction operations. Maintain existing systems in operation within all rooms of building at all times. Refer to "General Conditions of the Contract for Construction" for temporary facilities for additional contract requirements. Schedules for various phases of contract work shall be coordinated with all other trades and with Owner's Representative. Provide, as part of contract, temporary mechanical and electrical connections and relocations as required to accomplish the above. Obtain approval in writing as to date, time, and location for shutdown of existing mechanical/electrical facilities or services.

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1.13 ROUGHING

- A. The Contract Drawings have been prepared in order to convey design intent and are diagrammatic only. Drawings shall not be interpreted to be fully coordinated for construction.
- B. Due to small scale of Drawings, it is not possible to indicate all offsets, fittings, changes in elevation, interferences, etc. Make necessary changes in contract work, equipment locations, etc., as part of a contract to accommodate work to avoid obstacles and interferences encountered. Before installing, verify exact location and elevations at work site. **DO NOT SCALE** plans. If field conditions, details, changes in equipment or shop drawing information require an important rearrangement, report same to Owner's Representative for review. Obtain written approval for all major changes before installing.
- C. Install work so that items both existing and new are operable and serviceable. Eliminate interference with removal of coils, motors, filters, belt guards and/or operation of doors. Provide easy, safe, and code mandated clearances at controllers, motor starters, valve access, and other equipment requiring maintenance and operation. Provide new materials, including new piping and insulation for relocated work.
- D. Coordinate work with other trades and determine exact route or location of each duct, pipe, conduit, etc., before fabrication and installation. Coordinate with Architectural Drawings. Obtain from Owner's Representative exact location of all equipment in finished areas, such as thermostat, fixture, and switch mounting heights, and equipment mounting heights. Coordinate all work with the architectural reflected ceiling plans and/or existing Architecture. Mechanical and electrical drawings show design arrangement only for diffusers, grilles, registers, air terminals, lighting fixtures, sprinklers, speakers, and other items. Do not rough-in contract work without reflected ceiling location plans.
- E. Before roughing for equipment furnished by Owner or in other Divisions, obtain from Owner and other Divisions, approved roughing drawings giving exact location for each piece of equipment. Do not "rough in" services without final layout drawings approved for construction. Cooperate with other trades to insure proper location and size of connections to insure proper functioning of all systems and equipment. For equipment and connections provided in this contract, prepare roughing drawing as follows:
 - 1. Existing Equipment: Measure the existing equipment and prepare for installation in new location.
 - 2. New Equipment: Obtain equipment roughing drawings and dimensions, then prepare roughing-in-drawings. If such information is not available in time, obtain an acknowledgement in writing, then make space arrangements as required with Owner's Representative.

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1.14 COORDINATION DRAWINGS

- A. Before construction work commences, Divisions for all trades shall submit coordination drawings in the form of CAD drawing files, drawn at not less than 1/4 in. scale. Such drawings will be required throughout all areas, for all Contracts. These drawings shall show resolutions of trade conflicts in congested areas. Mechanical Equipment Rooms shall be drawn early in coordination drawing process simultaneous with all other congested areas. Prepare Coordination Drawings as follows:
1. Division 23 shall prepare the base plan CAD coordination drawings showing all ductwork, all pertinent heating piping, and equipment. These drawings may be CAD files of the required Ductwork Shop Drawings. The drawings shall be coordinated with lighting fixtures, sprinklers, air diffusers, other ceiling mounted items, ceiling heights, structural work, maintenance clearances, electric code clearance, reflected ceiling plans, and other contract requirements. Reposition proposed locations of work after coordination drawing review by the Owner's Representative. Provide adjustments to exact size, location, and offsets of ducts, pipes, conduit, etc., to achieve reasonable appearance objectives. Provide these adjustments as part of contract. Minor revisions need not be redrawn.
 2. Division 23 shall provide CAD files and submit the base plan CAD Coordination Drawings to all Divisions.
 3. Divisions 21 and 22 shall draw the location of piping and equipment on the base plan CAD Coordination Drawings, indicating areas of conflict and suggested resolutions.
 4. Divisions 26, 27 and 28 shall draw the location of lighting fixtures, cable trays, and feeders over 1-1/2 in. on the base plan CAD Coordination Drawings, indicating areas of conflict and suggested resolution.
 5. The General Construction Trade shall indicate areas of architectural/structural conflicts or obstacles on the CAD Coordination Drawings, and coordinate to suit the overall construction schedule.
 6. The Construction Manager shall expedite all Coordination Drawing work and coordinate to suit the overall construction schedule. In the case of unresolved interferences, he shall notify the Owner's Representative. The Owner's Representative will then direct the various trades as to how to revise their drawings as required to eliminate installation interferences.
 7. If a given trade proceeds prior to resolving conflicts, then if necessary, that trade shall change its work at no extra cost in order to permit others

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to proceed with a coordinated installation. Coordination approval will be given by areas after special site meetings involving all Divisions.

- B. The purpose of the coordination drawing process is to identify and resolve potential conflicts between trades, and between trades and existing or new building construction, before they occur in construction. Coordination drawings are intended for the respective trade's use during construction and shall not replace any Shop Drawings, or record drawings required elsewhere in these contract documents.

1.15 REMOVAL WORK

- A. Where existing equipment removals are called for, submit complete list to Owner's Representative. All items that Owner wishes to retain that do not contain asbestos or PCB material shall be delivered to location directed by Owner. Items that Owner does not wish to retain shall be removed from site and legally disposed of. Removal and disposal of material containing asbestos, lead paint, mercury and PCB's shall be in accordance with Federal, State and Local law requirements. Where equipment is called for to be relocated, contractor shall carefully remove, clean and recondition, then reinstall. Remove all abandoned piping, wiring, equipment, lighting, ductwork, tubing, supports, fixtures, etc. Visit each room, crawl spaces, and roofs to determine total Scope of Work. The disturbance or dislocation of asbestos-containing materials causes asbestos fibers to be released into the building's atmosphere, thereby creating a health hazard to workmen and building occupants. Consistent with Industrial Code Rule 56 and the content of recognized asbestos-control work, the Contractor shall apprise all of his workers, supervisory personnel, subcontractors, Owner and Consultants who will be at the job site of the seriousness of the hazard and of proper safeguards and work procedures which must be followed, as described in New York State Department of Labor Industrial Code Rule 56.
- B. For materials indicated to contain lead, that are being affected by demolition or construction, the contractor shall comply with all Federal, State and Local law requirements regarding worker exposure to lead disturbance and abatement procedures.
- C. Refer to the Owner's Lead Paint Survey. The Survey identifies the surfaces within the buildings that were tested for lead by collecting paint samples and performing laboratory analysis. If any unidentified surfaces are to be impacted the lead content shall be tested by analytical determinations conducted by a qualified laboratory approved by the Owner. The contractor shall review the current owner's lead paint reports on file before starting any work which may disturb existing surfaces.
- D. Refer to Division 02 for additional information regarding hazardous materials.

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1.16 REFRIGERANT RECOVERY

- A. Existing equipment to be removed, as shown on the plans may contain refrigerant and refrigerant oils. This refrigerant and refrigerant oil must be handled in accordance with Federal, State and Local law requirements.
- B. Removal and recovery of refrigerant shall be in accordance with the current edition of Section 608 of the Clean Air Act of 1990, including all final regulations.
- C. Refrigerant recovery must be performed by a technician, certified by an EPA-approved certification program, using refrigerant recovery and recycling equipment certified by an EPA-approved testing organization.
- D. Owner "reserves the right of first refusal" on ownership of recovered refrigerant. Should Owner choose to maintain ownership of refrigerant, refrigerant shall be reclaimed, cleaned by this Contractor to ARI 700-1993 Standard of Purity, by an EPA certified refrigerant reclaimer. Refrigerant shall be turned over to the Owner in suitable marked containers to be stored on site, at a place of the Owner's choosing.

1.17 EQUIPMENT AND MATERIAL REQUIREMENTS

- A. Provide materials that meet the following minimum requirements:
 - 1. Materials shall have a flame spread rating of 25 or less and a smoke developed rating of 50 or less, in accordance with NFPA 255.
 - 2. All equipment and material for which there is a listing service shall bear a UL label.
 - 3. Potable water systems and equipment shall be built according to AWWA Standards.
 - 4. Gas-fired equipment and system shall meet AGA Regulations and shall have AGA label.
 - 5. All electrical equipment and systems, as a whole, shall be tested and listed by an OSHA approved Nationally Recognized Testing Laboratory (NRTL) for the intended use in accordance with the applicable standards and have a physical label indicating such.
 - 6. Fire protection equipment shall be UL listed and FM approved.
- B. Exterior and wet locations shall utilize materials, equipment supports, mounting, etc. suitable for the intended locations. Metals shall be stainless steel, galvanized or with baked enamel finish as a minimum. Finishes and coatings shall be continuous and any surface damaged or cut ends shall be field corrected

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in accordance with the manufacturer's recommendations. Hardware (screws, bolts, nuts, washers, supports, fasteners, etc.) shall be:

1. Stainless steel where the associated system or equipment material is stainless steel or aluminum.
2. Hot dipped galvanized or stainless steel where the associated system or equipment is steel, galvanized steel or other.

1.18 CUTTING AND PATCHING

- A. Each trade shall include their required cutting and patching work unless shown as part of the General Construction Contract. Refer to General Conditions of the Contract for Construction, for additional requirements. Cut and drill from both sides of walls and/or floors to eliminate splaying. Patch cut or abandoned holes left by removals of equipment or fixtures. Patch adjacent existing work disturbed by installation of new work including insulation, walls and wall covering, ceiling and floor covering, other finished surfaces. Patch openings and damaged areas equal to existing surface finish. Cut openings in prefabricated construction units in accordance with manufacturer's instructions.

1.19 PAINTING

- A. Paint all insulated and bare piping, pipe hangers and supports exposed to view in mechanical equipment rooms, penthouse, boiler rooms and similar spaces. Paint all bare piping, ductwork and supports exposed to the out-of-doors with rust inhibiting coatings. Paint all equipment that is not factory finish painted (i.e. expansion tanks, etc.).
- B. All painting shall consist of one (1) prime coat and two (2) finish coats of non-lead oil base paint, unless otherwise indicated herein. Provide galvanized iron primer for all galvanized surfaces. All surfaces must be thoroughly cleaned before painting. Review system color coding prior to painting with the Owner's Representative or Architect.
- C. All items installed after finished painting is completed and any damaged factory finish paint on equipment furnished under this contract must be touched up by the Contractor responsible for same.
- D. Include painting for patchwork with color to match adjacent surfaces. Where color cannot be adequately matched, paint entire surface. Provide one (1) coat of primer and two (2) finish coats or as called for in the Specifications.
- E. All primers and paint used in the interior of the building shall comply with the maximum Volatile Organic Compound (VOC) limits called for in the current version of U.S. Green Building Council LEED Credits EQ 4.1 and EQ 4.2.

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- F. Refer to Division 9 - Finishes, for additional information.

1.20 EXISTING CEILING REMOVAL AND RE-INSTALLATION

- A. In a renovation project, any existing ceiling removal and re-installation work required for the completion of a Contractors or Subcontractors work, shall be removed and re-installed by that Contractor or Subcontractor. This applies in any areas not called for to have a new ceiling installed.
- B. The ceiling removal and re-installation shall include lay-in ceiling tile and grid, to the extent necessary to accomplish the work. Removed ceiling tile and grid shall be safely stored during the course of the work, and it shall be re-installed to the original existing condition.
- C. The ceiling removal and re-installation shall include gypsum board or plaster ceilings and the associated suspension systems. Removed ceiling areas shall be patched with materials to match the existing ceiling, and painted to match. If paint cannot be matched exactly, paint the entire ceiling a similar color.

1.21 CONCEALMENT

- A. **Conceal all contract work** above ceilings and in walls, below slabs, and elsewhere throughout building. If concealment is impossible or impractical, notify Owner's Representative before starting that part of the work and install only after their review. In areas with no ceilings, install only after Owner's Representative reviews and comments on arrangement and appearance.

1.22 CHASES

- A. New Construction:
 - 1. Certain chases, recesses, openings, shafts, and wall pockets will be provided as part of General Construction Trade. Mechanical and Electrical trades shall provide all other openings required for their contract work.
 - 2. Check Architectural and Structural Design and Shop Drawings to verify correct size and location for all openings, recesses and chases in general building construction work.
 - 3. Assume responsibility for correct and final location and size of such openings.
 - 4. Rectify improperly sized, improperly located or omitted chases or openings due to faulty or late information or failure to check final location.

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5. Provide 18 gauge galvanized sleeves and inserts. Extend all sleeves 2 in. above finished floor. Set sleeves and inserts in place ahead of new construction, securely fastened during concrete pouring. Correct, by drilling, omitted or improperly located sleeves. Assume responsibility for all work and equipment damaged during course of drilling. Firestop all unused sleeves.
 6. Provide angle iron frame where openings are required for contract work, unless provided by General Construction trade.
- B. In Existing Buildings:
1. Drill holes for floor and/or roof slab openings.
 2. Multiple pipes smaller than 1 in. properly spaced and supported may pass through one 6 in. or smaller diameter opening.
 3. Seal voids in fire rated assemblies with a fire-stopping seal system to maintain the fire resistance of the assembly. Provide 18 gauge galvanized sleeves at fire rated assemblies. Extend sleeves 2 in. above floors.
 4. In wall openings, drill or cut holes to suit. Provide 18 gauge galvanized sleeves at shafts and fire rated assemblies. Provide fire-stopping seal between sleeves and wall in drywall construction. Provide fire stopping similar to that for floor openings.
- 1.23 PENETRATION FIRESTOPPING
- A. Refer to Division 07 for project-wide fire stopping information.
- 1.24 NON-RATED WALL PENETRATIONS
- A. Each trade shall be responsible for sealing wall penetrations related to their installed work, including but not limited to ductwork, piping, conduits, etc. See individual specification sections for requirements.
- 1.25 SUPPORTS
- A. Provide required supports, beams, angles, hangers, rods, bases, braces, and other items to properly support contract work. Modify studs, add studs, add framing, or otherwise reinforce studs in metal stud walls and partitions as required to suit contract work. If necessary, in stud walls, provide special supports from floor to structure above.
- B. For precast panels/planks and metal decks, support mechanical/electrical work as determined by manufacturer and the Engineer. Provide heavy gauge steel

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mounting plates for mounting contract work. Mounting plates shall span two or more studs. Size, gauge, and strength of mounting plates shall be sufficient for equipment size, weight, and desired rigidity.

- C. For finished areas without a finished ceiling system such as classrooms, offices, conference rooms, etc., where decking and structure is exposed, and ductwork/piping/conduit is exposed: All mounting brackets, channel support systems and mounting hardware for ductwork, piping, lighting, etc. shall be concealed and approved by the Architect/Engineer prior to the installation. AirCRAFT cable style hanging for ductwork is required. It is recommended that room mockups be done and receive Architect/Engineer approval prior to proceeding with installation.
- D. Equipment, piping, conduit, raceway, etc. supports shall be installed to minimize the generation and transmission of vibration.
- E. Materials and equipment shall be solely supported by the building structure and connected framing. Gypboard, ceilings, other finishes, etc. shall not be used for support of materials and equipment.

1.26 ACCESS PANELS

- A. Provide access panels for required access to respective trade's work. Location and size shall be the responsibility of each trade. Access panels provided for equipment shall provide an opening not smaller than 22 in. by 22 in. Panels shall be capable of opening a minimum of 90 degrees. Bear cost of construction changes necessary due to improper information or failure to provide proper information in ample time. Access panels over 324 square inches shall have two cam locks. Provide proper frame and door type for various wall or ceiling finishes. Access panels shall be equal to "Milcor" as manufactured by Inland Steel Products Co., Milwaukee, Wisconsin. Provide General Construction trade with a set of architectural plans with size and locations of access panels.

1.27 CONCRETE BASES

- A. Provide concrete bases for all floor mounted equipment. Provide 3,000 lb. concrete, chamfer edges, trowel finish, and securely bond to floor by roughening slab and coating with cement grout. Bases 4 in. high (unless otherwise indicated); shape and size to accommodate equipment. Provide anchor bolts in equipment bases for all equipment provided for the project, whether mounted on new concrete bases or existing concrete bases.

1.28 HVAC EQUIPMENT CONNECTIONS

- A. Contractor is responsible for draining, filling, venting, chemically treating and restarting any systems which are affected by work shown on the Contract Documents unless specifically noted otherwise.

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- B. Provide final steam, condensate, hot water, glycol, chilled and condenser water, drain, vent, oil line and gas connections to all equipment as required by the equipment. Provide final connections, including domestic water piping, wiring, controls, and devices from equipment to outlets left by other trades. Provide equipment waste, drip, overflow and drain connections extended to floor drains.
- C. Provide for Owner furnished and Contractor furnished equipment all valves, piping, piping accessories, traps, pressure reducing valves, gauges, relief valves, vents, drains, insulation, sheet metal work, controls, dampers, as required.
- D. Refer to manufacturer drawings and specifications for requirements of medical equipment, laboratory equipment and special equipment. Verify connection requirements before bidding.

1.29 PLUMBING EQUIPMENT CONNECTIONS

- A. Contractor is responsible for draining, filling, venting, chemically treating and restarting any systems which are affected by work shown on the Contract Documents unless specifically noted otherwise.
- B. Provide roughing and final water, waste, vent, gas, air, vacuum, diesel and/or oxygen connections to all equipment. Provide loose key stops, sanitary "P" traps, tailpiece, adapters, gas or air cocks, and all necessary piping and fittings from roughing point to equipment. Provide installation of sinks, faucets, traps, tailpiece furnished by others. Provide cold water line with gate valve and backflow prevention device at locations called for. Provide continuation of piping and connection to equipment that is furnished by others. Provide relief valve discharge piping from equipment relief valves.
- C. Provide valved water outlet adjacent to equipment requiring same. Provide equipment type floor drains, or drain hubs, adjacent to equipment.
- D. Install controls and devices furnished by others.
- E. Refer to Contract Documents for roughing schedules, and equipment and lists indicating scope of connections required.
- F. Provide for Owner furnished and Contractor furnished equipment all valves, piping, piping accessories, traps, pressure reducing valves, gauges, relief valves, vents, drains, as required.
- G. Refer to Manufacturer drawings and specifications for requirements of medical equipment, laboratory equipment and special equipment. Verify connection requirements before bidding.

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1.30 ELECTRICAL EQUIPMENT CONNECTIONS

- A. Provide complete power connections to all electrical equipment. Provide control connections to equipment. Heavy duty NEC rated disconnect ahead of each piece of equipment. Ground all equipment in accordance with NEC.
- B. Provide for Owner furnished and Contractor furnished equipment all power wiring, electric equipment, control wiring, switches, lights, receptacles, and connections as required.
- C. Refer to Manufacturer's drawings/specifications for requirements of medical equipment, laboratory equipment, radiological equipment and special equipment. Verify connection requirements before bidding.

1.31 STORAGE AND PROTECTION OF MATERIALS AND EQUIPMENT

- A. Store Materials on dry base, at least 6 in. aboveground or floor. Store so as not to interfere with other work or obstruct access to buildings or facilities. Provide waterproof/windproof covering. Remove and provide special storage for items subject to moisture damage. Protect against theft or damage from any cause. Replace items stolen or damaged, at no cost to Owner.
- B. Refer to Division 01 for additional information.
- C. Division 23 shall provide airtight plastic covers over all supply and return air openings prior to the start of construction by any trade. The plastic shall be maintained airtight throughout the project construction and removed only with the approval of the Owner's Representative.
- D. Ductwork shall be delivered to the site from the fabrication shop with air tight plastic covers over all ends of the ducts. The plastic covers shall be in place during transportation and shall be removed prior to installation.

1.32 FREEZING AND WATER DAMAGE

- A. Take all necessary precautions with equipment, systems and building to prevent damage due to freezing and/or water damage. Repair or replace, at no change in contract, any such damage to equipment, systems, and building. Perform first seasons winterizing in presence of Owner's operating staff.

1.33 LUBRICATION CHART

- A. Provide lubrication chart, 8-1/2 in. x 11 in. minimum size, typed in capital letters, mounted under clear laminated plastic; secure to wall in area of equipment. List all motors and equipment in contract. Obtain and list necessary information by name/location of equipment, manufacturer recommended types of lubrication and schedule. Lubricate motors as soon as installed and perform lubrication

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maintenance until final acceptance. Divisions 22 and 26 shall add contract items to the chart provided by Division 23 or provide separate charts.

1.34 OWNER INSTRUCTIONS

- A. Before final acceptance of the work, furnish necessary skilled labor to operate all systems by seasons. Instruct designated person on proper operation, and care of systems/equipment. Repeat instructions, if necessary. Obtain written acknowledgement from person instructed prior to final payment. Contractor is fully responsible for system until final acceptance, even though operated by Owner's personnel, unless otherwise agreed in writing. List under clear plastic, operating, maintenance, and starting precautions procedures to be followed by Owner for operating systems and equipment.

1.35 OPERATION AND MAINTENANCE MANUALS

- A. Submit by email (preferred) or digital media, thru the normal project submittal process. Include a copy of each final approved Shop Drawing, wiring diagrams, piping diagrams, spare parts lists, final testing and balancing report, as-built drawings and manufacturer's instructions. Include typewritten instructions, describing equipment, starting/operating procedures, emergency operating instructions, summer-winter changeover, freeze protection, precautions and recommended maintenance procedures. Include name, address, and telephone number of installing contractor and of supplier manufacturer Representative and service agency for all major equipment items. Provide a table of contents page and dividers based upon specification section numbers. Submit in a compiled and bookmarked PDF format as outlined below.
- B. Provide content for Operation and Maintenance Manuals as specified in individual Specification Sections, and as reviewed and approved at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.
 - 1. Engineer and Commissioning Agent will comment on whether content of operation and maintenance submittals is acceptable.
 - 2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.
- C. Submit Operation and Maintenance Manuals in the following format:
 - 1. Submit by uploading to web-based project software site, or by email to Architect, as a formal project submittal in conformance with the project specific submittal procedures. Enable reviewer comments on draft submittals.

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2. 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.
 3. File Names and Bookmarks: Bookmark individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in the 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.
- D. Initial Manual Submittal: Submit draft copy of each manual at least 30 days before commencing Owner training. Engineer and Commissioning Agent will comment on whether general scope and content of manual are acceptable.
- E. Final Manual Submittal: Submit O&M manual in final form prior to requesting inspection for Substantial Completion and at least 2 weeks before commencing Owner training. Engineer and Commissioning Agent will return copy with review comments.
1. Correct or revise O&M manual to comply with Engineer's and Commissioning Agent's comments. Submit copies of each corrected manual within 2 weeks of receipt of Engineer's and Commissioning Agent's comments.
- F. Refer to Division 01 for additional requirements.

1.36 RECORD DRAWINGS

- A. The Contractor shall obtain at his expense one (1) set of construction Contract Drawings, (including non-reproduction black and white prints or electronic files) for the purpose of recording as-built conditions.
- B. The Contractor shall perform all survey work required for the location and construction of the work and to record information necessary for completion of the record drawings. Record drawings shall show the actual location of the constructed facilities in the same manner as was shown on the bid drawings. All elevations and dimensions shown on the drawings shall be verified or corrected so as to provide a complete and accurate record of the facilities as constructed.
- C. It shall be the responsibility of the Contractor to mark **EACH** sheet of the contract documents in red and to record thereon in a legible manner, any and all approved field changes and conditions as they occur. A complete file of approved field sketches, diagrams, and other changes shall also be maintained. At completion of the work, the complete set of red marked contract documents,

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plus all approved field sketches and diagrams shall be submitted to the engineer and used in preparation of the record drawings.

- D. A complete set of red marked contract drawings shall be submitted, at one time, as the "Record" set. If there are no changes to a specific drawing, the contractor shall indicate "NO CHANGES" on that drawing. ALL drawings shall be included in the "Record" set.
- E. The complete set of red marked Contract Documents or electronic files shall be certified by the Contractor as reflecting record conditions and submitted to the engineer for review.
- F. The Contractor shall have the marked up set scanned, if they are not already electronic files, and then submit them to the Engineer as the "Record Set".
- G. Refer to Division 01 for additional requirements.

1.37 FINAL INSPECTION

- A. Upon completion of all Engineering Site Observation list items, the Contractor shall provide a copy of the Engineering Site Observation Report back to the Engineer with each items noted as completed or the current status of the item.

1.38 COMMISSIONING

- A. Refer to General Commissioning Requirements in Division 01 for additional requirements

1.39 TEMPORARY HEATING AND COOLING

- A. Refer to the General Conditions of the Contract for Construction and Supplemental General Conditions.
- B. Systems and equipment installed as part of this project shall not be used for temporary heating or cooling.

1.40 MAINTENANCE OF HVAC SYSTEMS DURING TEMPORARY USE PERIODS

- A. Provide each air handling system with a set of prefilters in addition to the permanent filters. Furnish four sets of prefilters for each system for use when system is operated for temporary heating or cooling. During such use, change prefilters as often as directed by Owner's Representative. Provide MERV-8 filters in all open ended ducts, return grilles and registers to keep dust out of ductwork. Change as often as necessary. Remove all such temporary filters upon completion. Use supply fans only. Do not operate return fans.

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- B. Blank-off outside air intake opening during temporary heating period. Install first set of permanent filters and prefilters.
- C. Adjust dampers on supply system.
- D. Set all heating coil control valves for manual operation.
- E. Do not install any grilles or diffusers at room terminal ends of ducts until permission is given.
- F. Assume responsibility for systems and equipment at all times, even though used for temporary heat or ventilating. Repair or replace all dented, scratched or damaged parts of systems prior to final acceptance.
- G. Remove concrete, rust, paint spots, other blemishes, then clean.
- H. Just prior to final acceptance, remove used final filter and install new set. Deliver all unused sets of prefilters to the Owner and obtain written receipt. Properly lubricate system bearings before and during temporary use. Maintain thermostats, freeze stats, overload devices, and all other safety controls in operating condition.

1.41 TEMPORARY FACILITIES

- A. Refer to the Division 01 Sections, General Conditions and Supplemental General Conditions.

1.42 TEMPORARY LIGHT AND POWER

- A. Refer to the Division 01 Sections, General Conditions and Supplemental General Conditions.

1.43 CLEANING

- A. It is the Contractor's responsibility to keep clean all equipment and fixtures provided under this contract for the duration of the project. Each trade shall keep the premises free from an accumulation of waste material or rubbish caused by his operations. The facilities require an environment of extreme cleanliness, and it is the Contractor's responsibility to adhere to the strict regulations regarding procedures on the existing premises. After all tests are made and installations completed satisfactorily:
 - 1. Thoroughly clean entire installation, both exposed surfaces and interiors.
 - 2. Remove all debris caused by work.
 - 3. Remove tools, surplus, materials, when work is finally accepted.

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1.44 SYSTEM START-UP AND TESTING

- A. Prior to commencement of work, the Division(s) effecting such system shall survey all building mechanical, plumbing, fire protection and electrical systems and components and make written notice to the Owner regarding any damage, missing items and/or incomplete systems. Prior to the conclusion of this project, the Contractor shall verify with the Owner's Representative that all building systems have been returned to their original conditions.
- B. Start-up and testing of HVAC systems shall occur while the building is not occupied by Owner and only after notice to the Owner's Representative is made at least 24 hours in advance. Division 23 shall be responsible for providing temporary filter media over all supply air registers and diffusers during the HVAC system start-up procedure. Division 23 shall provide airtight plastic covers over all supply and return air openings prior to the start of construction by any contractor. The plastic shall be maintained airtight throughout the project construction and removed only with the approval of the Owner's Representative.

1.45 TRANSFER OF ELECTRONIC FILES

- A. M/E Engineering, P.C. will provide electronic files for the Contractor's use in the preparation of sheet metal shop drawings, coordination drawings, or record drawings related to the project, subject to a \$50.00 charge per drawing file and the following terms and conditions:
 - 1. The Contractor shall submit a formal request for electronic drawing files on the M/E Engineering, P.C. website, by utilizing the following website link: <http://www.meengineering.com/contact-pages/contractor-request>.
 - 2. M/E Engineering, P.C. makes no representation as to the compatibility of these files with the Contractor's hardware or the Contractor's software beyond the specific release of the referenced specifications.
 - 3. M/E Engineering can only provide CAD files of M/E/P/FP drawing levels for which we are the Engineer of Record. CAD files of Architectural backgrounds, reflected ceiling plans, structural plans, etc. must be obtained separately from the Architect of Record.
 - 4. Data contained on these electronic files is part of M/E Engineering, P.C.'s instruments of service shall not be used by the Contractor or anyone else receiving data through or from the Contractor for any purpose other than as convenience in the preparation of shop drawings for the referenced project. Any other use or reuse by the Contractor or by others will be at the Contractor's sole risk and without liability or legal exposure to M/E Engineering, P.C. The Contractor agrees to make no claim and hereby waive, to the fullest extent permitted by law, any claim or cause of action of any nature against M/E Engineering, P.C., its officers, directors,

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employees, agents or sub-consultants which may arise out of or in connection with the Contractor's use of the electronic files.

5. Furthermore, the Contractor shall, to the fullest extent permitted by law, indemnify and hold harmless, M/E Engineering, P.C. from all claims, damages, losses and expenses, including attorney's fees arising out of or resulting from the Contractor's use of these electronic files.
6. These electronic files are not contract documents. Significant difference may arise between these electronic files and corresponding hard copy contract documents due to addenda, change orders or other revisions. M/E Engineering, P.C. makes no representation regarding the accuracy or completeness of the electronic files the Contractor receives. In the event that a conflict arises between the signed contract documents prepared by M/E Engineering, P.C. and electronic files, the signed contract documents shall govern. The Contractor is responsible for determining if any conflicts exist. By the Contractor's use of these electronic files the Contractor is not relieved of the Contractor's duty to comply with the contract documents, including and without limitation, the need to check, confirm and coordinate all dimensions and details, take field measurements, field verify conditions and coordinate the Contractor's work with that of other contractors for the project.

1.46 VIDEO RECORDING OF TRAINING SESSIONS

- A. The contractor shall video record all training sessions required by their discipline. Video shall be in Windows Media Player video format saved on flash drives. Two (2) copies on flash drives are to be provided as a formal submittal. . Flash drives are to be tagged with project name, training session name(s), installing Contractor and date of training. The flash drive shall include a scanned version of the training session sign in list(s), including the presenter and the owner's participants.

1.47 ENERGY INCENTIVES

- A. The Contractor, his Subcontractors and Suppliers shall provide to the Owner all paperwork necessary to support the Owners pursuit of incentives related to energy conservation as offered by the utility company or state sponsored incentive programs. This shall include at a minimum, receipts, and quantities and data sheets for energy efficient equipment such as: lighting, motors, variable frequency drives, etc.

1.48 INFECTION CONTROL

- A. Construction procedures, temporary partitions, negative air systems, cleaning procedures, HVAC system isolation, dust control, etc. shall be in accordance with

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the infection control standards set forth by the Facility. A copy of the facilities standards are available from the Owner upon request.

END OF SECTION

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SECTION 21 05 53 - FIRE PROTECTION IDENTIFICATION

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Provide labor, materials, equipment and services as required for the complete installation designed in Contract Documents.

1.2 QUALIFICATIONS

- A. All identification devices shall comply with ANSI A13.1 for lettering size, length of color field, colors, and viewing angles.

1.3 SUBMITTALS

- A. Submit manufacturer's technical product data and installation instructions for each identification material and device. Submit valve schedule for each piping system typewritten on an 8-1/2 in. x 11 in. paper (minimum), indicating code number, location and valve function. Submit schedule of pipe, equipment and name identification for review before labeling.

1.4 ACCEPTABLE MANUFACTURERS

- A. Allen Systems, Inc., Brady (W.H.) Co.; Signmark Div., Emedco, Industrial Safety Supply Co., Inc., Lab Safety Supply, Seton Name Plate Corp.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Provide manufacturer's standard products of categories and types required for each application. In cases where there is more than one type specified for an application, selection is installer's option, but provide single selection for each product category.
- B. All adhesives used for labels in the interior of the building shall comply with the maximum Volatile Organic Compound (VOC) limits as called for in the current version of U.S. Green Building Council LEED Credits EQ 4.1 and EQ 4.2.
- C. For work within an existing building, the mechanical identification shall meet the intent of this section, but match the Owner's existing identification symbology.

2.2 PIPING IDENTIFICATION

- A. Identification Types:

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1. Snap-on type: Provide manufacturer's standard pre-printed, semi rigid snap-on, color coded pipe markers, complying with ANSI-A13.1.
2. Pressure sensitive type: Provide manufacturer's standard pre-printed, permanent adhesive, color coded, pressure sensitive vinyl pipe markers complying with ANSI A13.1. Provide a 360° wrap of flow arrow tape at each end of pipe label.
3. Stencil paint: Apply black or yellow stencil paint directly to covering or bare pipe; color to contrast with background. Stencil as follows:

O.D. PIPE OR COVERING	SIZE STENCIL LETTER
3/4 in., 1 in., 1-1/4 in.	1/2 in.
1-1/2 in., 2 in.	3/4 in.
2-1/2 in. and over	1-1/4 in.

B. Lettering:

1. Piping labeling shall conform to the following list:

PIPE FUNCTION	IDENTIFICATION
Fire Sprinkler Water	FIRE SPRINKLER WATER

2.3 VALVE IDENTIFICATION

A. Valve Tags:

1. Standard brass valve tags, 2 in. diameter with 1/2 in. high black-filled numerals. Attach to valve with brass jack chain and "S" hook. Identify between fire protection, heating and plumbing services with 1/4 in. letters above the valve number.
2. Equal to Seton Style No. M4507.

B. Provide a sign for each control, sectional and drain valve identifying the portion of the building served in accordance with NFPA 13. Signs shall be permanently attached to the piping, the valve or the nearest wall. Signs shall not be hung from the piping of valves with wires or chains.

C. Valve Chart:

1. Provide valve chart for all valves provided as a part of this project. Frame and place under clear glass. Mount in Mechanical Room.

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2.4 EQUIPMENT IDENTIFICATION

A. General:

1. Provide engraved vinyl nameplates for each major piece of mechanical equipment provided, 2-1/2 in. x 3/4 in. size.
2. Nameplates: Equal to Seton Style No. M4562.

2.5 ABOVE CEILING EQUIPMENT LOCATOR

- A. 3/4 in. diameter adhesive stickers placed on ceiling grid and color-coded.
- B. The color for all fire protection valves shall be RED.

PART 3 - EXECUTION

3.1 GENERAL

- A. Provide valve tags for all valves provided on project. Coordinate valve numbers with the Owner's existing numbering system. Do not duplicate numbers.
- B. Provide piping identification with directional flow arrows for all piping on project, maximum every 20'-0" or piping installed through rooms, provide at least one pipe label in each room, for each pipe function.
- C. Provide equipment tags for all equipment provided.

END OF SECTION

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SECTION 21 10 10 - PIPING SYSTEMS AND ACCESSORIES

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Provide labor, materials, equipment and services to perform operations required for the complete installation and related Work as required in Contract Documents.

1.2 SUBMITTALS

- A. Provide a schedule of pipe materials, fittings and connections.
- B. Provide a detailed matrix listing the specific UL approved firestop system assembly to be used for each type of piping provided and each type of construction to be penetrated along with all associated UL assembly details.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Pipe and fittings shall be new, marked with manufacturer's name and comply with applicable ASTM and ANSI Standards.

2.2 STEEL PIPING AND FITTINGS

- A. Pipe: ASTM A53, or ASTM A106 seamless, Schedule 40 or Schedule 80 weight; black or galvanized finish as called for; ends chamfered for welding or grooved for grooved mechanical connections.
- B. Fittings: Same material and pressure class as adjoining pipe.
 - 1. Welded Fittings: Factory forged, seamless construction, butt weld type chamfered ends. Where branch connections are two or more sizes smaller than main size, use of "Weldolets", "Thredolets" or "Sockolets" acceptable. Mitered elbows, "shaped" nipples, and job fabricated reductions not acceptable unless specifically called for. Socket weld type, 2000 psi wp, where called for.
 - 2. Threaded Fittings: Class 125, cast or malleable iron, black or galvanized, as called for; UL listed and FM approved for fire protection systems. Street type 45° and 90° elbows are not acceptable.

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- C. Flanges, Unions, and Couplings:
 - 1. Threaded Connections:
 - a. Flanges: Cast iron companion type; for sizes 2-1/2 in. and larger.
 - b. Unions: Malleable iron, bronze to iron seat, 300 lb. wwp; for sizes 2 in. and smaller.
 - c. Couplings: Malleable iron. Steel thread protectors are not acceptable as couplings.
 - 2. Welded Connections:
 - a. Flanges: Welding neck type. Slip-on type not allowed unless noted and shall not be installed in conjunction with butterfly valves.
 - 3. Grooved Mechanical Connections:
 - a. Couplings: Ductile iron, ASTM A395 and ASTM A536, with painted coating, designed for rolled grooved piping, hot dipped galvanized finish complying with ASTM A153 where called for.
 - b. Gaskets: Grade "E" EPDM synthetic rubber, -30°F to 230°F temperature range, suitable for water service.
 - c. Bolts and Nuts: Heat treated, hex head carbon steel, ASTM A183, cadmium plated or zinc electroplated.
 - d. Fittings: Elbows, tees, laterals, reducers, adapters as required shall be ductile iron conforming to ASTM A395 and A536 Fittings shall have grooves designed to accept grooved end couplings of the same manufacturer.
 - e. Victaulic, rigid system, Style 005 couplings cast with offsetting angle pattern bolt pads to provide system rigidity and support in accordance with ANSI B31.1 and B 31.9. UL listed and FM approved; 300 psi wwp; follow all terms of listings/approvals.
 - f. Acceptable Manufacturers: Grinnell, Gruvlok by Anvil, Victaulic or approved equal.
- D. Gauge and Instrument Connections: Nipples and plugs for adapting gauges and instruments to piping system shall be IPS brass.

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2.3 THINWALL STEEL PIPE

- A. Pipe: ASTM A53, or A135, with Schedule 10 wall thickness for 2-1/2 in. through 5 in.; 0.134 in. for 6 in. and 0.188 in. for 8 in. and 10 in.; black or galvanized finish as called for; roll grooved ends.
- B. Fittings: Same construction as noted for steel pipe, ends roll grooved for grooved mechanical connections.

2.4 HANGERS, INSERTS AND SUPPORTS

- A. Hangers, Inserts, Clamps: B-Line, Grinnell, Michigan Hanger, PHD Manufacturing.
- B. Hangers:
 - 1. Adjustable, wrought malleable iron or steel with electroplated zinc or cadmium finish. Copper plated or PVC coated where in contact with copper piping. Hot-dipped galvanized finish for exterior locations.
 - 2. Adjustable ring type where piping is installed directly on hanger for piping 3 in. and smaller.
 - 3. Adjustable steel clevis type for piping 4 in. and larger.
 - 4. Nuts, washers and rods with electroplated zinc or cadmium finish. Hot-dipped galvanized finish for exterior locations.
- C. Spacing Schedule (Maximum Distance between Hangers (ft.-in.):

NOMINAL PIPE SIZE (IN.)	3/4	1	1-1/4	1-1/2	2	2-1/2	3	3-1/2	4	5	6	8
Steel Pipe	N/A	12-0	12-0	15-0	15-0	15-0	15-0	15-0	15-0	15-0	15-0	15-0
Rod Size (in.)	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	1/2	1/2	1/2

- D. Beam Attachments:
 - 1. C-Clamp style, locknut, restraining strap, electroplated finish, UL listed, FM approved for pipe sizes 2 in. and smaller, complying with NFPA 13.
 - 2. Center loaded style with clamp attachments that engage both edges of beam, electroplated finish, UL listed, FM approved, for pipe sizes larger than 2 in., refer to "Supports" for additional requirements, complying with NFPA 13.

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- E. Inserts: Carbon steel body and square insert nut, galvanized finish, maximum loading 1300 lbs., for 3/8 in. to 3/4 in. rod sizes, reinforcing rods on both sides, MSS-SP-69 Type 19 or approved equal, complying with NFPA 13.
- F. Supports:
 - 1. For all piping larger than 2 in., provide intermediate structural steel members for hanger attachment. Members shall span across the bar joists at panel points of joists. Secure member to structure. Select size of members based on a minimum factor of safety of four.
 - 2. For weights under 1,000 lbs.: "Drill-In" inserts, "U" shaped Channel, beam clamps or other structurally reviewed support. The factor of safety shall be at least four. Follow manufacturer's recommendations.
 - 3. For Metal Decks: Drill hole through for hanger rods and imbed a welded plate in concrete or use devices designed for this application, with a safety factor of four.
 - 4. Acceptable Manufacturers: Hilti, ITW Ramset, Phillips "Red Head" or approved equal.
- G. Hangers for fire protection piping as specified and in accordance with NFPA 13 and NFPA 14. Hangers and building attachments shall be UL listed and FM approved for fire protection service. Adjustable swivel ring type hangers are permitted for 3 in. and smaller piping.

2.5 PIPING ACCESSORIES

- A. Escutcheon Plates: Steel or cast brass, split hinge type with setscrew, high plates where required for extended sleeves. Chrome plated in finished areas.
- B. All bushings and nipples required for instruments and gauges shall be brass.

2.6 SLEEVES

- A. Standard Type:
 - 1. Schedule 40 black steel pipe sleeves for structural surfaces, two (2) pipe sizes larger than the pipe, and as recommended by the sealing element manufacturer. Provide full circle water stop collar for sleeves located within below grade walls, wet wells and waterproofed surfaces. The collar shall be fabricated from steel plate and welded to the sleeve around its entire circumference.

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2. Schedule 40 PVC sleeves or sheet metal sleeves for nonstructural surfaces and existing construction. Sheet metal sleeves shall be 18 gauge minimum and braced to prevent collapsing.

2.7 SEALING ELEMENTS

- A. Expanding neoprene link type, watertight seal consisting of interlocking links with zinc plated bolts.
 1. Acceptable Manufacturers: Thunderline "Link-Seal" Series 200, 300 or 400, Pyropac, Calipco.

2.8 FIRESTOP SYSTEM FOR OPENINGS THROUGH FIRE RATED WALL AND FLOOR ASSEMBLIES

- A. Materials for firestopping seals shall be listed by an approved independent testing laboratory for "Through-Penetration Firestop Systems". The system shall meet the standard fire test for Through-Penetration Firestop Systems designated ASTM E814. Firestop system seals shall be provided at locations where piping pass through fire rated wall, floor/ceiling, or ceiling/roof assembly. Minimum required fire resistant ratings of the assembly shall be maintained by the Firestop System. Installation shall conform to the manufacturer's recommendations and other requirements necessary to meet the testing laboratory's listing for the specific installation.

2.9 PIPING MATERIALS AND SCHEDULE

- A. See Exhibit "A" - Piping Materials at end of this Section for Fire Protection piping.
- B. See Exhibit "B" - Testing at end of this Section for Fire Protection piping.

PART 3 - EXECUTION

3.1 EQUIPMENT AND SYSTEMS

- A. Install equipment and systems in accordance with provisions of each applicable section of these Specifications, and Local/State Codes/Regulations having jurisdiction. Accurately establish grade and elevation of piping before setting sleeves. Install piping without springing or forcing, except where specifically called for, making proper allowance for expansion and anchoring. Changes in size shall be made with reducing fittings. Reducing couplings are not acceptable. Arrange piping at equipment with necessary offsets, unions, flanges, and valves, to allow for easy part removal and maintenance. Offset piping and change elevation as required, to coordinate with other work. Avoid contact with other mechanical or electrical systems. Provide adequate means of draining and venting systems. Conceal piping unless otherwise called for.

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- B. Copper tubing shall be cut with a wheeled tubing cutter or other approved copper tubing cutter tool. The tubing must be cut square to permit proper joining with the fittings. Ream pipes after cutting and clean before installing.
- C. Cap or plug equipment and pipe openings during construction. Install piping parallel with lines of building, properly spaced to provide clearance for insulation. Make changes in direction and branch connections with fittings. Do not install valves, unions and flanges in inaccessible locations. Materials within a system and between systems shall be consistent. If this is not possible, install dielectric fittings.

3.2 PIPING OVER ELECTRICAL EQUIPMENT

- A. Contractor shall route piping to avoid installation directly over electric equipment, including, but not limited to panels, transformers, disconnects, starters, motor control center, adjustable speed drives and fused switches.
- B. Piping shall not be installed in the dedicated electric and working space as defined by NEC 110. Dedicated electrical space is generally equal to the depth and width of electrical equipment, and extends 6 ft. above the electrical equipment, or to a structural ceiling. Dedicated working space is a minimum of 30 in. wide or the width of equipment (whichever is larger) a minimum of 6 ft.-6 in. tall, with a depth of 3ft. to 9 ft. depending on the voltage.

3.3 HANGERS, INSERTS AND SUPPORTS

- A. Piping shall not be supported by wires, band iron, chains, from other piping, or by vertical expansion bolts. Support piping with individual hangers from concrete inserts, wood construction, welded supports, or beam clamps of proper configuration and loading design requirements for each location; replace if not suitable. Follow manufacturer's safe loading recommendations. Suspend with rods of sufficient length for swing and of size called for, using four (4) nuts per rod. Provide additional structural steel members, having one coat rustproof paint, where required for proper support. Provide oversized hangers on diesel engine exhaust piping where insulation/supports must pass between pipe and hanger. Hangers, when attached to joists, shall only be placed at the top or bottom chord panel point. Only concentric type hangers are permissible on piping larger than 2-1/2 in.; "C" types are permitted for piping 2 in. and smaller on joists. Provide riser clamps for each riser at each floor.

3.4 PIPE CONNECTIONS

- A. Threaded Connections: Clean out tapering threads, made up with pipe dope; screwed until tight connection. Pipe dope must be specifically selected for each application.

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- B. Grooved Mechanical Joints: Pipes joined with grooved fittings shall be joined by a listed combination of fittings, couplings, gaskets and grooves of a single manufacturer. Lubricate and install gasket and couplings. Follow manufacturer's recommendations. Grooved ends shall be clean and free of indentations, projections and roll marks in the area from pipe end to groove.

3.5 WELDING

- A. Welding shall be performed in compliance with the welding procedure specifications prepared by the National Certified Pipe Welding Bureau. Welded piping fabricated by qualified welder. Use certified welder where specifically required by code or insurance company. If indicated and permitted for fire protection systems, all provisions for welded pipe shall additionally be in accordance with NFPA Standard 13. Use full length pipe where possible; minimum distance between welds, 18 in. on straight runs. Welds must be at least full thickness of pipe with inside smooth and remove cutting beads, slag and excess material at joints; chamfer ends. Minimum gap 1/8 in., maximum 1/4 in., for butt welds. Overlaps on position and bench welds to be not less than 3/4 in. One internal pass and one external pass minimum required on slip-on flanges. Do not apply heat to rectify distorted pipe due to concentrated welding; replace distorted pipe.
- B. When welding galvanized pipe, apply cold galvanizing on joint following welding.

3.6 SLEEVES

- A. Provide for pipes passing through floors, walls or ceilings. Not required for floors that are core-drilled, except where floor is waterproofed. Extend 1/8 in. above finished floor in finished areas. In above grade Mechanical Rooms and other areas with floor drains use steel pipe sleeves 2 in. above floor. Use steel pipe sleeves in bearing wall, structural slabs, beams and other structural surfaces, and where called for. Sleeves shall be as small as practical, consistent with insulation, so as to preserve fire rating. Fill abandoned sleeves with concrete. Provide rubber grommet seals for pipes passing through ducts or air chambers or built-up housings.

3.7 SLEEVE PACKING

- A. Seal void space at sleeves as follows:
 - 1. Interior locations: Firmly pack with fiberglass and caulk.
 - 2. Exterior walls above grade: Use sealing element.
 - 3. Exterior walls below grade and above floors: Use sealing element.

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4. Cored holes: Use sealing element.
5. Fire rated, partitions and floor slabs: Use fire rated sealing elements, materials and methods. Provide per manufacturer's instructions to maintain firestop.
6. Waterproofed walls/floors: Use waterproof sealing element, device or compound.

3.8 ESCUTCHEON PLATES

- A. Provide polished chrome setscrew type escutcheon plates for all exposed piping passing through floors, walls or ceilings, in all rooms except in Boiler, Fan and Mechanical Rooms.

3.9 TESTS

- A. Fire suppression systems shall be hydrostatically tested at 200 psi for two (2) hours in accordance with NFPA 13.
- B. Provide all necessary items to complete proper testing of work. Perform all testing in accordance with governing Codes, local utilities and other agencies having jurisdiction and as specified. Pay all costs to perform tests. Perform all testing in a safe manner. Isolate existing systems.

3.10 PIPE LINE SIZING

- A. Pipe sizes called for are to be maintained. Pipe size changes made only as reviewed by Owner's Representative and shall be justified by hydraulic calculations. Where discrepancy in size occurs, the larger size shall be provided.

EXHIBIT "A" - PIPING MATERIALS
(Notes at end of Exhibit "A")

<u>SERVICE</u>	<u>PIPE MATERIALS</u>	<u>FITTINGS</u>	<u>CONNECTIONS</u>
Sprinkler (wet)	Schedule 40, black steel, 2 in. and smaller	Cast or malleable iron	Threaded
	"Thinwall" black steel, 2-1/2 in. and larger	Ductile iron	Roll grooved mechanical type couplings

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EXHIBIT "B" - TESTING

SERVICE

TEST REQUIREMENTS

Sprinklers

Test hydrostatically at 200 psi for two (2) hours in accordance with NFPA 13.

END OF SECTION

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SECTION 21 13 00 - FIRE SUPPRESSION SPRINKLER SYSTEMS

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Provide labor, materials, equipment and services to perform operations required for the complete installation and related Work as required in Contract Documents.

1.2 QUALITY ASSURANCE

- A. Comply with the 2020 Fire Code of New York State referenced edition of the following National Fire Protection Association (NFPA) Standards:
 - 1. NFPA 13: Standard for the Installation of Sprinkler Systems.
 - 2. NFPA 25: Inspection, Testing and Maintenance of Water-Based Fire Protection Systems.
 - 3. NFPA 72: National Fire Alarm Code.
 - 4. NFPA 241: Standard for Safeguarding Construction, Alteration and Demolition Operations.
 - 5. NFPA 291: Recommended Practice for Fire Flow Testing and Marking of Hydrants.
- B. Follow all requirements, recommendations and appendices to comply with the latest edition of the following publications, codes, standards, and listings/approvals:
 - 1. Underwriters Laboratories, Inc. (UL) Fire Protection Equipment Directory.
 - 2. 2020 Fire Code of New York State.
 - 3. OSHA Rules and Regulations.
 - 4. Requirements of Insurance Underwriter and other Authorities Having Jurisdiction.
- C. Equipment, devices, hangers and components shall be UL listed and labeled for the intended fire protection service.
- D. The fire protection work shall be performed by an experienced firm regularly engaged in the installation of fire protection sprinkler systems.

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- E. Preparation of working plans, calculations and site observation of systems shall be completed by a NICET Level III technician under the direction of a qualified New York State Registered Professional Engineer.

1.3 SYSTEM DESCRIPTION

- A. The fire protection system shall be a wet pipe automatic sprinkler system arranged to properly protect spaces as indicated.
- B. This contractor shall arrange for a new flow test on the municipal main prior to performing hydraulic calculations. The more restrictive of these two tests shall be used as the basis of design.
- C. The system shall be hydraulically calculated in accordance with all provisions of the Contract Documents and any Authority Having Jurisdiction.
- D. Calculations shall be based upon the specific hazard for the areas being protected. The following minimum requirements shall be provided as actually installed in the protected spaces.
 - 1. Light hazard: These areas shall include: Offices, Conference rooms, Toilet rooms, Hallways and similar spaces
 - a. Water density: 0.10 gpm/sq. ft.
 - b. Maximum coverage per sprinkler = 225 sq. ft.
 - c. Hydraulic remote area: 1500 sq. ft.
 - d. Interior hose demand: 50 gpm.
 - e. Exterior hose demand: 50 gpm.
 - 2. Ordinary Hazard Group 1: These areas shall include: Storage, Labs, Mechanical rooms, Data Rooms and similar spaces
 - a. Water density: 0.15 gpm/sq. ft.
 - b. Maximum coverage per sprinkler = 130 sq. ft.
 - c. Hydraulic remote area: 1500 sq. ft.
 - d. Interior hose demand: 100 gpm.
 - e. Exterior hose demand: 150 gpm.

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- E. Maximum coverage for any sprinkler head shall not exceed NFPA requirements and the listing for the sprinklers provided.
- F. A minimum 10 psi safety factor shall be provided between the available municipal water supply curve and the total system demand point. The total system demand point shall be at the municipal water main and include the calculated sprinkler and interior hose stream demands plus the exterior hose stream demand at the residual pressure required for proper system operation.
- G. The maximum flow velocity shall not exceed 20 ft. per second in the piping system and 15 ft. per second in mains with paddle type waterflow indicators.
- H. Water supply control valves shall be electrically supervised and mechanically locked for proper position. Waterflow and supervisory circuits shall be in accordance with the requirements of electrical specifications. Electric connections to sprinkler system shall be by Division 26. Furnish wiring diagrams for all equipment.
- I. Provide 3/16 in. x 1 in. cadmium plated carbon steel chains and master keyed all brass case hardened padlocks to lock water supply valves in the proper position.

1.4 SUBMITTALS

- A. Product Data:
 - 1. Submit manufacturer's catalog cut, specifications and installation instructions for each item or component of fire protection system. Clearly indicate pertinent information such as, but not limited to:
 - a. Manufacturer's model number.
 - b. Materials, size, finish and type of connection.
 - c. Pressure ratings of components.
 - d. FM approval/UL listing.
- B. Certification: Submit Contractor's NICET certification and number.
- C. Samples:
 - 1. If requested, submit sample of sprinklers.
- D. Drawings and Calculations:

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1. All drawings and calculations shall be signed and sealed by a New York State Registered Professional Engineer.
 2. Submit complete NFPA 13 drawings and hydraulic calculations with cross reference to applicable drawings, water supply data, and equipment schedule with ratings for the system to the Owner's Representative, Insurance Underwriter, and other Authorities Having Jurisdiction.
 3. Submit hydraulic calculations for each design density/remote area with items in NFPA 13 incorporated including sketches to indicate flow quantities, sprinklers operating and direction of flow for pipes in looped and gridded systems.
 4. Drawing shall be fabrication drawings provided to indicate actual sprinkler, standpipe and equipment layouts. Drawings shall be 1/4" = 1'-0" scale on reproducible sheets of uniform size. Drawings shall show all data required by NFPA 13.
 5. Submit drawings in one (1) complete package.
- E. Record Drawings and Documents:
1. Submit Record Drawings, hydraulic calculations, test reports, and NFPA Above and Below Ground Material and Test Certificates to the Owner's Representative, Insurance Underwriter and other Authorities Having Jurisdiction.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Mixing of manufacturers or models of the same or similar component will not be acceptable.

2.2 SPRINKLERS AND ACCESSORIES

- A. Brass or bronze, 1/2 in. orifice, 1/2 in. NPT. 165°F ordinary temperature classification for light and ordinary hazards. Use 286°F sprinklers in Mechanical, Electrical and Elevator Rooms; in vicinity of heat equipment/sources; and in accordance with NFPA 13.
1. Finished Ceiling Areas: Concealed pendent sprinklers with matching coverplate, color as selected by Architect.
 2. Unfinished Ceiling Areas: Natural brass/bronze finish pendent or upright sprinklers as required.

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B. Sprinkler Types and Design Equipment:

1. Quick Response Pendent and Upright: Reliable Model F1FR.
2. Quick Response Concealed Pendent: Reliable Model G4A.
3. Quick Response Horizontal Sidewall: Reliable Model F1FR-HSW1.

C. Flexible Sprinkler Drops:

1. FM Approved braided Type 304 stainless steel tube with union joints, factory tested to 400 psi and listed for up to three (3) 90° bends including bracket for mounting to ceiling or building structure.
 - a. Design Equipment: Victaulic "VicFlex".

2.3 ALARM EQUIPMENT

A. Paddle Waterflow Detectors:

1. Adjustable retard feature, SPDT contacts, 24 volt DC, 250 psi rated.
2. Design Equipment: Potter Electric #VSR Series.

B. Tamper Switches:

1. Integral with valve or separate device installed on valve to actuate alarm upon valve movement, steel enclosure, SPDT contacts, 24 volt DC, mounting brackets and hardware.
2. Design Equipment: Potter Electric #OSYSU (for OS&Y valves) and #PIVSU-A (for post indicator and butterfly valves).

C. Acceptable Manufacturers: Autocall, Potter Electric, System Sensor or approved equal.

2.4 INSPECTOR'S TEST EQUIPMENT

A. Test and Drain Valve:

1. Combined test and drain valves, sight glass and interchangeable restricting orifice, sized for smallest orifice in sprinkler zone.
2. Design Equipment: AGF Manufacturing "Test and Drain".

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3. Acceptable Manufacturers: AGF Manufacturing, Viking, Victaulic or approved equal.

2.5 SYSTEM COMPONENT IDENTIFICATION

- A. At control, test and drain valves, provide permanently marked identification signs constructed of 18 gauge steel with baked enameled finish. The signs shall be permanently mounted on the piping or wall at the valve, or on the valve, but shall not be hung on the valve with wires or chains which permits easy removal of the sign. The sign shall clearly indicate the valve's purpose and what portion of the structure it serves. Additional signs, shall be provided at each alarm check and dry pipe valve to clearly indicate hydraulic calculation data.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. The nature of the work requires coordination with other trades. Shop fabrication shall be done at the Contractor's risk. Relocation of piping and components to avoid obstructions may be necessary. Relocation, if required, shall be done at the Contractor's expense. The installation shall be performed in a workmanlike manner as determined by the Owner's Representative and in accordance with the Contract Documents, manufacturer's printed installation instructions, and submitted and Owner's Representative reviewed drawings.
- B. Piping shall not pass directly over electric panelboards, switchboards, motor control centers, and similar electric and telephone equipment. However, protection for these spaces shall be provided.
- C. Piping shall be installed concealed above finish ceiling area with sprinklers located in the center of ceiling tiles where ceiling tiles are used.
- D. Provide a readily removable flushing connection consisting of a cap at each end of cross mains.
- E. Pipe ball drip valves at a floor drain or to the exterior. Pipe 2 in. main drains and water motor gong drains to discharge to the exterior at approximately 2 ft. above finished grade.
- F. Securely install the spare sprinkler cabinets to the building wall at the main riser.
- G. Inspector's test valves shall be installed 7 ft. or less above the finished floor.
- H. Fire department connections shall be installed 3 ft. above finished grade and water motor gongs approximately 10 ft. above finished grade.

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- I. Upright sprinklers directly on branch lines shall be installed with their frame parallel to the piping.
- J. Provide sprinkler protection under ductwork, groups of ductwork and other obstructions to water spray and distribution. Use intermediate level sprinklers if subject to waterspray from above.
- K. Exposed pipe shall be left clean for painting.
- L. Coordinate and activate the systems or portions of the system to operational status as soon as possible.

3.2 PIPING, VALVES AND HANGERS

- A. Refer to other applicable sections.
- B. All piping shall be installed to permit drainage of the system through a main drain valve. Where a change in piping direction prevents drainage of the system, auxiliary drains shall be provided. The auxiliary drain assembly shall consist of a lockable ball valve, nipple and cap or plug and shall be located 7 ft. or less above the finished floor. Pipe drain to an accessible location.

3.3 TESTS

- A. General:
 - 1. Pipe installation shall be inspected by Owner's Representative prior to being covered by building construction or backfill.
 - 2. Give the Owner's Representative advance notice of final tests. Perform tests in a safe manner. Provide written certification that tests have been successfully completed. Use NFPA Above and Below Ground Material and Test Certificate Forms.
 - 3. Correct system leaks prior to final test. Do not utilize water additives, caulking, etc. to correct leaks. Provide appliances, equipment, instruments, devices and personnel.
 - 4. Flushing: Follow Contract Documents and utilize open end pipe sections if possible.
- B. Pressure Tests:
 - 1. Hydrostatic Tests: Minimum 200 psi and in accordance with NFPA 13 for two (2) hours.

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- a. Air test not accepted as final test.
- 2. Do not subject existing systems to excess pressures.
- C. Alarm Tests:
 - 1. Demonstrate activation of alarms

3.4 SYSTEM TURNOVER

- A. Prior to final acceptance, instruct the Owner's Representative in the proper operation, maintenance, testing, inspection and emergency procedures for all systems furnished, for a period of time as needed. Provide one (1) new original pamphlet of NFPA 25. Indicate in writing to the Owner's Representative the provisions for proper maintenance, testing, and inspection of the systems as required by local fire codes.

END OF SECTION

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SECTION 22 05 00 - BASIC PLUMBING REQUIREMENTS

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Provide all labor, tools, materials, accessories, parts, transportation, taxes, and related items, essential for installation of the work and necessary to make work, complete, and operational. Provide new equipment and material unless otherwise called for. References to codes, specifications and standards called for in the specification sections and on the drawings mean, the latest edition, amendment and revision of such referenced standard in effect on the date of these contract documents. All materials and equipment shall be installed in accordance with the manufacturer's recommendations.

1.2 LICENSING

- A. The Contractor shall hold a license to perform the work as issued by the authority having jurisdiction.
- B. Plumbing contract work shall be performed by, or under, the direct supervision of a licensed master plumber.
- C. Electrical contract work shall be performed by, or under, the direct supervision of a licensed electrician.

1.3 PERMITS

- A. Apply for and obtain all required permits and inspections, pay all fees and charges including all service charges. Provide certificate of approval from the Authorities Having Jurisdiction prior to request for final payment.
- B. Provide electrical inspection certificate of approval from Middle Department Inspection Agency, Commonwealth Inspection Agency, or an Engineer approved Inspection Agency prior to request for final payment.

1.4 CODE COMPLIANCE

- A. Provide work in compliance with the following:
 - 1. 2020 Building Code of New York State.
 - 2. 2020 Existing Building Code of New York State.
 - 3. 2020 Fire Code of New York State.
 - 4. 2020 Plumbing Code of New York State.

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5. 2020 Mechanical Code of New York State.
6. 2020 Fuel Gas Code of New York State.
7. 2020 Property Maintenance Code of New York State.
8. 2020 Energy Conservation Code of New York State
9. Accessible and Usable Buildings and Facilities, ICC A117.1 (2009).
10. New York State Department of Labor Rules and Regulations.
11. New York State Department of Health.
12. 2017 National Electrical Code (NEC)
13. Occupational Safety and Health Administration (OSHA).
14. Local Codes and Ordinances.
15. Life Safety Code, NFPA 101.

1.5 GLOSSARY

ACI	American Concrete Institute
AGA	American Gas Association
AGCA	Associated General Contractors of America, Inc.
AIA	American Institute of Architects
AISC	American Institute of Steel Construction
AFBMA	Anti-Friction Bearing Manufacturer's Association
AMCA	Air Moving and Conditioning Association, Inc.
ANSI	American National Standards Institute
ARI	Air Conditioning and Refrigeration Institute
ASHRAE	American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc.
ASME	American Society of Mechanical Engineers
ASPE	American Society of Plumbing Engineers
ASTM	American Society for Testing Materials
AWSC	American Welding Society Code
AWWA	American Water Works Association

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FM	Factory Mutual Insurance Company
IBR	Institute of Boiler & Radiation Manufacturers
IEEE	Institute of Electrical and Electronics Engineers
IRI	Industrial Risk Insurers
NEC	National Electrical Code
NEMA	National Electrical Manufacturer's Association
NESC	National Electrical Safety Code
NFPA	National Fire Protection Association
NYS/DEC	New York State Department of Environmental Conservation
SBI	Steel Boiler Institute
SMACNA	Sheet Metal and Air Conditioning Contractors National Association
UFPO	Underground Facilities Protective Organization
UL	Underwriter's Laboratories, Inc.
OSHA	Occupational Safety and Health Administration
XL - GAP	XL Global Asset Protection Services

1.6 DEFINITIONS

Acceptance	Owner acceptance of the project from Contractor upon certification by Owner's Representative.
As Specified	Materials, equipment including the execution specified/shown in the contract documents.
Basis of Design	Equipment, materials, installation, etc. on which the design is based. (Refer to the article, Equipment Arrangements, and the article, Substitutions.)
Code Requirements	Minimum requirements.
Concealed	Work installed in pipe and duct shafts, chases or recesses, inside walls, above ceilings, in slabs or below grade.
Coordination Drawings	Show the relationship and integration of different construction elements and trades that require careful coordination during fabrication or installation, to fit in the space provided or to function as intended.
Delegated-Design Services	Performance and Design criteria for Contractor provided professional services. Where professional design services or certifications by a design professional are specifically required of a Contractor, by the

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	Contract Documents. Provide products and systems with the specific design criteria indicated. If criteria indicated is insufficient to perform services or certification required, submit a written request for additional information to the Engineer. Submit wet signed and sealed certification by the licensed design professional for each product and system specifically assigned to the Contractor to be designed or certified by a design professional. Examples: structural maintenance ladders, stairs and platforms, pipe anchors, seismic compliant system, wind, structural supports for material equipment, sprinkler hydraulic calculations.
Equal, Equivalent, Equal To, Equivalent To, As Directed and As Required	Shall all be interpreted and should be taken to mean "to the satisfaction of the Engineer".
Exposed	Work not identified as concealed.
Extract	Carefully dismantle and store where directed by Owner's Representative and/or reinstall as indicated on drawings or as described in specifications.
Furnish	Purchase and deliver to job site, location as directed by the Owner's Representative.
Inspection	Visual observations by Owner's site Representative.
Install	Store at job site if required, proper placement within building construction including miscellaneous items needed to affect placement as required and protect during construction. Take responsibility to mount, connect, start-up and make fully functional.
Labeled	Refers to classification by a standards agency.
Manufacturers	Refer to the article, Equipment Arrangements, and the article, Substitutions.
Prime Professional	Architect or Engineer having a contract directly with the Owner for professional services.
Product Data	Illustrations, standard schedules, performance charts, instructions, brochures, wiring diagrams, finishes, or other information furnished by the Contractor to illustrate materials or equipment for some portion of the work.
Provide (Furnish and Install)	Contractor shall furnish all labor, materials, equipment and supplies necessary to install and place in operating condition, unless otherwise specifically stated.
Relocate	Disassemble, disconnect, and transport equipment to new locations,

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	then clean, test, and install ready for use.
Remove	Dismantle and take away from premises without added cost to Owner, and dispose of in a legal manner.
Review and Reviewed	Should be taken to mean to be followed by "for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents".
Roughing	Pipe, duct, conduit, equipment layout and installation.
Samples	Physical full scale examples which illustrate materials, finishes, coatings, equipment or workmanship, and establishes standards by which work will be judged.
Satisfactory	As specified in contract documents.
Shop Drawings	Fabrication drawings, diagrams, schedules and other instruments, specifically prepared for the work by the Contractor or a Sub-contractor, manufacturer, supplier or distributor to illustrate some portion of the work.
Site Representative	Owner's Inspector or "Clerk of Works" at the work site.
Submittals Defined (Technical)	Any item required to be delivered to the Engineer for review as requirement of the Contract Documents. The purpose of technical submittals is to demonstrate for those portions of the work for which a submittal is required, the manner in which the Contractor proposes to conform to the information given and design concepts expressed and required by the Contract Documents.

1.7 EXISTING CONDITIONS

- A. Contractor shall review all available record documents of existing construction or other existing conditions and hazardous material information. Owner does not guarantee that existing conditions are the same as those indicated in these documents. Contractor shall record existing conditions via measured drawings and preconstruction photographs or video. Inventory and record the condition of items to be removed and salvaged. Provide photographs or video of conditions that might be misconstrued as damage caused by salvage, removal or construction operations.
- B. Owner will occupy portions of the building immediately adjacent to the area(s) of removals. Conduct removals so Owner's operations are not disrupted. Contractor shall locate, identify, disconnect and seal or cap mechanical, plumbing, fire protection and/or electrical systems serving areas of removals, unless noted otherwise in the contract documents. Contractor shall arrange shut-down of systems with the Construction Manager. Piping and ductwork indicated to be removed shall be removed and capped or plugged with compatible materials. If services/systems are required to be removed, relocated

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or abandoned, provide temporary services/systems the bypass area(s) of removals to maintain continuity of services/systems to other parts of the building, as required.

1.8 SHOP DRAWINGS/PRODUCT DATA/SAMPLES

- A. Provide submittals on all items of equipment and materials to be furnished and installed. Submittals shall be accompanied by a transmittal letter, stating name of project and contractor, name of vendor supplying equipment, number of drawings, titles, specification sections (name and number) and other pertinent data called for in individual sections. Submittals shall have individual cover sheets that shall be dated and contain: Name of project; name of prime professional; name of prime contractor; description or names of equipment, materials and items; and complete identification of locations at which materials or equipment are to be installed. Individual piecemeal or incomplete submittals will not be accepted. Similar items, (all types specified) shall be submitted at under one cover sheet per specification section (e.g. lighting fixtures, valves, plumbing fixtures, etc.). Submittals shall include all required documentation for each product listed in the specification section at the same time as a complete package. Number each submittal by trade. Indicate deviations from contract requirements on Letter of Transmittal. Submittals will be given a general review only. Corrections or comments made on the Submittals during the review do not relieve Contractor from compliance with requirements of the drawings and specifications. The Contractor is responsible for: confirming and correcting all quantities; checking electrical characteristics and dimensions; selecting fabrication processes and techniques of construction; coordinating his work with that of all other trades; and performing his work in a safe and satisfactory manner. If submitting hard copies, submit four (4) copies for review.
- B. The Engineer will review up to two (2) submissions of any single submittal. The Contractor will be invoiced on an hourly rate basis for the time spent reviewing the same shop drawing in excess of twice.
- C. If submittals are to be submitted electronically, all requirements in Item A apply. Submittals shall be emailed in PDF format to specific email address provided by the Construction Manager, General Contractor, Architect or Project Manager. Name of project shall be in subject line of email. Send emails to mealbasubmittalclerk@meengineering.com.
- D. Refer to Division 01 for additional requirements.

1.9 PROTECTION OF PERSONS AND PROPERTY

- A. Contractor shall assume responsibility for construction safety at all times and provide, as part of contract, all trench or building shoring, scaffolding, shielding, dust/fume protection, mechanical/electrical protection, special grounding, safety

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railings, barriers, and other safety feature required to provide safe conditions for all workmen and site visitors.

1.10 EQUIPMENT ARRANGEMENTS

- A. The contract documents are prepared using one manufacturer as the Basis of Design, even though other manufacturers' names are listed. If Contractor elects to use one of the listed manufacturers other than Basis of Design, submit detailed drawings, indicating proposed installation of equipment. Show maintenance clearances, service removal space required, and other pertinent revisions to the design arrangement. Make required changes in the work of other trades, at no increase in any contract. Provide larger motors, feeders, breakers, and equipment, additional control devices, valves, fittings and other miscellaneous equipment required for proper operation, and assume responsibility for proper location of roughing and connections by other trades. Remove and replace doorframes, access doors, walls, ceilings, or floors required to install other than Basis of Design. If revised arrangement submittal is rejected, revise and resubmit specified Basis of Design item which conforms to Contract Documents.

1.11 SUBSTITUTIONS

- A. If Contractor desires to bid on any other kind, type, brand, or manufacture of material or equipment than those named in specifications, secure prior approval. To request such approval, Contractor shall submit complete information comparing (item-for-item) material or equipment offered with design material or equipment. Include sufficient information to permit quick and thorough comparison, and include performance curves on same basis, capacities, power requirements, controls, materials, metal gauges, finishes, dimensions, weights, etc., of major parts. If accepted, an addendum will be issued to this effect ahead of bid date. Unless such addendum is issued, substitution offered may not be used.
- B. Refer to Division 01 for additional requirements.

1.12 CONTINUITY OF SERVICES

- A. The building will be in use during construction operations. Maintain existing systems in operation within all rooms of building at all times. Refer to "General Conditions of the Contract for Construction" for temporary facilities for additional contract requirements. Schedules for various phases of contract work shall be coordinated with all other trades and with Owner's Representative. Provide, as part of contract, temporary mechanical and electrical connections and relocations as required to accomplish the above. Obtain approval in writing as to date, time, and location for shutdown of existing mechanical/electrical facilities or services.

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1.13 ROUGHING

- A. The Contract Drawings have been prepared in order to convey design intent and are diagrammatic only. Drawings shall not be interpreted to be fully coordinated for construction.
- B. Due to small scale of Drawings, it is not possible to indicate all offsets, fittings, changes in elevation, interferences, etc. Make necessary changes in contract work, equipment locations, etc., as part of a contract to accommodate work to avoid obstacles and interferences encountered. Before installing, verify exact location and elevations at work site. **DO NOT SCALE** plans. If field conditions, details, changes in equipment or shop drawing information require an important rearrangement, report same to Owner's Representative for review. Obtain written approval for all major changes before installing.
- C. Install work so that items both existing and new are operable and serviceable. Eliminate interference with removal of coils, motors, filters, belt guards and/or operation of doors. Provide easy, safe, and code mandated clearances at controllers, motor starters, valve access, and other equipment requiring maintenance and operation. Provide new materials, including new piping and insulation for relocated work.
- D. Coordinate work with other trades and determine exact route or location of each duct, pipe, conduit, etc., before fabrication and installation. Coordinate with Architectural Drawings. Obtain from Owner's Representative exact location of all equipment in finished areas, such as thermostat, fixture, and switch mounting heights, and equipment mounting heights. Coordinate all work with the architectural reflected ceiling plans and/or existing Architecture. Mechanical and electrical drawings show design arrangement only for diffusers, grilles, registers, air terminals, lighting fixtures, sprinklers, speakers, and other items. Do not rough-in contract work without reflected ceiling location plans.
- E. Before roughing for equipment furnished by Owner or in other Divisions, obtain from Owner and other Divisions, approved roughing drawings giving exact location for each piece of equipment. Do not "rough in" services without final layout drawings approved for construction. Cooperate with other trades to insure proper location and size of connections to insure proper functioning of all systems and equipment. For equipment and connections provided in this contract, prepare roughing drawing as follows:
 - 1. Existing Equipment: Measure the existing equipment and prepare for installation in new location.
 - 2. New Equipment: Obtain equipment roughing drawings and dimensions, then prepare roughing-in-drawings. If such information is not available in time, obtain an acknowledgement in writing, then make space arrangements as required with Owner's Representative.

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1.14 COORDINATION DRAWINGS

- A. Before construction work commences, Divisions for all trades shall submit coordination drawings in the form of CAD drawing files, drawn at not less than 1/4 in. scale. Such drawings will be required throughout all areas, for all Contracts. These drawings shall show resolutions of trade conflicts in congested areas. Mechanical Equipment Rooms shall be drawn early in coordination drawing process simultaneous with all other congested areas. Prepare Coordination Drawings as follows:
1. Division 23 shall prepare the base plan CAD coordination drawings showing all ductwork, all pertinent heating piping, and equipment. These drawings may be CAD files of the required Ductwork Shop Drawings. The drawings shall be coordinated with lighting fixtures, sprinklers, air diffusers, other ceiling mounted items, ceiling heights, structural work, maintenance clearances, electric code clearance, reflected ceiling plans, and other contract requirements. Reposition proposed locations of work after coordination drawing review by the Owner's Representative. Provide adjustments to exact size, location, and offsets of ducts, pipes, conduit, etc., to achieve reasonable appearance objectives. Provide these adjustments as part of contract. Minor revisions need not be redrawn.
 2. Division 23 shall provide CAD files and submit the base plan CAD Coordination Drawings to all Divisions.
 3. Divisions 21 and 22 shall draw the location of piping and equipment on the base plan CAD Coordination Drawings, indicating areas of conflict and suggested resolutions.
 4. Divisions 26, 27 and 28 shall draw the location of lighting fixtures, cable trays, and feeders over 1-1/2 in. on the base plan CAD Coordination Drawings, indicating areas of conflict and suggested resolution.
 5. The General Construction Trade shall indicate areas of architectural/structural conflicts or obstacles on the CAD Coordination Drawings, and coordinate to suit the overall construction schedule.
 6. The Construction Manager shall expedite all Coordination Drawing work and coordinate to suit the overall construction schedule. In the case of unresolved interferences, he shall notify the Owner's Representative. The Owner's Representative will then direct the various trades as to how to revise their drawings as required to eliminate installation interferences.
 7. If a given trade proceeds prior to resolving conflicts, then if necessary, that trade shall change its work at no extra cost in order to permit others

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to proceed with a coordinated installation. Coordination approval will be given by areas after special site meetings involving all Divisions.

- B. The purpose of the coordination drawing process is to identify and resolve potential conflicts between trades, and between trades and existing or new building construction, before they occur in construction. Coordination drawings are intended for the respective trade's use during construction and shall not replace any Shop Drawings, or record drawings required elsewhere in these contract documents.

1.15 REMOVAL WORK

- A. Where existing equipment removals are called for, submit complete list to Owner's Representative. All items that Owner wishes to retain that do not contain asbestos or PCB material shall be delivered to location directed by Owner. Items that Owner does not wish to retain shall be removed from site and legally disposed of. Removal and disposal of material containing asbestos, lead paint, mercury and PCB's shall be in accordance with Federal, State and Local law requirements. Where equipment is called for to be relocated, contractor shall carefully remove, clean and recondition, then reinstall. Remove all abandoned piping, wiring, equipment, lighting, ductwork, tubing, supports, fixtures, etc. Visit each room, crawl spaces, and roofs to determine total Scope of Work. The disturbance or dislocation of asbestos-containing materials causes asbestos fibers to be released into the building's atmosphere, thereby creating a health hazard to workmen and building occupants. Consistent with Industrial Code Rule 56 and the content of recognized asbestos-control work, the Contractor shall apprise all of his workers, supervisory personnel, subcontractors, Owner and Consultants who will be at the job site of the seriousness of the hazard and of proper safeguards and work procedures which must be followed, as described in New York State Department of Labor Industrial Code Rule 56.
- B. For materials indicated to contain lead, that are being affected by demolition or construction, the contractor shall comply with all Federal, State and Local law requirements regarding worker exposure to lead disturbance and abatement procedures.
- C. Refer to the Owner's Lead Paint Survey. The Survey identifies the surfaces within the buildings that were tested for lead by collecting paint samples and performing laboratory analysis. If any unidentified surfaces are to be impacted the lead content shall be tested by analytical determinations conducted by a qualified laboratory approved by the Owner. The contractor shall review the current owner's lead paint reports on file before starting any work which may disturb existing surfaces.
- D. Refer to Division 02 for additional information regarding hazardous materials.

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1.16 REFRIGERANT RECOVERY

- A. Existing equipment to be removed, as shown on the plans may contain refrigerant and refrigerant oils. This refrigerant and refrigerant oil must be handled in accordance with Federal, State and Local law requirements.
- B. Removal and recovery of refrigerant shall be in accordance with the current edition of Section 608 of the Clean Air Act of 1990, including all final regulations.
- C. Refrigerant recovery must be performed by a technician, certified by an EPA-approved certification program, using refrigerant recovery and recycling equipment certified by an EPA-approved testing organization.
- D. Owner "reserves the right of first refusal" on ownership of recovered refrigerant. Should Owner choose to maintain ownership of refrigerant, refrigerant shall be reclaimed, cleaned by this Contractor to ARI 700-1993 Standard of Purity, by an EPA certified refrigerant reclaimer. Refrigerant shall be turned over to the Owner in suitable marked containers to be stored on site, at a place of the Owner's choosing.

1.17 EQUIPMENT AND MATERIAL REQUIREMENTS

- A. Provide materials that meet the following minimum requirements:
 - 1. Materials shall have a flame spread rating of 25 or less and a smoke developed rating of 50 or less, in accordance with NFPA 255.
 - 2. All equipment and material for which there is a listing service shall bear a UL label.
 - 3. Potable water systems and equipment shall be built according to AWWA Standards.
 - 4. Gas-fired equipment and system shall meet AGA Regulations and shall have AGA label.
 - 5. All electrical equipment and systems, as a whole, shall be tested and listed by an OSHA approved Nationally Recognized Testing Laboratory (NRTL) for the intended use in accordance with the applicable standards and have a physical label indicating such.
 - 6. Fire protection equipment shall be UL listed and FM approved.
- B. Exterior and wet locations shall utilize materials, equipment supports, mounting, etc. suitable for the intended locations. Metals shall be stainless steel, galvanized or with baked enamel finish as a minimum. Finishes and coatings shall be continuous and any surface damaged or cut ends shall be field corrected

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in accordance with the manufacturer's recommendations. Hardware (screws, bolts, nuts, washers, supports, fasteners, etc.) shall be:

1. Stainless steel where the associated system or equipment material is stainless steel or aluminum.
2. Hot dipped galvanized or stainless steel where the associated system or equipment is steel, galvanized steel or other.

1.18 CUTTING AND PATCHING

- A. Each trade shall include their required cutting and patching work unless shown as part of the General Construction Contract. Refer to General Conditions of the Contract for Construction, for additional requirements. Cut and drill from both sides of walls and/or floors to eliminate splaying. Patch cut or abandoned holes left by removals of equipment or fixtures. Patch adjacent existing work disturbed by installation of new work including insulation, walls and wall covering, ceiling and floor covering, other finished surfaces. Patch openings and damaged areas equal to existing surface finish. Cut openings in prefabricated construction units in accordance with manufacturer's instructions.

1.19 PAINTING

- A. Paint all insulated and bare piping, pipe hangers and supports exposed to view in mechanical equipment rooms, penthouse, boiler rooms and similar spaces. Paint all bare piping, ductwork and supports exposed to the out-of-doors with rust inhibiting coatings. Paint all equipment that is not factory finish painted (i.e. expansion tanks, etc.).
- B. All painting shall consist of one (1) prime coat and two (2) finish coats of non-lead oil base paint, unless otherwise indicated herein. Provide galvanized iron primer for all galvanized surfaces. All surfaces must be thoroughly cleaned before painting. Review system color coding prior to painting with the Owner's Representative or Architect.
- C. All items installed after finished painting is completed and any damaged factory finish paint on equipment furnished under this contract must be touched up by the Contractor responsible for same.
- D. Include painting for patchwork with color to match adjacent surfaces. Where color cannot be adequately matched, paint entire surface. Provide one (1) coat of primer and two (2) finish coats or as called for in the Specifications.
- E. All primers and paint used in the interior of the building shall comply with the maximum Volatile Organic Compound (VOC) limits called for in the current version of U.S. Green Building Council LEED Credits EQ 4.1 and EQ 4.2.

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- F. Refer to Division 9 - Finishes, for additional information.

1.20 EXISTING CEILING REMOVAL AND RE-INSTALLATION

- A. In a renovation project, any existing ceiling removal and re-installation work required for the completion of a Contractors or Subcontractors work, shall be removed and re-installed by that Contractor or Subcontractor. This applies in any areas not called for to have a new ceiling installed.
- B. The ceiling removal and re-installation shall include lay-in ceiling tile and grid, to the extent necessary to accomplish the work. Removed ceiling tile and grid shall be safely stored during the course of the work, and it shall be re-installed to the original existing condition.
- C. The ceiling removal and re-installation shall include gypsum board or plaster ceilings and the associated suspension systems. Removed ceiling areas shall be patched with materials to match the existing ceiling, and painted to match. If paint cannot be matched exactly, paint the entire ceiling a similar color.

1.21 CONCEALMENT

- A. **Conceal all contract work** above ceilings and in walls, below slabs, and elsewhere throughout building. If concealment is impossible or impractical, notify Owner's Representative before starting that part of the work and install only after their review. In areas with no ceilings, install only after Owner's Representative reviews and comments on arrangement and appearance.

1.22 CHASES

- A. New Construction:
 - 1. Certain chases, recesses, openings, shafts, and wall pockets will be provided as part of General Construction Trade. Mechanical and Electrical trades shall provide all other openings required for their contract work.
 - 2. Check Architectural and Structural Design and Shop Drawings to verify correct size and location for all openings, recesses and chases in general building construction work.
 - 3. Assume responsibility for correct and final location and size of such openings.
 - 4. Rectify improperly sized, improperly located or omitted chases or openings due to faulty or late information or failure to check final location.

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5. Provide 18 gauge galvanized sleeves and inserts. Extend all sleeves 2 in. above finished floor. Set sleeves and inserts in place ahead of new construction, securely fastened during concrete pouring. Correct, by drilling, omitted or improperly located sleeves. Assume responsibility for all work and equipment damaged during course of drilling. Firestop all unused sleeves.
 6. Provide angle iron frame where openings are required for contract work, unless provided by General Construction trade.
- B. In Existing Buildings:
1. Drill holes for floor and/or roof slab openings.
 2. Multiple pipes smaller than 1 in. properly spaced and supported may pass through one 6 in. or smaller diameter opening.
 3. Seal voids in fire rated assemblies with a fire-stopping seal system to maintain the fire resistance of the assembly. Provide 18 gauge galvanized sleeves at fire rated assemblies. Extend sleeves 2 in. above floors.
 4. In wall openings, drill or cut holes to suit. Provide 18 gauge galvanized sleeves at shafts and fire rated assemblies. Provide fire-stopping seal between sleeves and wall in drywall construction. Provide fire stopping similar to that for floor openings.
- 1.23 PENETRATION FIRESTOPPING
- A. Refer to Division 07 for project-wide fire stopping information.
- 1.24 NON-RATED WALL PENETRATIONS
- A. Each trade shall be responsible for sealing wall penetrations related to their installed work, including but not limited to ductwork, piping, conduits, etc. See individual specification sections for requirements.
- 1.25 SUPPORTS
- A. Provide required supports, beams, angles, hangers, rods, bases, braces, and other items to properly support contract work. Modify studs, add studs, add framing, or otherwise reinforce studs in metal stud walls and partitions as required to suit contract work. If necessary, in stud walls, provide special supports from floor to structure above.
- B. For precast panels/planks and metal decks, support mechanical/electrical work as determined by manufacturer and the Engineer. Provide heavy gauge steel

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mounting plates for mounting contract work. Mounting plates shall span two or more studs. Size, gauge, and strength of mounting plates shall be sufficient for equipment size, weight, and desired rigidity.

- C. For finished areas without a finished ceiling system such as classrooms, offices, conference rooms, etc., where decking and structure is exposed, and ductwork/piping/conduit is exposed: All mounting brackets, channel support systems and mounting hardware for ductwork, piping, lighting, etc. shall be concealed and approved by the Architect/Engineer prior to the installation. AirCRAFT cable style hanging for ductwork is required. It is recommended that room mockups be done and receive Architect/Engineer approval prior to proceeding with installation.
- D. Equipment, piping, conduit, raceway, etc. supports shall be installed to minimize the generation and transmission of vibration.
- E. Materials and equipment shall be solely supported by the building structure and connected framing. Gypboard, ceilings, other finishes, etc. shall not be used for support of materials and equipment.

1.26 ACCESS PANELS

- A. Provide access panels for required access to respective trade's work. Location and size shall be the responsibility of each trade. Access panels provided for equipment shall provide an opening not smaller than 22 in. by 22 in. Panels shall be capable of opening a minimum of 90 degrees. Bear cost of construction changes necessary due to improper information or failure to provide proper information in ample time. Access panels over 324 square inches shall have two cam locks. Provide proper frame and door type for various wall or ceiling finishes. Access panels shall be equal to "Milcor" as manufactured by Inland Steel Products Co., Milwaukee, Wisconsin. Provide General Construction trade with a set of architectural plans with size and locations of access panels.

1.27 CONCRETE BASES

- A. Provide concrete bases for all floor mounted equipment. Provide 3,000 lb. concrete, chamfer edges, trowel finish, and securely bond to floor by roughening slab and coating with cement grout. Bases 4 in. high (unless otherwise indicated); shape and size to accommodate equipment. Provide anchor bolts in equipment bases for all equipment provided for the project, whether mounted on new concrete bases or existing concrete bases.

1.28 HVAC EQUIPMENT CONNECTIONS

- A. Contractor is responsible for draining, filling, venting, chemically treating and restarting any systems which are affected by work shown on the Contract Documents unless specifically noted otherwise.

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- B. Provide final steam, condensate, hot water, glycol, chilled and condenser water, drain, vent, oil line and gas connections to all equipment as required by the equipment. Provide final connections, including domestic water piping, wiring, controls, and devices from equipment to outlets left by other trades. Provide equipment waste, drip, overflow and drain connections extended to floor drains.
- C. Provide for Owner furnished and Contractor furnished equipment all valves, piping, piping accessories, traps, pressure reducing valves, gauges, relief valves, vents, drains, insulation, sheet metal work, controls, dampers, as required.
- D. Refer to manufacturer drawings and specifications for requirements of medical equipment, laboratory equipment and special equipment. Verify connection requirements before bidding.

1.29 PLUMBING EQUIPMENT CONNECTIONS

- A. Contractor is responsible for draining, filling, venting, chemically treating and restarting any systems which are affected by work shown on the Contract Documents unless specifically noted otherwise.
- B. Provide roughing and final water, waste, vent, gas, air, vacuum, diesel and/or oxygen connections to all equipment. Provide loose key stops, sanitary "P" traps, tailpiece, adapters, gas or air cocks, and all necessary piping and fittings from roughing point to equipment. Provide installation of sinks, faucets, traps, tailpiece furnished by others. Provide cold water line with gate valve and backflow prevention device at locations called for. Provide continuation of piping and connection to equipment that is furnished by others. Provide relief valve discharge piping from equipment relief valves.
- C. Provide valved water outlet adjacent to equipment requiring same. Provide equipment type floor drains, or drain hubs, adjacent to equipment.
- D. Install controls and devices furnished by others.
- E. Refer to Contract Documents for roughing schedules, and equipment and lists indicating scope of connections required.
- F. Provide for Owner furnished and Contractor furnished equipment all valves, piping, piping accessories, traps, pressure reducing valves, gauges, relief valves, vents, drains, as required.
- G. Refer to Manufacturer drawings and specifications for requirements of medical equipment, laboratory equipment and special equipment. Verify connection requirements before bidding.

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1.30 ELECTRICAL EQUIPMENT CONNECTIONS

- A. Provide complete power connections to all electrical equipment. Provide control connections to equipment. Heavy duty NEC rated disconnect ahead of each piece of equipment. Ground all equipment in accordance with NEC.
- B. Provide for Owner furnished and Contractor furnished equipment all power wiring, electric equipment, control wiring, switches, lights, receptacles, and connections as required.
- C. Refer to Manufacturer's drawings/specifications for requirements of medical equipment, laboratory equipment, radiological equipment and special equipment. Verify connection requirements before bidding.

1.31 STORAGE AND PROTECTION OF MATERIALS AND EQUIPMENT

- A. Store Materials on dry base, at least 6 in. aboveground or floor. Store so as not to interfere with other work or obstruct access to buildings or facilities. Provide waterproof/windproof covering. Remove and provide special storage for items subject to moisture damage. Protect against theft or damage from any cause. Replace items stolen or damaged, at no cost to Owner.
- B. Refer to Division 01 for additional information.
- C. Division 23 shall provide airtight plastic covers over all supply and return air openings prior to the start of construction by any trade. The plastic shall be maintained airtight throughout the project construction and removed only with the approval of the Owner's Representative.
- D. Ductwork shall be delivered to the site from the fabrication shop with air tight plastic covers over all ends of the ducts. The plastic covers shall be in place during transportation and shall be removed prior to installation.

1.32 FREEZING AND WATER DAMAGE

- A. Take all necessary precautions with equipment, systems and building to prevent damage due to freezing and/or water damage. Repair or replace, at no change in contract, any such damage to equipment, systems, and building. Perform first seasons winterizing in presence of Owner's operating staff.

1.33 LUBRICATION CHART

- A. Provide lubrication chart, 8-1/2 in. x 11 in. minimum size, typed in capital letters, mounted under clear laminated plastic; secure to wall in area of equipment. List all motors and equipment in contract. Obtain and list necessary information by name/location of equipment, manufacturer recommended types of lubrication and schedule. Lubricate motors as soon as installed and perform lubrication

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maintenance until final acceptance. Divisions 22 and 26 shall add contract items to the chart provided by Division 23 or provide separate charts.

1.34 OWNER INSTRUCTIONS

- A. Before final acceptance of the work, furnish necessary skilled labor to operate all systems by seasons. Instruct designated person on proper operation, and care of systems/equipment. Repeat instructions, if necessary. Obtain written acknowledgement from person instructed prior to final payment. Contractor is fully responsible for system until final acceptance, even though operated by Owner's personnel, unless otherwise agreed in writing. List under clear plastic, operating, maintenance, and starting precautions procedures to be followed by Owner for operating systems and equipment.

1.35 OPERATION AND MAINTENANCE MANUALS

- A. Submit by email (preferred) or digital media, thru the normal project submittal process. Include a copy of each final approved Shop Drawing, wiring diagrams, piping diagrams, spare parts lists, final testing and balancing report, as-built drawings and manufacturer's instructions. Include typewritten instructions, describing equipment, starting/operating procedures, emergency operating instructions, summer-winter changeover, freeze protection, precautions and recommended maintenance procedures. Include name, address, and telephone number of installing contractor and of supplier manufacturer Representative and service agency for all major equipment items. Provide a table of contents page and dividers based upon specification section numbers. Submit in a compiled and bookmarked PDF format as outlined below.
- B. Provide content for Operation and Maintenance Manuals as specified in individual Specification Sections, and as reviewed and approved at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.
 - 1. Engineer and Commissioning Agent will comment on whether content of operation and maintenance submittals is acceptable.
 - 2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.
- C. Submit Operation and Maintenance Manuals in the following format:
 - 1. Submit by uploading to web-based project software site, or by email to Architect, as a formal project submittal in conformance with the project specific submittal procedures. Enable reviewer comments on draft submittals.

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2. 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.
 3. File Names and Bookmarks: Bookmark individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in the 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.
- D. Initial Manual Submittal: Submit draft copy of each manual at least 30 days before commencing Owner training. Engineer and Commissioning Agent will comment on whether general scope and content of manual are acceptable.
- E. Final Manual Submittal: Submit O&M manual in final form prior to requesting inspection for Substantial Completion and at least 2 weeks before commencing Owner training. Engineer and Commissioning Agent will return copy with review comments.
1. Correct or revise O&M manual to comply with Engineer's and Commissioning Agent's comments. Submit copies of each corrected manual within 2 weeks of receipt of Engineer's and Commissioning Agent's comments.
- F. Refer to Division 01 for additional requirements.

1.36 RECORD DRAWINGS

- A. The Contractor shall obtain at his expense one (1) set of construction Contract Drawings, (including non-reproduction black and white prints or electronic files) for the purpose of recording as-built conditions.
- B. The Contractor shall perform all survey work required for the location and construction of the work and to record information necessary for completion of the record drawings. Record drawings shall show the actual location of the constructed facilities in the same manner as was shown on the bid drawings. All elevations and dimensions shown on the drawings shall be verified or corrected so as to provide a complete and accurate record of the facilities as constructed.
- C. It shall be the responsibility of the Contractor to mark **EACH** sheet of the contract documents in red and to record thereon in a legible manner, any and all approved field changes and conditions as they occur. A complete file of approved field sketches, diagrams, and other changes shall also be maintained. At completion of the work, the complete set of red marked contract documents,

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plus all approved field sketches and diagrams shall be submitted to the engineer and used in preparation of the record drawings.

- D. A complete set of red marked contract drawings shall be submitted, at one time, as the "Record" set. If there are no changes to a specific drawing, the contractor shall indicate "NO CHANGES" on that drawing. ALL drawings shall be included in the "Record" set.
- E. The complete set of red marked Contract Documents or electronic files shall be certified by the Contractor as reflecting record conditions and submitted to the engineer for review.
- F. The Contractor shall have the marked up set scanned, if they are not already electronic files, and then submit them to the Engineer as the "Record Set".
- G. Refer to Division 01 for additional requirements.

1.37 FINAL INSPECTION

- A. Upon completion of all Engineering Site Observation list items, the Contractor shall provide a copy of the Engineering Site Observation Report back to the Engineer with each items noted as completed or the current status of the item.

1.38 COMMISSIONING

- A. Refer to General Commissioning Requirements in Division 01 for additional requirements

1.39 TEMPORARY HEATING AND COOLING

- A. Refer to the General Conditions of the Contract for Construction and Supplemental General Conditions.
- B. Systems and equipment installed as part of this project shall not be used for temporary heating or cooling.

1.40 MAINTENANCE OF HVAC SYSTEMS DURING TEMPORARY USE PERIODS

- A. Provide each air handling system with a set of prefilters in addition to the permanent filters. Furnish four sets of prefilters for each system for use when system is operated for temporary heating or cooling. During such use, change prefilters as often as directed by Owner's Representative. Provide MERV-8 filters in all open ended ducts, return grilles and registers to keep dust out of ductwork. Change as often as necessary. Remove all such temporary filters upon completion. Use supply fans only. Do not operate return fans.

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- B. Blank-off outside air intake opening during temporary heating period. Install first set of permanent filters and prefilters.
- C. Adjust dampers on supply system.
- D. Set all heating coil control valves for manual operation.
- E. Do not install any grilles or diffusers at room terminal ends of ducts until permission is given.
- F. Assume responsibility for systems and equipment at all times, even though used for temporary heat or ventilating. Repair or replace all dented, scratched or damaged parts of systems prior to final acceptance.
- G. Remove concrete, rust, paint spots, other blemishes, then clean.
- H. Just prior to final acceptance, remove used final filter and install new set. Deliver all unused sets of prefilters to the Owner and obtain written receipt. Properly lubricate system bearings before and during temporary use. Maintain thermostats, freeze stats, overload devices, and all other safety controls in operating condition.

1.41 TEMPORARY FACILITIES

- A. Refer to the Division 01 Sections, General Conditions and Supplemental General Conditions.

1.42 TEMPORARY LIGHT AND POWER

- A. Refer to the Division 01 Sections, General Conditions and Supplemental General Conditions.

1.43 CLEANING

- A. It is the Contractor's responsibility to keep clean all equipment and fixtures provided under this contract for the duration of the project. Each trade shall keep the premises free from an accumulation of waste material or rubbish caused by his operations. The facilities require an environment of extreme cleanliness, and it is the Contractor's responsibility to adhere to the strict regulations regarding procedures on the existing premises. After all tests are made and installations completed satisfactorily:
 - 1. Thoroughly clean entire installation, both exposed surfaces and interiors.
 - 2. Remove all debris caused by work.
 - 3. Remove tools, surplus, materials, when work is finally accepted.

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1.44 SYSTEM START-UP AND TESTING

- A. Prior to commencement of work, the Division(s) effecting such system shall survey all building mechanical, plumbing, fire protection and electrical systems and components and make written notice to the Owner regarding any damage, missing items and/or incomplete systems. Prior to the conclusion of this project, the Contractor shall verify with the Owner's Representative that all building systems have been returned to their original conditions.
- B. Start-up and testing of HVAC systems shall occur while the building is not occupied by Owner and only after notice to the Owner's Representative is made at least 24 hours in advance. Division 23 shall be responsible for providing temporary filter media over all supply air registers and diffusers during the HVAC system start-up procedure. Division 23 shall provide airtight plastic covers over all supply and return air openings prior to the start of construction by any contractor. The plastic shall be maintained airtight throughout the project construction and removed only with the approval of the Owner's Representative.

1.45 TRANSFER OF ELECTRONIC FILES

- A. M/E Engineering, P.C. will provide electronic files for the Contractor's use in the preparation of sheet metal shop drawings, coordination drawings, or record drawings related to the project, subject to a \$50.00 charge per drawing file and the following terms and conditions:
 - 1. The Contractor shall submit a formal request for electronic drawing files on the M/E Engineering, P.C. website, by utilizing the following website link: <http://www.meengineering.com/contact-pages/contractor-request>.
 - 2. M/E Engineering, P.C. makes no representation as to the compatibility of these files with the Contractor's hardware or the Contractor's software beyond the specific release of the referenced specifications.
 - 3. M/E Engineering can only provide CAD files of M/E/P/FP drawing levels for which we are the Engineer of Record. CAD files of Architectural backgrounds, reflected ceiling plans, structural plans, etc. must be obtained separately from the Architect of Record.
 - 4. Data contained on these electronic files is part of M/E Engineering, P.C.'s instruments of service shall not be used by the Contractor or anyone else receiving data through or from the Contractor for any purpose other than as convenience in the preparation of shop drawings for the referenced project. Any other use or reuse by the Contractor or by others will be at the Contractor's sole risk and without liability or legal exposure to M/E Engineering, P.C. The Contractor agrees to make no claim and hereby waive, to the fullest extent permitted by law, any claim or cause of action of any nature against M/E Engineering, P.C., its officers, directors,

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employees, agents or sub-consultants which may arise out of or in connection with the Contractor's use of the electronic files.

5. Furthermore, the Contractor shall, to the fullest extent permitted by law, indemnify and hold harmless, M/E Engineering, P.C. from all claims, damages, losses and expenses, including attorney's fees arising out of or resulting from the Contractor's use of these electronic files.
6. These electronic files are not contract documents. Significant difference may arise between these electronic files and corresponding hard copy contract documents due to addenda, change orders or other revisions. M/E Engineering, P.C. makes no representation regarding the accuracy or completeness of the electronic files the Contractor receives. In the event that a conflict arises between the signed contract documents prepared by M/E Engineering, P.C. and electronic files, the signed contract documents shall govern. The Contractor is responsible for determining if any conflicts exist. By the Contractor's use of these electronic files the Contractor is not relieved of the Contractor's duty to comply with the contract documents, including and without limitation, the need to check, confirm and coordinate all dimensions and details, take field measurements, field verify conditions and coordinate the Contractor's work with that of other contractors for the project.

1.46 VIDEO RECORDING OF TRAINING SESSIONS

- A. The contractor shall video record all training sessions required by their discipline. Video shall be in Windows Media Player video format saved on flash drives. Two (2) copies on flash drives are to be provided as a formal submittal. . Flash drives are to be tagged with project name, training session name(s), installing Contractor and date of training. The flash drive shall include a scanned version of the training session sign in list(s), including the presenter and the owner's participants.

1.47 ENERGY INCENTIVES

- A. The Contractor, his Subcontractors and Suppliers shall provide to the Owner all paperwork necessary to support the Owners pursuit of incentives related to energy conservation as offered by the utility company or state sponsored incentive programs. This shall include at a minimum, receipts, and quantities and data sheets for energy efficient equipment such as: lighting, motors, variable frequency drives, etc.

1.48 INFECTION CONTROL

- A. Construction procedures, temporary partitions, negative air systems, cleaning procedures, HVAC system isolation, dust control, etc. shall be in accordance with

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the infection control standards set forth by the Facility. A copy of the facilities standards are available from the Owner upon request.

END OF SECTION

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SECTION 22 05 23 - VALVES

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Provide labor, materials, equipment and services to perform operations required for the complete installation and related Work as required in Contract Document.

1.2 SUBMITTALS

- A. Submit manufacturer's data in accordance with Basic Mechanical and Electrical Requirements. Obtain approval prior to ordering material.
- B. Provide submittals for all items specified under Part 2 of this section.

PART 2 - PRODUCTS

2.1 VALVES - GENERAL

- A. Valves shall have following requirements:
 - 1. Working pressure stamped or cast on bodies.
 - 2. Stem packing serviceable without removing valve from line.
 - 3. All items here-in used to convey water for potable use shall be lead free in accordance with NSF Standard, Standard 61, Section 9 - Standard for Drinking Water and Lavatory Faucets and NSF Standard 372 - Maximum Lead Requirements. Compliance shall be via third party testing and certification.
- B. Acceptable Manufacturers:
 - 1. Balance Valves: Armstrong, Bell & Gossett, Red White, Taco, Tour and Anderson.
 - 2. Ball Valves: Apollo, Hammond, Milwaukee, Nibco, Red White, Watts.
 - 3. Butterfly Valves: Bray, Jamesbury, Keystone, Milwaukee, Red White, Watts.
 - 4. Gate and Check Valves: Hammond, Milwaukee, Nibco, Red White, Stockham, Watts.

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5. To establish a standard of quality and identify features, certain manufacturer's numbers are given in the following paragraphs.

2.2 DOMESTIC WATER VALVES

A. Check Valves:

1. 2 in. and Smaller: Lead-free swing check with silicone bronze body, bonnet and trim, PTFE disc seat and stainless steel seat disc washer, 200 psi working pressure, Nibco T-413-Y-LF (threaded) or Nibco's S-413-Y-LF (solder).
2. Silent Type: Lead-free spring check with silicone bronze body, stainless steel trim and PTFE disc: 250 psi working pressure; Nibco T-480-4-LF (threaded) or Nibco S-480-Y-LF (solder).

B. Ball Valves:

1. 2 in. and Smaller: American-made, lead-free, bronze 2-piece body, chrome-plated lead-free brass ball, lead-free brass stem, full port, teflon seats and stem packing, separate packing and handle nut, blow out proof stem extended for insulation, vinyl insulator for handle, 600 WOG, 150 SWP: Watts #LFB-6080G2 (threaded ends) or Watts #LFB-6081G2 (sweat ends).
2. 2 in. and Smaller: True union style, CPVC body and ball, 150 psi, EPDM O-ring seals, constructed for end entrance with socket, flanged or threaded ends, full port design, conforming to and listed by NSF 14 for potable water.

C. Balance Valves:

1. 2 in. and Smaller: Lead-free, brass body, chrome plated brass ball, glass and carbon filled PTFE seat rings, Viton packing, threaded or solder ends, differential readout ports, calibrated nameplate and memory stop indicator rated for 125 psi; and pre-formed insulation to permit access for balancing and readout; Watt Series LFCSM-61-S.
 - a. Balance valve sizes shall be based upon gpm range rather than pipe size.

Balance Valve Size	GPM Range
1/2 in.	Up to 2.5
3/4 in.	2.5 - 4.5
1 in.	4.5 - 10

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Balance Valve Size	GPM Range
1-1/4 in.	10 - 15
1-1/2 in.	15 - 30
2 in.	30 - 60

D. Valves for Gauges and Instruments:

1. 1/2 in. Size: Brass bar stock for 1000 psi and 300°F; Trerice No. 735 needle valve.

E. Hose Thread Drain Valves:

1. Ball valve, bronze body, hardened chrome ball with hose thread end, cap and chain; Watts #LFFBV/FBVS-3C-CC.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Provide all shutoff, check, balancing and other type valves as indicated, as required by Code and as required for proper system maintenance, isolation and safety. Provide at major building and systems sections. Provide shutoff valves on all branch lines serving two fixtures or more, at all equipment, fixtures, before and after automatic control valves, and at future connections.
- B. Locate valves for easy access and provide separate support where necessary. Install valves with stems at or above the horizontal position. Install swing check valves in horizontal position with hinge pin level.
- C. Provide drain valves with hose thread connections on all equipment. Provide hose thread drain valves at all low points to enable complete drainage of all piping systems including, water mains, branches, at base of vertical risers and at strainers.
- D. Provide shutoff valve and wye-strainer before all automatic control valves and pressure reducing valves.
- E. Inspect valves for proper operation before installation. Install underground valve boxes vertically over each valve. Adjust top of box to proper grade. Immediately backfill with crushed stone and carefully tamp into place. Unless otherwise noted, leave in the open position.

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3.2 DOMESTIC WATER SYSTEM

- A. Install balance valves in each hot water circulation branch and where noted.

END OF SECTION

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SECTION 22 05 53 - PLUMBING IDENTIFICATION

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Provide labor, materials, equipment and services as required for the complete installation designed in Contract Documents.

1.2 QUALIFICATIONS

- A. All identification devices shall comply with ANSI A13.1 for lettering size, length of color field, colors, and viewing angles.

1.3 SUBMITTALS

- A. Submit manufacturer's technical product data and installation instructions for each identification material and device. Submit valve schedule for each piping system typewritten on an 8-1/2 in. x 11 in. paper (minimum), indicating valve number, location and valve function. Submit schedule of pipe, equipment and name identification for review before stenciling or labeling.

1.4 MAKES

- A. Allen Systems, Inc., Brady (W.H.) Co.; Signmark Div., Industrial Safety Supply Co., Inc., Seton Name Plate Corp.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Provide manufacturer's standard products of categories and types required for each application. In cases where there is more than one type specified for an application, selection is installer's option, but provide single selection for each product category.
- B. All adhesives used for labels in the interior of the building shall comply with the maximum Volatile Organic Compound (VOC) limits as called for in the current version of U.S. Green Building Council LEED Credits EQ 4.1 and EQ 4.2.
- C. For work within an existing building, the mechanical identification shall meet the intent of this section, but match the Owner's existing identification symbology.

2.2 PIPING IDENTIFICATION

- A. Identification Types:

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1. Pressure Sensitive Type: Provide manufacturer's standard pre-printed, permanent adhesive, color coded, pressure sensitive vinyl pipe markers complying with ANSI A13.1. Provide a 360° wrap of flow arrow tape at each end of pipe label.
2. Snap-On Type: Provide manufacturer's standard pre-printed, semi rigid snap-on, color coded pipe markers, complying with ANSI-A13.1.

B. Lettering:

1. Piping labeling shall conform to the following list:

PIPE FUNCTION	IDENTIFICATION
Cold Water	DOMESTIC COLD WATER
Hot Water	DOMESTIC HOT WATER
Hot Water Recirculating	DOMESTIC HOT WATER RECIRCULATING
Sanitary Waste	SANITARY WASTE
Indirect Waste	INDIRECT WASTE
Storm	STORM
Vent	VENT
Vacuum	VACUUM
Oxygen	OXYGEN

2.3 VALVE IDENTIFICATION

A. Valve Tags:

1. Standard brass valve tags, 2 in. diameter with 1/2 in. high black-filled numerals. Attach to valve with brass jack chain and "S" hook. Identify between heating and plumbing services with 1/4 in. letters above the valve number.
2. Acceptable Manufacturers: Seton Style No. M4507, or approved equal.

B. Valve Chart:

1. Provide valve chart for all valves provided as a part of this project. Frame and place under clear glass. Mount in Mechanical Room.

2.4 ABOVE CEILING EQUIPMENT LOCATOR

- A. 3/4 in. diameter adhesive stickers placed on ceiling grid and color-coded.
- B. The color for all plumbing valves shall be BLUE.

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PART 3 - EXECUTION

3.1 GENERAL

- A. Provide valve tags for all valves provided on project.
- B. Provide equipment tags for all equipment provided on project.
- C. Provide piping identification with directional flow arrows for all piping on project, maximum intervals of 20'-0". For piping installed through rooms, provide at least one (1) pipe label in each room, for each pipe function.

END OF SECTION

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SECTION 22 05 93 - ADJUSTING AND BALANCING

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Provide labor, materials, equipment and services to perform operations required for complete adjusting and balancing Work as required in Contract Documents.

1.2 SUBMITTALS

- A. Provide information in report form listing items required by specifications. Report shall be typed and three copies submitted for review. Results shall be guaranteed. Contractor shall be subject to recall to site to verify report information before acceptance of the report by the Owner's Representative.
- B. Report format shall consist of the following:
 - 1. Title sheet with job name, contractor, engineer, date, balance contractor's name, address, telephone number and contact person's name and the balancing technician's name.

1.3 QUALIFICATIONS

- A. Follow procedures and methods published by one or more of the following:
 - 1. Individual manufacturer requirements and recommendations.
- B. Maintain qualified person at project for system operation, trouble shooting and perform mechanical adjustments in conjunction with balancing procedure.
- C. Balancing contractor shall be current member of AABC or NEBB.

1.4 GENERAL REQUIREMENTS

- A. Before concealment of systems visit the job site to verify and advise on type and location of balancing devices and test points. Make changes as required to balancing facilities.
- B. Place systems in satisfactory operating condition.
 - 1. Adjusting and balancing shall be accomplished as soon as the systems are complete and before Owner takes possession.
 - 2. Prior to balancing adjust balancing devices for full flow; fill, vent and clean hydronic systems, replace temporary strainers.

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3. Initial adjustment and balancing to quantities as called for or as directed by the engineer, to satisfy job conditions.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

- A. Provide tools, ladders, recording meters, gauges, thermometers, velometers, anemometers, inclined gauge manometers, magnehelic gauges, amprobes, voltmeters, psychrometers and tachometers required. Instruments used shall be accurately calibrated as per AABC or NEBB requirements.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Examine Bid Documents and notify Owner's Representative of any questions regarding balancing, within thirty (30) days after receipt of bid and prior to starting work.

3.2 WATER SIDE

- A. Test, adjust and record the following:
 1. Hot Water Recirculating Pump:
 - a. Check rotation
 - b. GPM
 - c. Running suction pressure
 - d. Running discharge pressure
 - e. Running load amps
 - f. RPM - motor
 - g. Complete nameplate motor and pump
 2. Recirculation Balancing Valves:
 - a. Balance every valve to 0.5 GPM, unless otherwise noted.

END OF SECTION

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SECTION 22 07 00 - INSULATION

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Provide labor, materials, equipment and services to perform operations required for the complete installation and related Work as required in Contract Documents.

1.2 SUBMITTAL

- A. Shall include product description, manufacturer's installation instructions, types and recommended thicknesses for each application, and location of materials.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Insulation, jackets, adhesive, and coatings shall comply with the following:
 - 1. Treatment of jackets or facing for flame and smoke safety must be permanent. Water-soluble treatments not permitted.
 - 2. Insulation, including jackets, finishes and adhesives on the exterior surfaces of pipes and equipment, shall have a flame spread rating of 25 or less and a smoke developed rating of 50 or less.
 - 3. Asbestos or asbestos bearing materials are prohibited.
 - 4. 2020 Energy Conservation Code of New York State All adhesives and sealants used for insulation in the interior of the building shall comply with the maximum Volatile Organic Compound (VOC) limits as called for in the current version of U.S. Green Building Council LEED Credits EQ E4.1 and EQ E4.2.
 - 5. Provide materials which are the standard products of manufacturers regularly engaged in the manufacture of such products and that essentially duplicate items that have been in satisfactory use for at least two (2) years prior to bid opening. Provide insulation systems in accordance with the approved MICA or NAIMA Insulation Standards.
 - 6. Insulation shall be clearly marked with manufacturer's name, identification of installed thermal resistance (R) value, out-of-package R value, flame spread and smoke developed indexes in accordance with Energy Code requirements.

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2.2 ACCEPTABLE MANUFACTURERS

- A. Fiberglass: Knauf, Johns Manville, Owen-Corning, Certainteed
- B. Polyisocyanurate: Dow Trymer 2000XP, HyTherm.
- C. Calcium Silicate: Industrial Insulation Group (ILG).
- D. Flexible Elastomeric: Armacell, K-Flex.
- E. Adhesives: Childers Products, Foster.
- F. Heat Tracing: Raychem, Thermon.

2.3 PIPE INSULATION (RIGID FIBERGLASS TYPE)

- A. Product meeting ASTM C 547, ASTM C 585, and ASTM C 795; rigid, molded, noncombustible.
- B. 'K' Value: ASTM C 335, 0.23 at 75°F mean temperature. Maximum Service Temperature: 1000°F.
- C. Vapor Retarder Jacket: ASJ/SSL conforming to ASTM C 1136 Type I, secured with self-sealing longitudinal laps and butt strips.
- D. Field-Applied PVC Fitting Covers with Flexible Fiberglass Insulation: Proto Corporation 25/50 or Indoor/Outdoor, UV-resistant fittings, jacketing and accessories, white or colored. Fitting cover system shall consist of pre-molded, high-impact PVC materials with blanket type fiberglass wrap inserts. Blanket fiberglass wrap inserts shall have a thermal conductivity ('K') of 0.26 at 75°F mean temperature. Closures shall be stainless steel tacks, matching PVC tape, or PVC adhesive per manufacturer's recommendations.
- E. Prefabricated Thermal Insulating Fitting Covers: Comply with ASTM C 450 for dimensions used in pre-forming insulation to cover valves, elbows, tees, and flanges.

2.4 PIPE INSULATION (RIGID POLYISOCYANURATE TYPE)

- A. Preformed Rigid Polyisocyanurate Insulation: Cellular foam complying with ASTM C591, rigid molded, non-combustible. 2-lb./ft³ nominal density. Maximum thermal conductivity (k) shall be 0.19 BTU-in/ft² hr. °F at 75°F mean temperature.

2.5 PIPE INSULATION (FLEXIBLE TYPE)

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- A. Flexible Elastomeric Thermal Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials. Adhesive: As recommended by insulation material manufacturer.
- B. Insulation (1 in. thickness and smaller) shall have a flame-spread index of less than 25 and a smoke-developed index of less than 50 as tested by ASTM E 84 and CAN/ULC S-102, "Method of Test for Surface Burning Characteristics of Building Materials".

2.6 CALCIUM SILICATE

- A. Flat-, curved- and grooved-block sections of noncombustible, inorganic, hydrous calcium silicate with a non-asbestos fibrous reinforcement. Comply with ASTM C 533, Type I, rated for a maximum temperature of 1700 degree F.

2.7 FIELD-APPLIED JACKETS

- A. Piping:
 - 1. PVC Pipe Jacket: High-impact, ultraviolet-resistant PVC; 20 mils thick; 25 or less flame spread rating/50 or less smoke developed rating, roll stock ready for shop or field cutting and forming. Adhesive: As recommended by insulation material manufacturer. PVC Jacket Color: White.

2.8 COATINGS, MASTICS, ADHESIVES AND SEALANTS

- A. Vapor Barrier Coatings: Used in conjunction with reinforcing mesh to coat insulation on below ambient services temperatures. Permeance shall be no greater than 0.08 perms at 45 mils dry as tested by ASTM F1249. Foster 30-65 Vapor Fas; Childers CP-34, or approved equal.
- B. Lagging Adhesives: Used in conjunction with canvas or glass lagging cloth to protect equipment/piping indoors. Foster 30-36 Sealfas; Childers CP-50AMV1 Chil Seal, or approved equal.
- C. Weather Barrier Mastic: Used outdoors to protect above ambient insulation from weather. Foster 46-50 Weatherite; Childers CP-10 Vi Cryl, or approved equal.
- D. Fiberglass Adhesive: Used bond low density fibrous insulation to metal surfaces. Shall meet ASTM C916 Type II. Foster 85-60; Childers CP-127, or approved equal.
- E. Elastomeric Insulation Adhesive: Used to bond elastomeric insulation. Foster 85-75; Childers CP-82, or approved equal.

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- F. Elastomeric Insulation Coating: Water based coating used to protect outside of elastomeric insulation. Foster 30-65, Childers CP-34 or approved equal.
- G. Insulation Joint Sealant: Used as a vapor sealant on below ambient piping with polyisocyanurate and cellular glass insulation. Foster 95-50; Childers CP-76, or approved equal.
- H. Metal Jacketing Sealant: Used as a sealant on metal jacketing seams to prevent water entry. Foster 95-44; Childers CP-76, or approved equal.
- I. Reinforcing Mesh: Used in conjunction with coatings/mastics to reinforce. Foster Mast A Fab; Childers Chil Glass #10, or approved equal.

2.9 PIPE SUPPORT INSULATION INSERTS

- A. 20 lbs./cu. ft. molded fiberglass, for -120°F to +450°F service temperature, non-combustible, 0.30 thermal conductivity (k), same thickness as pipe insulation.
- B. Acceptable Manufacturers: Hamfab "H" Block, or approved equal.

2.10 MATERIALS AND SCHEDULES

- A. See Exhibits at the end of this section.

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

- A. All materials shall be installed by skilled labor regularly engaged in this type of work. All materials shall be installed in strict accordance with manufacturer's recommendations, building codes, and industry standards.
- B. Locate insulation and cover seams in the least visible location. All surface finishes shall be extended in such a manner as to protect all raw edges, ends and surfaces of insulation. No glass fibers shall be exposed to the air.
- C. All pipe insulation shall be continuous through hangers, sleeves, walls, ceiling, floor, or roof openings, unless not allowed by fire stop system. Refer to Sections 220500, "Basic Plumbing Requirements" and 221010, "Piping Systems and Accessories" for firestop systems.
- D. Provide thermal insulation on clean, dry surfaces and after piping and equipment (as applicable) have been tested. Do not cover pipe joints with insulation until required tests are completed.

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- E. All cold surfaces that may "sweat" must be insulated. Vapor barrier must be maintained; insulation shall be applied with a continuous, unbroken moisture and vapor seal. All hangers, supports, anchors, or other projections that are secured to cold surfaces shall be insulated and vapor sealed to prevent condensation. Cover valves, fittings and similar items in each piping system with insulation as applied to adjoining pipe run. Extra care must be taken on piping appurtenances to insure a tight fit to the piping system. For piping systems with fluid temperatures below ambient, all vapor retarder jacket (ASJ) seams must be coated with vapor barrier coating. All associated elbows, fittings, valves, etc. must be coated with vapor barrier coating and reinforcing mesh to prevent moisture ingress. Valve extension stems require Elastomeric insulation that is tight fitting to the adjoining fiberglass system insulation. Pumps, strainers, drain valves, etc. must be totally encapsulated with Elastomeric insulation.
- F. Items such as manholes, handholds, clean-outs, plugged connections, pet cocks, air vents, ASME stamp, and manufacturers' nameplates, may be left un-insulated unless omitting insulation would cause a condensation problem. When such is the case, appropriate tagging shall be provided to identify the presence of these items. Provide neatly beveled edges at interruptions of insulation.
- G. Provide protective insulation as required to prevent personal injury.
- H. All pipes shall be individually insulated.
- I. If any insulation material becomes 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.
- J. All exposed surfaces shall be white, unless noted otherwise.

3.2 PIPE INSULATION

- A. Insulate piping systems including fittings, valves, flanges, unions, strainers, and other attachments installed in piping system, whether exposed or concealed
- B. Insulation installed on piping operating below ambient temperatures must have a continuous vapor retarder. All joints, seams and fittings must be sealed. Insulation shall be continuous through hangers on all water piping and storm water piping.
- C. Hanger Shields: Refer to Section 221010 "Piping Systems and Accessories".
- D. Hanger shields shall be installed between hangers or supports and the piping insulation. Rigid insulation inserts shall be installed as required between the pipe and the insulation shields. Inserts shall be of equal thickness to the adjacent insulation and shall be vapor sealed as required.

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1. Pre-Insulated Type: Butt insulation to hanger shields and apply a wet coat of vapor barrier cement to the joints and seal with 3 in. wide vapor barrier tape.
 2. Field Insulated Type: Provide Hamfab Co. "H" blocks per manufacturers recommended spacing between pipe and shield.
 3. Tape shields to insulation.
- E. Joints in section pipe covering made as follows:
1. All ends must be firmly butted and secured with appropriate butt-strip material. On high-temperature piping, double layering with staggered joints may be appropriate. When double layering, the inner layer should not be jacketed.
 2. Standard: Longitudinal laps and butt joint sealing strips cemented with white vapor barrier coating, or factory supplied pressure sensitive adhesive lap seal.
 3. Vapor Barrier: For cold services, Longitudinal laps and 4 in. vapor barrier strip at butt joints shall be sealed with white vapor barrier coating. Seal ends of pipe insulation at valves, flanges, and fittings with white vapor barrier coating.
- F. Fittings, Valves and Flanges:
1. Domestic Hot and Cold Water: Premolded fitting insulation of the same material and thickness as the adjacent pipe insulation.
 2. White PVC jacketing, with continuous solvent weld of all seams. Tape all fittings.
- G. Flexible Pipe Insulation:
1. Split longitudinal joint and seal with adhesive.
 2. Fittings made from miter-cut pieces properly sealed with adhesive, or elbows may be continuous.
 3. Where exposed outdoors, provide with Alumaguard jacketing.
- H. For piping exposed to the elements, jacketing shall be aluminum with a factory applied moisture barrier. Fitting covers shall be of similar materials. The insulation and jacketing shall be held firmly in place with a friction type Z lock or a minimum 2 in. overlap joint. All joints shall be sealed completely along the

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longitudinal seam and installed so as to shed water. All circumferential joints shall be sealed by use of preformed butt strips; minimum 2 in. wide or a minimum 2 in. overlap. Butt strips shall overlap the adjacent jacketing a minimum 1/2 in. and be completely weather sealed. Jacket at elbows and tees shall be mitered, or pre-manufactured fitting jackets shall be provided, with additional aluminum holding bands, as required. All joints shall be sealed watertight using specified metal jacketing sealant as recommended by the manufacturer.

- I. Apply PVC jacket where indicated, with 1 in. overlap at longitudinal seams and end joints. Seal with manufacturers recommended adhesive.
- J. Apply either aluminum or PVC jacketing to exposed insulated pipe, valves, fittings, and specialties, at an elevation of 8 feet or less above finished floor in mechanical/electrical rooms, penthouses, and services aisles/pipe chases. Fittings of aluminum-jacketed piping may be either aluminum or standard PVC fitting covers. Jacketing for piping in existing areas shall match existing jacketing.
- K. Piping in exterior walls, spaces, overhangs, attics, or where subject to freezing: Insulate pipe with double the thickness called for. Piping in wall chases: In addition to the above, pack chase with loose glass fiber insulation.
- L. Provide insulation on exposed hot and cold plumbing piping to within 18 in. of fixture or equipment connection.
- M. Insulate exposed domestic water and waste piping for plumbing fixtures designated for use by the handicapped.

3.3 EXISTING INSULATION

- A. Patch existing insulation damaged during the course of the work.
- B. Jacketing for piping in existing areas shall match existing jacketing.

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EXHIBIT "I" - PIPE INSULATION MATERIALS
(Notes at end of Exhibit "I")

<u>SERVICE</u>	<u>INSULATION MATERIAL</u>	<u>THICKNESS</u>	<u>REMARKS</u>
Domestic cold water	Glass fiber	1-1/2 in. and larger: 1 in. 1-1/4 in. and smaller: 1/2 in.	SEE NOTES 1, 2
Non potable cold water	Glass fiber	1-1/2 in. and larger: 1 in. 1-1/4 in. and smaller: 1/2 in.	SEE NOTE 2
Domestic hot, tempered and circulation water (105°F - 140°F)	Glass fiber	1-1/2 in. and larger: 1-1/2 in. 1-1/4 in. and smaller: 1 in.	SEE NOTES 1, 2
Storm and secondary storm water	Glass fiber	All sizes: 1 in.	Insulate body of drain and storm water piping, horizontal and vertical, down to connection below ground floor slab or in crawl space SEE NOTE 4
Sanitary and waste	Glass fiber	All sizes: 1/2 in.	SEE NOTE 3, 4

NOTES FOR EXHIBIT I:

NOTE 1: Exposed insulation at kitchen, laundry, and sterilizer equipment shall be covered with aluminum jacket.

NOTE 2: Flexible allowed in 1/2 in. thickness only.

NOTE 3: Insulation on sanitary and waste piping located within plumbing chases and crawl spaces are not required.

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NOTE 4: When PVC piping is installed for storm, sanitary and vent piping within return air plenums, the piping shall be insulated and enclosed in materials listed and labeled for installation within a plenum.

END OF SECTION

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SECTION 22 10 10 - PIPING SYSTEMS AND ACCESSORIES

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Provide labor, materials, equipment and services to perform operations required for the complete installation and related Work as required in Contract Documents.

1.2 SUBMITTALS

- A. Provide a schedule of pipe materials, fittings and connections.
- B. Provide a detailed matrix listing the specific UL approved firestop system assembly to be used for each type of piping provided and each type of construction to be penetrated along with all associated UL assembly details.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Pipe and fittings shall be new, marked with manufacturer's name and comply with applicable ASTM and ANSI Standards.
- B. All items here-in used to convey water for potable use shall be lead free in accordance with NSF, Standard 61, Section 9 - Standard for Drinking Water and Lavatory Faucets and NSF Standard 372 - Maximum Lead Requirements. Compliance shall be via third party testing and certification.

2.2 STEEL PIPING AND FITTINGS

- A. Pipe: ASTM A53, or ASTM A106 seamless, Schedule 40 or Schedule 80 weight; black or galvanized finish as called for; ends chamfered for welding or grooved for grooved mechanical connections.
- B. Fittings: Same material and pressure class as adjoining pipe.
 - 1. Welded fittings: Factory forged, seamless construction, butt weld type chamfered ends. Where branch connections are two or more sizes smaller than main size, use of "Weldolets", "Thredolets" or "Sokolets" acceptable. Mitered elbows, "shaped" nipples, and job fabricated reductions not acceptable unless specifically called for. Socket weld type, 2000 psi wp, where called for.

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2. Threaded fittings: Cast or malleable iron, black or galvanized, as called for; drainage type where called for; UL listed and FM approved for fire protection systems. Street type 45° and 90° elbows are not acceptable.
- C. Flanges, Unions, and Couplings:
1. Threaded Connections:
 - a. Flanges: Cast iron companion type; for sizes 2-1/2 in. and larger.
 - b. Unions: Malleable iron, bronze to iron seat, 300 lb. wwp; for sizes 2 in. and smaller.
 - c. Couplings: Malleable iron. Steel thread protectors are not acceptable as couplings.
 2. Welded Connections:
 - a. Flanges: Welding neck type. Slip-on type not allowed unless noted and shall not be installed in conjunction with butterfly valves.
 3. Grooved Mechanical Connections:
 - a. Couplings: Ductile iron, ASTM A536, with painted coating, designed for rolled grooved piping, hot dipped galvanized finish were called for.
 - b. Gaskets: Grade "E" EPDM synthetic rubber, -30°F to 230°F temperature range, suitable for water service.
 - c. Bolts and Nuts: Heat treated, hex head carbon steel, ASTM A183, cadmium plated or zinc electroplated.
 - d. Fittings: Elbows, tees, laterals, reducers, adapters as required. Same construction as couplings.
 - e. Design Equipment: Victaulic, rigid system, Style 07 couplings.
 - f. Design Equipment: Victaulic, flexible system, Style 77 couplings.
 - g. Acceptable Manufacturers: Grinnell, Gruvlok, Victaulic.
- D. Gauge and Instrument Connections: Nipples and plugs for adapting gauges and instruments to piping system shall be IPS brass.

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E. Base Elbows:

1. Cast iron or steel type, flange connections; Crane 500 or equivalent made from welding elbows, with welded pipe support and steel base. Reducing elbows where necessary.

Elbow Size	Support Size	Base Plate
Up to 3 in.	1-1/4 in.	6 in. x 6 in. x 1/4 in.
4 in. to 6 in.	2-1/2 in.	8 in. x 8 in. x 1/4 in.
8 in. and larger	6 in.	14 in. x 14 in. x 5/16 in.

2. Anchor bolt holes in each corner of base for securely bolting to floor or concrete base; minimum 3/4 in. bolts.

2.3 STEEL PIPING AND FITTINGS - PRESS CONNECT FITTINGS

- A. Piping Standard: Black steel piping shall conform to ASTM A53 or ASTM A106 seamless, Schedule 40 weight pipe.
- B. Fittings: Listed in accordance with ANSI LC4/CSA 6.32.
 1. For natural gas service, -40 deg. F to 180 deg F at 125 PSI.
 2. Sizes 1/2 inch through 4 inch, Schedule 40.
 3. Schedule 40 steel fittings with zinc/nickel coating for use with IPS schedule 40 carbon steel, pipe conforming to ASTM A53 or ASTM A106. Fittings shall have an HNBR sealing element, 420 stainless steel grip ring, separator ring and "Smart Connect" (SC) feature.
- C. Design Make: Viega Mega Press G System.
- D. Acceptable Manufacturer: Viega.

2.4 COPPER TUBE AND FITTINGS

- A. Pipe: ASTM B88; Type K or L, hard temper. Soft temper only as called for. Plans show copper tube sizes.
- B. Fittings: Wrought copper and copper alloy, ASME B16.22 or cast copper alloy, ASME B16.18; solder end connections.
- C. Joints: Comply with the requirements of ASTM B828.

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- D. Unions and Flanges: 2 in. and smaller use unions, solder type, cast bronze, ground joint, 150 lb. swp; 2-1/2 in. and over use flanges, cast bronze, companion type, ASME drilled, solder connection, 150 lb. swp.
- E. Flux Materials: Flux shall comply with ASTM B813 and the provisions of the New York State Plumbing Code.
- F. Solder Materials: No-lead solder, using alloys made from tin, copper, silver and nickel. Harris, Inc., "Stay-Safe 50" and "Bright", Engelhard "Silvabright 100", Canfield "Watersafe" or approved equal.
- G. Brazing Materials: Class BcuP-5 for brazing copper to brass, bronze to copper. Harris, Inc. "Stay-Silv 15" or approved equal.

2.5 COPPER TUBE AND FITTINGS - PRESS FITTINGS

- A. Tubing Standard: Copper tubing shall conform to ASTM B75 or ASTM B88.
- B. Fitting Standard: Copper fittings shall conform to ASME B16.18, ASME B16.22, or ASME B16.26.
- C. Press Fittings: Copper press fittings shall conform to the material and sizing requirements of ASME B16.18 or ASME B16.22. O-rings for copper press fittings shall be EPDM.
- D. Acceptable Manufacturers: Apollo, Mueller, Nibco, Viega.

2.6 COPPER TUBE AND FITTINGS FOR MEDICAL GAS

- A. Pipe: ASTM B819, Type K or L, hard temper, precleaned and sealed for medical gas service.
- B. Fittings: Wrought copper, ANSI B16.22 precleaned, and sealed for medical gas service.
- C. Unions and Flanges: Unions for 2 in. and smaller. Brazed type cast bronze ground joint, 150 lb. swp; flanged for 2-1/2 in. and larger, brazed type, cast bronze, companion type, gasketed and bolted, ASME drilled 150 lb. swp.
- D. Brazing Materials: Class BcuP-5 for brazing copper to brass, bronze or copper. Harris, Inc. "Stay-Silv 15" or approved equal.

2.7 HUB AND SPIGOT CAST IRON SOIL PIPE AND FITTINGS

- A. Pipe: ASTM A74 service weight cast iron, bitumen coated.

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- B. Fittings: Cast iron, service weight, hub and spigot, drainage pattern, bitumen coated.
- C. Connections: ASTM C564 neoprene gaskets and lubricant.
- D. All cast iron soil pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute (CISPI) and be listed by NSF International.

2.8 NO-HUB CAST IRON SOIL PIPE AND FITTINGS

- A. Pipe: ASTM A888, CISPI Standard 301, no-hub cast iron, bitumen coated.
 - 1. For above grade only.
- B. Fittings: Cast iron, no-hub drainage pattern, bitumen coated.
- C. Couplings:
 - 1. 1-1/2 in. to 2 in.: CISPI standard 310 with 300 series stainless steel corrugated shield and clamp assembly with ASTM C564 neoprene sealing sleeve (or) same as specified for 3 in. and larger.
 - 2. 3 in. and Larger: 24 gauge, Type 304 stainless steel housing clamp assembly with ASTM C564 neoprene sealing sleeve, 60 in. lbs. minimum torque rating, shall meet requirements of pipe manufacturer and shall be compatible with specified pipe. Acceptable Manufacturers: Clamp-All Coupling System, Tyler "Wide Body", Husky "Series 2000", Mission "Heavy Weight" or approved equal.
- D. All cast iron soil pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute (CISPI) and be listed by NSF International.

2.9 PVC SOLID WALL PIPE AND FITTINGS - DWV SYSTEM

- A. Pipe: PVC Schedule 40 solid wall pipe, iron pipe size conforming to ASTM D1785 and ASTM D2665. Pipe shall be manufactured from PVC compounds as identified in ASTM D1784. Both pipe and fittings shall conform to National Sanitation Foundation Standard 14.
- B. Fittings: Type DWV, socket type conforming to ASTM D2665. Fittings shall be manufactured from PVC compounds as identified in ASTM D1784. Solvent cement joints shall be made utilizing a two-step process with primer manufactured for thermoplastic piping and solvent cement conforming to ASTM D2564.

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2.10 HANGERS, INSERTS AND SUPPORTS

- A. Hangers, Inserts, Clamps: B-Line, Grinnell, Michigan Hanger, PHD Manufacturing.
- B. Hangers:
1. Adjustable, wrought malleable iron or steel with electroplated zinc or cadmium finish. PVC coated where in contact with copper piping.
 2. Adjustable ring type where piping is installed directly on hanger for piping 3 in. and smaller.
 3. Adjustable steel clevis type for piping 4 in. and larger.
 4. Nuts, washers and rods with electroplated zinc or cadmium finish.
 5. Provide hot dipped galvanized finish for hangers and accessories installed in exterior locations and interior areas with moist environment conditions such as pools, pool filter rooms, areaways, garages and similar areas.
- C. Spacing Schedule:

Pipe Size	Steel	Copper	Plastic	Cast Iron	Rod Size
3/4 in. to 1 in.	8 ft.	6 ft.	3 ft.	Each	3/8 in.
1-1/4 in. to 2 in.	10 ft.	6 ft.	3 ft.	Horizontal	3/8 in.
2-1/2 in. to 4 in.	12 ft.	10 ft.	4 ft.	Joint 5 ft.	1/2 in.
5 in. and over	12 ft.	10 ft.	4 ft.	Maximum	5/8 in.
8 in.	12 ft.	10 ft.	4 ft.	O.C.	3/4 in.
Over 8 in.	To suit loading conditions.				

- D. Cast Iron No-Hub Supports:
1. In accordance with manufacturer's recommendations.
 2. Vertical piping supported at each stack base, at each floor and 15 ft. on center, maximum. Freestanding vertical pipe should be adequately staked or braced during construction to maintain alignment. Bases of stacks shall be supported on concrete, brick laid in cement mortar, metal brackets attached to the building construction or by other methods approved by the Owner's Representative.

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3. Horizontal piping supported within 24 in. each side of the coupling joint at 10 ft. intervals for 10 ft. pipe lengths and at 5 ft. intervals for 5 ft. pipe lengths. Supports or hangers placed to maintain alignment and grade with provision made to prevent shear. Greater than 3 in. diameter pipe braced at changes of direction to prevent horizontal movement.
- E. Beam Attachments:
1. C-Clamp style, locknut, restraining strap, electroplated finish, UL listed, FM approved for pipe sizes 2 in. and smaller.
 2. Center loaded style with clamp attachments that engage both edges of beam, electroplated finish, UL listed, FM approved, for pipe sizes larger than 2 in., refer to "Supports" for additional requirements.
- F. Inserts: Carbon steel body and square insert nut, galvanized finish, maximum loading 1300 lbs., for 3/8 in. to 3/4 in. rod sizes, reinforcing rods on both sides, MSS-SP-69 Type 19 or approved equal.
- G. Supports:
1. Provide intermediate structural steel members where required for hanger attachment. Members shall span across the bar joists at panel points of joists. Secure member to structure. Select size of members based on a minimum factor of safety of four.
 2. For Weights Under 1000 lbs.: "Drill-In" inserts, "U" shaped Channel, beam clamps or other structurally reviewed support. The factor of safety shall be at least four. Follow manufacturer's recommendations.
 3. For Weights Above 1000 lbs.: Drill through floor slabs and provide flat flush plate welded to top of rod or provide additional "Drill-In" inserts and hangers to reduce load per hanger below 1000 lbs.
 4. For Metal Decks: Drill hole through for hanger rods and imbed a welded plate in concrete or use devices designed for this application, with a safety factor of four.
 5. For Wood Construction: Provide hangers and supports designed for attachment to wood construction.
 6. Acceptable Manufacturers: Hilti, ITW Ramset, Phillips "Red Head" or approved equal.

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- H. Trapeze Hangers:
 - 1. For plumbing systems only.
 - 2. Hangers shall be supported with rod sized with a safety factor of four.
 - 3. May be manufactured type "U" shaped channel, or suitable angle iron or channel. Round off all sharp edges.
 - 4. Securely fasten piping to trapeze with "U" bolt or pipe clamps, dissimilar metals shall not touch, use isolation gaskets, similar to HoldRite strut-mounted cushion clamps. Fasten piping to trapeze at every third support, except uninsulated piping which shall be fastened at every support using strut-mounted cushion clamps.
 - 5. Acceptable Manufacturers: B-Line, HoldRite, Kindorf, Unistrut or approved equal.
- I. Piping systems with material not listed above shall be supported and protected in accordance with manufacturer's recommendations.

2.11 PIPING ACCESSORIES

- A. Escutcheon Plates: Steel or cast brass, split hinge type with setscrew, high plates where required for extended sleeves. Chrome plated in finished areas and at plumbing fixtures.
- B. All cleanout plugs, bushings and nipples, required for instruments and gauges shall be brass.
- C. Hubless cast iron fitting restraints shall be Holdrite Series #117 or approved equal.

2.12 SLEEVES

- A. Standard Type:
 - 1. Schedule 40 black steel pipe sleeves for structural surfaces, two pipe sizes larger than the pipe, and as recommended by the sealing element manufacturer. Provide full circle water stop collar for sleeves located within below grade walls, wet wells and waterproofed surfaces. The collar shall be fabricated from steel plate and welded to the sleeve around its entire circumference.

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2. Schedule 40 PVC sleeves or sheet metal sleeves for nonstructural surfaces and existing construction. Sheet metal sleeves shall be 18 gauge minimum and braced to prevent collapsing.

2.13 SEALING ELEMENTS

- A. Expanding neoprene link type, watertight seal consisting of interlocking links with zinc plated bolts.
 1. Acceptable Manufacturers: Thunderline "Link-Seal" Series 200, 300 or 400, Pyropac, Calipco.

2.14 FIRESTOP SYSTEM FOR OPENINGS THROUGH FIRE RATED WALL AND FLOOR ASSEMBLIES

- A. Materials for firestopping seals shall be listed by an approved independent testing laboratory for "Through-Penetration Firestop Systems". The system shall meet the standard fire test for Through-Penetration Firestop Systems designated ASTM E814. Firestop system seals shall be provided at locations where piping pass through fire rated wall, floor/ceiling, or ceiling/roof assembly. Minimum required fire resistant ratings of the assembly shall be maintained by the Firestop System. Installation shall conform with the manufacturer's recommendations and other requirements necessary to meet the testing laboratory's listing for the specific installation.

2.15 STACK SLEEVE

- A. Cast iron body with caulking recess, flashing clamp and under deck clamp.
- B. Acceptable Manufacturers: Jay R. Smith Series 1720, Zurn, Wade.

2.16 STRAINERS

- A. Description: Y-Pattern, self-cleaning, except where otherwise indicated, full size of connecting piping, Type 304 stainless steel screens, 125 lb. SWP, unless otherwise indicated.
- B. Copper Piping 2-1/2 in. and Smaller: Lead free, cast bronze body, threaded ends, tapped retainer cap with closure plug, 20 mesh screen, Watts #LF777S.
- C. Steel Piping 2-1/2 in. and Smaller: Iron body, threaded ends, tapped retainer cap with closure plug, 20 mesh screen, Watts #77S
- D. Piping 3 in. and Larger, Cold Water Applications: Lead free, cast iron body, flanged ends, standard screen openings, FDA approved epoxy coating, tapped retainer cap and gasket with closure plug; Watts #77F-DI-FDA-125.

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- E. Fuel Oil Strainers 2 in. and Smaller: Line strainer, top cleanout, cast iron body and cap, malleable iron yoke, 50 psi operating pressure, 24 mesh stainless steel cage and basket for #2 fuel oil, female threaded ends, UL listed; Morrison Figure #286-U.

2.17 PIPING MATERIALS AND SCHEDULE

- A. See Exhibit "A", "Schedule of Piping Materials" at end of this Section for (Plumbing) piping.
- B. See Exhibit "B", "Testing" at end of this Section.

PART 3 - EXECUTION

3.1 EQUIPMENT AND SYSTEMS

- A. Install equipment and systems in accordance with provisions of each applicable Section of these Specifications, and Local/State Codes/Regulations having jurisdiction. Accurately establish grade and elevation of piping before setting sleeves. Install piping without springing or forcing, except where specifically called for, making proper allowance for expansion and anchoring. Changes in sizes shall be made with reducing fittings. Reducing couplings are not acceptable. Arrange piping at equipment with necessary offsets, unions, flanges, and valves, to allow for easy part removal and maintenance. Offset piping and change elevation as required to coordinate with other work. Avoid contact with other mechanical or electrical systems. Provide adequate means of draining and venting units, risers, circuits and systems. Conceal piping unless otherwise called for. Copper tubing shall be cut with a wheeled tubing cutter or other approved copper tubing cutter tool. The tubing must be cut square to permit proper joining with the fittings. Ream pipes after cutting and clean before installing. Cap or plug equipment and pipe openings during construction. Install piping parallel with lines of building, properly spaced to provide clearance for insulation. Make changes in direction and branch connections with fittings. Do not install valves, unions and flanges in inaccessible locations. Materials within a system and between systems shall be consistent. If this is not possible, install dielectric fittings.

3.2 PIPING OVER ELECTRICAL EQUIPMENT

- A. Contractor shall route piping to avoid installation directly over electric equipment, including, but not limited to panels, transformers, disconnects, starters, motor control center, adjustable speed drives and fused switches.
- B. Piping shall not be installed in the dedicated electric and working space as defined by NEC 110. Dedicated electrical space is generally equal to the depth and width of electrical equipment, and extends 6 ft. above the electrical

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equipment, or to a structural ceiling. Dedicated working space is a minimum of 30 in. wide or the width of equipment (whichever is larger) a minimum of 6 ft.-6 in. tall, with a depth of 3ft. to 9 ft. depending on the voltage.

3.3 HANGERS, INSERTS AND SUPPORTS

- A. Piping shall not be supported by wires, band iron, chains, from other piping, or by vertical expansion bolts. Support piping with individual hangers from concrete inserts, wood construction, welded supports, or beams clamps of proper configuration and loading design requirements for each location; replace if not suitable. Follow manufacturer's safe loading recommendations. Suspend with rods of sufficient length for swing and of size called for, using four (4) nuts per rod. Provide additional structural steel members, having one coat rustproof paint, where required for proper support. Provide oversized hangers where insulation/supports must pass between pipe and hanger. Provide continuous support or extra supports for plastic piping per manufacturer's requirements. Hangers, when attached to joists, shall only be placed at the top or bottom chord panel point. Only concentric type hangers are permissible on piping larger than 2-1/2 in.; "C" types are permitted for piping 2 in. and smaller on joists. Provide riser clamps for each riser at each floor. Use trapeze hangers where a group of piping can be installed.
- B. Provide a pipe hanger within 12 inches of pipe unions and piping connections to equipment, in order to facilitate disconnections of piping without pipe sagging.

3.4 PIPE CONNECTIONS

- A. No-Lead Solder Connections: Nonacid flux and clean off excess flux and solder.
- B. Copper Press Connections: Copper press fittings shall be made in accordance with the manufacturer's installation instructions. The tubing shall be fully inserted into the fitting and the tubing marked at the shoulder of the fitting. The fitting alignment shall be checked against the mark on the tubing to assure the tubing is fully engaged (inserted) in the fitting. The joints shall be pressed using the tool approved by the manufacturer.
- C. Steel Press Connections:
 - 1. Natural Gas Systems: Sealing elements shall be verified for the intended use. Pipe ends shall be cut on a right angle (square) to the pipe. Pipe ends shall be reamed and all paint, lacquer, grease, oil, and dirt shall be removed from the pipe end with an abrasive cloth, or with a Ridgid MegaPress pipe end prep tool. Visually examine each fitting sealing element to ensure there is no damage. Insert the pipe fully into the fitting and mark the pipe wall at the face of the fitting. Always examine the pipe to ensure it is fully inserted into the fitting prior to pressing the joint. Steel

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Press fittings shall be installed using Ridgid, MegaPress Tools. Steel Press fittings shall be installed according to the most current edition of the manufacturer's installation guidelines. Installers shall be trained by a manufacturer representative on proper installation procedures.

2. Testing: After Steel Press fittings have been installed a "two step test" shall be followed. Utilizing air or, dry nitrogen, pressurize the system between 5 psi and 45 psi. Check the pressure gauge for pressure loss. If the system does not hold pressure, inspect entire system and check for un-pressed fittings. Should un-pressed fittings be identified, ensure the pipe is fully inserted into the fitting and properly marked prior to pressing the joint. After appropriate repairs have been made, test the system per local code, or specification requirements, not to exceed 200 psig.
- D. Brazed Connections: Make joints with silver brazing alloy in accordance with manufacturer's instructions. Remove working parts of valves before applying heat.
- E. Threaded Connections: Clean out tapering threads, made up with pipe dope; screwed until tight connection. Pipe dope must be specifically selected for each application.
- F. Flanged Joints: Select appropriate gasket material, size, type and thickness for service applications. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.
- G. Dielectric Pipe Fittings: Provide dielectric unions at ALL equipment connections where dissimilar metals meet. In addition, provide dielectric unions in all open type piping systems (condensing water, domestic water, etc.) where dissimilar metals are to be joined.
- H. FRP Pipe Joints: Bonded with resin catalyst adhesive.
- I. Grooved Mechanical Joints: Pipe to be prepared in accordance with the latest manufacturer's grooving specification. Use manufacturer's recommended grooving tools. Pipe shall be checked to be sure it is free of indentations, projections; weld seams or roll marks on the exterior of the pipe over the entire gasket seating area. Pipe ends are to be square cut. Lubricant shall be applied to gasket and/or pipe ends and housing interiors to eliminate pinching the gasket.

3.5 WELDING

- A. Welding shall be performed in compliance with the welding procedure specifications prepared by the National Certified Pipe Welding Bureau. Welded pipe fabricated by certified welder. Contractor shall submit proof of current certification of each welder if requested by Owner. Use full-length pipe where

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possible; minimum distance between welds, 18 in. on straight runs. Welds must be at least full thickness of pipe inside smooth and remove cutting beads, slag and excess material at joints; chamfer ends. Minimum gap 1/8 in., maximum 1/4 in., for butt welds. Overlaps on position and bench welds to be not less than 3/4 in. One internal pass and one external pass minimum required on slip-on flanges. Do not apply heat to rectify distorted pipe due to concentrated welding; replace distorted pipe.

- B. When welding galvanized pipe, apply cold galvanizing on joint following welding.

3.6 SLEEVES

- A. Provide for pipes passing through floors, walls or ceilings. Not required for floors that are core-drilled, except where floor is waterproofed.
- B. Extend 1/8 in. above finished floor in finished areas. In above grade Mechanical Rooms and other areas with floor drains, use steel pipe sleeves 2 in. above floor.
- C. Use steel pipe sleeves in bearing wall, structural slabs, beams and other structural surfaces, and where called for.
- D. Sleeves shall be as small as practical, consistent with insulation, so as to preserve fire rating.
- E. Fill abandoned sleeves with concrete.
- F. Provide rubber grommet seals for pipes passing through ducts or air chambers or built-up housings.

3.7 SLEEVE PACKING

- A. Seal void space at sleeves as follows:
 - 1. Interior Locations: Firmly pack with fiberglass and caulk.
 - 2. Exterior Walls and Below Grade Cored Holes: Use sealing element.
 - 3. Cored Holes: Use sealing element.
 - 4. Fire Rated, Partitions and Floor Slabs: Use fire rated sealing elements, materials and methods. Provide per manufacturer's instructions to maintain firestop.
 - 5. Waterproofed Walls/Floors: Use waterproof sealing element, device or compound.

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3.8 ESCUTCHEON PLATES

- A. Provide polished chrome setscrew type escutcheon plates for all exposed piping passing through floors, walls or ceilings, in all rooms except in Boiler, Fan and Mechanical Rooms.

3.9 TESTS

- A. Refer to Exhibit "B" at the end of this section for testing of Plumbing Systems.
- B. Provide all necessary items to complete proper testing of work. Perform all testing in accordance with governing Codes, local utilities and other agencies having jurisdiction and as specified. Pay all costs to perform tests. Perform all testing in a safe manner. Isolate existing systems.
- C. Domestic Water:
 - 1. Do not cover joints with insulation until required tests are completed and the Owner's Representative accepts the system.
 - 2. Make leaks tight; no caulking permitted. Replace defective fittings, pipe or connections. Piping shall be tight and show no loss of pressure.
 - 3. Air test not acceptable as final test.
 - 4. Confirm in writing that tests and flushing have been conducted and successfully completed. Submit copy of the test report to Owner's Representative.
- D. Sanitary and Storm:
 - 1. There shall be no loss of water when testing interior piping.
 - 2. Air test not acceptable as final test.
 - 3. Should any leaks, defective joints or defective construction be detected in sewers and/or floors or walls of appurtenant structures, they shall be permanently stopped. Should any defective pipes, fittings or accessories be discovered they shall be removed and replaced at the Contractor's expense.
 - 4. Confirm in writing that tests have been conducted and successfully completed. Submit copy of the test report to Owner's Representative.

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3.10 DOMESTIC WATER PIPING CLEANING AND DISINFECTION

- A. Cleaning and disinfecting shall be in accordance with requirements of New York State Department of Health and authority having jurisdiction. Prior to disinfecting, flush piping to remove any sediment and debris.
- B. Clean and disinfect water distribution piping systems and parts of existing potable water systems that have been altered, extended or repaired.
- C. After disinfection procedures, submit water samples in sterile bottles to an approved Department of Health Laboratory. Samples shall be proven equal to the water quality served to the public from the existing water supply system and acceptable to the Department of Health. Flush and disinfect all sections of pipe that fail the laboratory tests. Submit test results indicating water is potable.

3.11 PIPE LINE SIZING

- A. Pipe sizes called for are to be maintained. Pipe size changes made only as reviewed by Owner's Representative. Where discrepancy in size occurs, the larger size shall be provided.

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EXHIBIT "A" - PIPING MATERIALS (PLUMBING)
(Note at end of Exhibit "A")

<u>SERVICE</u>	<u>PIPE MATERIALS</u>	<u>FITTINGS</u>	<u>CONNECTIONS</u>
Domestic water interior/hot, cold and circulating 3 in. and smaller	Type L copper	Wrought or cast copper	No-lead solder
	Type L copper	Wrought or cast copper	Press fit
Sanitary, sanitary vent and grease waste	Service weight cast iron soil pipe	Cast iron hub and spigot	Neoprene compression type gasket
	Service weight cast iron soil pipe	No hub	No hub neoprene gasket and stainless steel clamp assembly
	Schedule 40 PVC, solid wall	PVC, socket type	Solvent cement (SEE NOTE 1)
Storm	Service weight cast iron soil pipe	Cast iron hub and spigot	Neoprene compression type gasket
	Service weight cast iron soil pipe	No hub	No hub neoprene gasket and stainless steel clamp assembly
	Schedule 40 galvanized steel	Galvanized ductile iron	Roll grooved mechanical type couplings
	Schedule 40 PVC, solid wall	PVC, socket type	Solvent cement (SEE NOTE 1)
Indirect waste	Type DWV copper	Wrought copper	No-lead solder
	Schedule 40 PVC, solid wall	PVC, socket type	Solvent cement (SEE NOTE 1)

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<u>SERVICE</u>	<u>PIPE MATERIALS</u>	<u>FITTINGS</u>	<u>CONNECTIONS</u>
	Schedule 40 PVC, foam core	PVC, socket type	Solvent cement (SEE NOTE 1)
Vacuum (Medical)	Type L copper	Wrought copper	Brazed
Oxygen	Type L precleaned copper for medical gas	Precleaned wrought copper	Brazed
Nitrous Oxide	Type L precleaned copper for medical gas	Precleaned wrought copper	Brazed

NOTE FOR EXHIBIT A:

NOTE 1: PVC piping shall not be installed within return air plenums.

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EXHIBIT "B" - TESTING

<u>SERVICE</u>	<u>TEST REQUIREMENTS</u>
Domestic water	Test hydrostatically at 150 PSI for two (2) hours or at 1.5 times the working pressure when working pressure exceeds 100 PSI
Sanitary, sanitary vent, storm	Maintain 10 ft. head of water for two (2) hours.
Indirect waste	Maintain 10 ft. head of water for two (2) hours.
Acid waste and vent	Maintain 10 ft. head of water for two (2) hours.
Swimming pool piping	Refer to Section 225100 - "Pool Equipment".
Pump discharge	Hydrostatically test at 5 PSI greater than the pump rating for two (2) hours.
Fuel oil piping, supply and return, fill and vent	Refer to Section 227020 - "Fuel Storage Tanks and Accessories".
Engine exhaust	Test in accordance with the engineer/generator manufacturer's recommendations.
Natural gas	Refer to Section 227010 - "Natural Gas Systems".
LP gas (propane)	Refer to Section 227011 - "LP Gas System".
Reverse osmosis, deionized water	Test with inert gas (nitrogen) at a pressure of 125 PSI for two (2) hours.
Compressed air (house, shop and industrial)	Test with clean air or nitrogen at a pressure of 175 PSI for 24 hours.
Compressed air (medical, air intake)	Refer to Section 226100 - "Medical Compressed Air".
Vacuum (medical, exhaust piping)	Refer to Section 226200 - "Vacuum System".

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SERVICE

Nitrous oxide,
nitrogen

TEST REQUIREMENTS

Test with oil free dry nitrogen at 1.5 times the working pressure (150 PSI min.) Maintain pressure until all joints have been examined. Refer to Section 226300 for applicable information.

END OF SECTION

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SECTION 22 30 10 - EQUIPMENT

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Provide labor, materials, equipment and services to perform operations required for the complete installation and related Work as required in Contract Document.

1.2 SUBMITTALS

- A. Provide submittals for all items specified under Part 2 of this section.

PART 2 - PRODUCTS

2.1 FLOOR DRAINS

- A. Drain Description: All Floor Drains Type A unless otherwise noted.
 - 1. Type A: Cast iron body, flashing collar with weepholes, nickel bronze 7 in. diameter adjustable strainer with separate oval funnel; Jay R. Smith Figure #2010-A with #3590 funnel recessed anti-flood rim; Jay R. Smith Figure #2010 with #F37 rim.
- B. Where floor drains are not installed in slabs on grade, provide flashing collar and flash with 24 in. square four (4) pound lead flashing or equal.
- C. Make: Josam, Jay R. Smith, Mifab, Watts or Zurn.

2.2 FLOOR SINKS

- A. Sink Description:
 - 1. Type A: Acid resistant coated body with 12-1/2 in. square nickel bronze top, 8 in. deep with sediment bucket; Jay R. Smith Figure #3150.
 - 2. 1/2 grate to allow indirect discharge.
- B. Make: Josam, Jay R. Smith, Mifab, Watts or Zurn.

2.3 CLEANOUTS

- A. Floors: Cast iron body, nickel-bronze top with adjustable feature, bronze plug and flashing clamp where required, carpet marker and tile cover where applicable; Jay R. Smith Series #4028.

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- B. Walls: Cast iron ferrule, with bronze plug and stainless steel smooth access cover.
 - 1. Horizontal: Jay R. Smith Figure #4402.
 - 2. Vertical: Jay R. Smith Figure #4531.
- C. Yard Cleanout:
 - 1. Cast iron body, adjustable round heavy duty top, with tractor cover, vandal proof screws and bronze plug; Jay R. Smith Figure #4246.
- D. Make: Josam, Jay R. Smith, Mifab, Watts or Zurn.

2.4 GREASE INTERCEPTOR STEEL

- A. Welded 1/4 in. steel body, 3/8 in. nonskid tread plate cover, secured with stainless steel bolts, extra heavy leakproof gasket, above floor installation, integral extension to floor/grade. Acid-resistant coating inside and outside.
- B. 50 gpm full flow, 40 gallon liquid holding capacity, 3 in. tapped inlet and outlet with outlet vent connection, 100 lb. greasy sludge capacity, removable separator screen, filter screen and anchor flange.
- C. Make: Zurn Z1108, Mifab.

2.5 SHOCK ABSORBERS

- A. Hydropneumatically controlled with permanently sealed expansion chamber pre-charged with non-combustible gas; lead-free, threaded connection, meets or exceeds Plumbing and Drainage Institute Standard PDI WH-201 and ASSE Standard 1010.
 - 1. Bellows Type: Stainless steel construction with stainless steel bellows.
 - 2. Piston Type: Hard drawn copper body with brass piston, cap and adapter, and elastomer seals.
- B. Elastomer or rubber compound type bellows not allowed.
- C. Make: Watts #LF15M2, Precision Plumbing Products, Jay R. Smith, or Zurn.

2.6 TRAP GUARDS

- A. Elastomeric, normally closed seal to prevent evaporation of P-traps. Inserts into throat of floor drain. Provide for each new floor drain.

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- B. Make: ProVent Systems, Inc. "ProSet Trap Guard".

PART 3 - EXECUTION

3.1 EQUIPMENT CONNECTIONS

- A. Plumbing Contractor shall:
1. Provide all roughing and final water, waste, vent, gas, air, vacuum, diesel and/or oxygen connections to all equipment requiring same as called for on Contract Documents.
 2. Refer to Contract Documents for roughing schedules, and equipment and lists indicating scope of connections required.
 3. Provide loose key stops, "P" traps, tailpieces, adapters, gas or air cocks and all necessary piping and fittings from roughing point to equipment.
 4. Provide for installation of sinks, faucets, traps, tailpieces provided by an Equipment Contractor. These items to be delivered, in easily identified cartons, to the proper room for Contractor's installation.
 5. Install controls and devices furnished by others.
 6. Provide cold water line with gate valve and backflow prevention device at locations called for. Continuation and connection to equipment by others.
 7. Install relief valve discharge piping from equipment relief valves.

3.2 CLEANOUTS

- A. Install cleanouts out of traffic patterns and flush to floor. Provide offset from sanitary line served. Do not locate under doors or under lockers. Maintain distance between cleanouts on piping 4 in. and smaller, 50 ft.; over 4 in., 100 ft. At changes in direction greater than 45°. Install at base of soil, waste, vent, stacks and roof conductors and where called for.
- B. Cleanouts: Same nominal size as pipe, but not larger than 4 in.

3.3 SHOCK ABSORBERS

- A. Install in vertical position.

3.4 GREASE TRAP

- A. Install in accordance with manufacturer's written installation instructions.

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END OF SECTION

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SECTION 22 40 00 - PLUMBING FIXTURES AND TRIM

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Provide labor, materials, equipment and services to perform operations required for the complete installation and related Work as required in Contract Documents.

1.2 SUBMITTALS

- A. Submit manufacturer's data in accordance with Basic Mechanical/Electrical Requirements. Obtain approval prior to ordering material.
- B. Provide submittals for all items specified under Part 2 - Products of this section.

1.3 DESCRIPTION OF FIXTURES

- A. Fixtures and trim shall be of those manufacturers listed, unless otherwise indicated. Fixtures for this project shall be of same manufacturer.
 - 1. Fixtures: American Standard, Kohler, Mansfield, Sloan, Toto, Watts or Zurn.
 - 2. Faucets: Chicago Faucets, Delta, Moen, Symmons, T&S Brass or Zurn. All faucets shall be lead-free in accordance with NSF 61 and NSF 372.
 - 3. Flushometers: Sloan "Regal XL" or Zurn.
 - 4. Closet Seats: Bemis, Beneke, Church or Olsonite.
 - 5. Fixture Carriers: Jay R. Smith, Watts, Wade, Josam or Zurn.
 - 6. Sinks: Elkay, Just or Kohler.
 - 7. Water Coolers: Elkay, Halsey Taylor or Haws.
 - 8. Supplies, Stops and Traps: Brasscraft, EBC, McGuire or Sanitary Dash.
- B. Exposed parts of trim shall have polished chrome plated finish.
- C. Tubular drainage products ("P" traps, nipples, etc.) shall be 17 gauge brass.

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1.4 QUALITY ASSURANCE

- A. Comply with requirements of the Plumbing Fixture Law of the New York State Department of Environmental Conservation.
- B. Comply with the American Disabilities Act Guidelines and ANSI A117.1 "Accessible and Usable Buildings and Facilities".
- C. All items here-in used to convey water for potable use shall be lead free in accordance with NSF Standard 61, Section 9 Standard for Drinking Water and Lavatory Faucets and NSF Standard 372 - Maximum Lead Requirements. Compliance shall be via third-party testing and certification.
- D. All fixture trim used to convey water for potable use shall be lead free.

PART 2 - PRODUCTS

2.1 WATER CLOSETS

- A. WC-A (HDGP):
 - 1. American Standard #3043.102 Madera Right Height, floor mounted, vitreous china, 16-1/2 in. high, siphon jet, 1.28 GPF, elongated bowl, fully glazed 2 in. ball pass trapway with 1-1/2 in. top spud, fitted with the following:
 - a. FV-A flush valve as specified herein.
 - b. Church #9500SCC, extra heavy weight, white elongated solid plastic, open front closet seat with self-sustaining check hinge, less cover.
 - c. Cast iron closet flange with stainless steel bolts and wax setting ring.
 - d. Color matching bolt caps.
- B. FV-A: American Standard Selectronic 6065.161.002 Sensor-operated, closet flushometer, exposed diaphragm type, for 1-1/2" top spud bowls. CR-P2 lithium battery powered.

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2.2 LAVATORIES

A. LAV-A (HDCP):

1. American Standard #0355.012 Lucerne, 20 in. x 18 in., wall hung, vitreous china lavatory with 4 in. centers, front overflow, self-draining deck and punching for concealed arm carrier, fitted with following:
 - a. F-A faucet as specified herein.
 - b. McGuire #155WC offset chrome plated P.O. plug with open grid strainer and 1-1/4 in., 17 gauge offset tailpiece.
 - c. McGuire #8902 chrome plated, 17 gauge, 1-1/4 in. x 1-1/2 in. "P" trap with cleanout plug and cast brass escutcheon with set screw.
 - d. McGuire # LF165LKF, lead-free, 3/8 in. chrome plated wall supplies with loose key angle stops, 12 in. long flexible risers, cast brass escutcheon with set screws.
 - e. Jay R. Smith Series 700 concealed arm floor mounted carrier with rectangular uprights.
 - f. Cover exposed waste, stops and supply piping with ADA conforming pipe covers, Truebro, Inc. "Lav-Guard".
 - g. Mount at ADA required height and location or as shown on Architectural drawings.

2.3 SINKS

A. SK-A (HDCP):

1. Elkay Lustertone LRAD2219, 22 in. x 19 in. x 6 in. deep, nickel type 302 stainless steel single bowl sink, ADA compliant, three (3) faucet holes, 18 gauge, self rimming for countertop installation, fitted with the following:
 - a. F-B faucet as specified herein.
 - b. Elkay #LKAD35 strainer with removable cup, LKADOS 1-1/2 in. O.D. offset tailpiece.
 - c. McGuire #8912 semi-cast brass adjustable "P" trap, 1-1/2 in. x 1-1/2 in., with cleanout plug and cast brass escutcheon with set screw.

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- d. McGuire #LF2167LKF, lead-free, 1/2 in. copper sweat supplies with 1/2 in. OD flexible risers, loose key stops and cast brass escutcheons with set screws.

B. SK-B (HDCP):

- 1. American Standard #0355.012 Lucerne, 20 in. x 18 in., wall hung, vitreous china lavatory with 4 in. centers, front overflow, self-draining deck and punching for concealed arm carrier, fitted with following:
 - a. F-A faucet as specified herein.
 - b. Elkay #LKAD35 strainer with removable cup, LKADOS 1-1/2 in. O.D. offset tailpiece.
 - c. McGuire #8902 chrome plated, 17 gauge, 1-1/4 in. x 1-1/2 in. "P" trap with cleanout plug and cast brass escutcheon with set screw.
 - d. McGuire # LF165LKF, lead-free, 3/8 in. chrome plated wall supplies with loose key angle stops, 12 in. long flexible risers, cast brass escutcheon with set screws.
 - e. Jay R. Smith Series 700 concealed arm floor mounted carrier with rectangular uprights.
 - f. Cover exposed waste, stops and supply piping with ADA conforming pipe covers, Truebro, Inc. "Lav-Guard".
 - g. Mount at ADA required height and location or as shown on Architectural drawings.

2.4 FAUCETS

- A. F-A: Chicago Faucets #116.878.AB.1 (1.5 GPM laminar flow control insert in base of plain-end spout) CP solid cast brass HyTronic Curve lead-free sensor-activated lavatory faucet with 4 in. center deck plate and user-adjustable temperature and temperature limit stop to adjust outlet temperature, automatic shut-off feature, 6 Volt Lithium CRP2 battery included, braided stainless steel supply hoses with checks/strainers. Electronic components are sealed and housed above deck in a cast brass body for maximum vandal resistance.
 - 1. Chicago #131-ABNF, lead-free, thermostatic mixing valve, 3/8 in. connections.

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B. F-B:

1. Chicago LWM1-A11-E, Single Hole Deck Mounted Dual Inlet Water Faucet, 6" Rigid/Swing gooseneck spout with vacuum breaker with straight serrated nozzle, deck mounted, lead-free, and fitted with the following:
 - a. Chicago #131-ABNF, lead-free, thermostatic mixing valve, 3/8 in. connections.

PART 3 - EXECUTION

3.1 FIXTURES, EQUIPMENT AND SYSTEMS

- A. Install fixtures, equipment and systems as shown on Drawings or specified herein in accordance with provisions of each applicable Specification Section and all local and state codes having jurisdiction.

3.2 INSTALLATION OF PLUMBING FIXTURES

- A. Install plumbing fixtures level and plumb, in accordance with fixture manufacturers written installation instructions.
- B. Carefully drill holes for through bolts to avoid chipping blocks or plaster.
- C. Except where carriers are specified, attach hangers or brackets to walls as follows:
 1. Masonry Construction: Secure fixture hangers to partition by thru-bolts extending through a steel plate on opposite side of partition. Obtain Owner's Representative's approval prior to work.
 2. Metal Stud Construction: Anchor backing for fixtures or equipment to 1/8 in. x 12 in. steel plate bolted or riveted to at least three studs. Obtain Owner's Representative's approval prior to work.
- D. Anchor carriers to concrete floor with 1/2 in. x 3 in. anchor or thru-bolts and washers. Provide for drilling of floor and installation of expansion shields. Quantity of anchors:
 1. Water Closets - Four (4).
 2. Lavatories - Eight (8).
- E. Seal fixtures in contact with walls, floors and counters using a sanitary-type, one-part, mildew-resistant, silicone caulk. Match color to fixture color.

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- F. Set self-rimming lavatories and sinks in a bed of silicone caulk.
- G. Install floor-mounted, floor-outlet water closets with closet flanges and gasket seals.
- H. Fasten wall-hanging plumbing fixtures securely to supports attached to building substrate when supports are specified and to building wall construction where no support is indicated.
- I. Fasten counter-mounting-type plumbing fixtures to casework.
- J. Immediately after installation, provide protective covering over fixtures and trim.

3.3 MOUNTING HEIGHT AND LOCATION

- A. Mount fixtures at height and location as indicated on Architectural plans and elevations.
- B. Mount accessible fixtures in conformance with the requirements of ANSI A117.1.

3.4 CONNECTIONS

- A. Install piping connections between plumbing fixtures and piping systems and plumbing equipment specified in other sections of Division 22.

3.5 ADJUSTING AND CLEANING

- A. Operate and adjust faucets and controls. Replace damaged and malfunctioning fixtures, fittings and controls.
- B. Adjust water pressure at electric water coolers, faucets and flush valves to provide proper flow and stream.
- C. Replace washers of leaking and dripping faucets and stops.
- D. Clean fixtures, fittings, spout and drain strainers with manufacturers' recommended cleaning methods and materials.
- E. Test fixtures to demonstrate proper operation upon completion of installation and after units are water pressurized. Replace malfunctioning fixtures and components and retest. Repeat procedure until all units operate properly.

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APPENDIX A

TAG	MOUNT TYPE	FLUSH TYPE	ADA	HEALT H CARE	K-12	HIGHER ED	COMMERCIA L	RES .	LEED	REMARKS
WATER CLOSETS										
WC-A	WALL	FV 1.6		X	X	X	X			MANUAL/BATTERY/WIRE D
WC-B	WALL	FV 1.6	X	X	X	X	X			MANUAL/BATTERY/WIRE D
WC-C	FLOOR	FV 1.6		X	X	X	X			MANUAL
WC-D	FLOOR	FV 1.6	X	X	X	X	X			MANUAL
WC-E	FLOOR	TANK					X	X		
WC-F	FLOOR	TANK	X				X	X		
WC-G	FLOOR	FV 1.6			X					CHILD HEIGHT
WC-H	WALL	FV 3.5	X	X						BEDPAN WASHER
WC-I	FLOOR	FV 3.5	X	X						BEDPAN WASHER
WC-J	FLOOR	TANK				X	X			PRESSURE ASSIST
WC-K	FLOOR	TANK				X	X			PRESSURE ASSIST
WC-L	WALL	FV 1.6	X	X						BARIATRIC

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WC-M	FLOOR	FV 1.6	X	X						BARIATRIC
WC-N	WALL	FV 1.28			X	X	X		X	HETS MANUAL
WC-O	WALL	FV 1.28	X		X	X	X		X	HETS MANUAL
WC-P	WALL	FV 1.28			X	X	X		X	HETS BATTERY
WC-Q	WALL	FV 1.28	X		X	X	X		X	HETS BATTERY
WC-R	FLOOR	FV 1.28			X	X	X		X	HETS MANUAL
WC-S	FLOOR	FV 1.28	X		X	X	X		X	HETS MANUAL

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TAG	MOUNT TYPE	FLUSH TYPE	ADA	HEALT H CARE	K-12	HIGHER ED	COMMERCIA L	RES .	LEED	REMARKS
URINALS										
UR-A	WALL	FV 1.0		X	X	X	X			MANUAL/BATTERY/ WIRED
UR-B	WALL	FV 1.0	X	X	X	X	X			MANUAL/BATTERY/ WIRED
UR-C	WALL	WATERLESS							X	
UR-D	WALL	WATERLESS	X						X	
UR-E	FLOOR	FV 1.0	X							REPLACEMENT ONLY

FLUSH VALVES										
FV-A										
FV-B										
FV-C										
FV-D										

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FV-E										
FV-F										
FV-G										
FV-H										

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TAG	MOUNT TYPE	DRAIN STYLE	ADA	HEALT H CARE	K-12	HIGHER ED	COMMERCIA L	RES .	LEED	FAUCET STYLE & TYPE
LAVATORIES										
LAV-A	WALL	GRID		X	X	X	X			MANUAL/METERING/ BATTERY/HARDWIRED
LAV-B	WALL	GRID	X	X						GOOSENECK W/WRIST BLADES
LAV-C	WALL	POP-UP						X		SINGLE HANDLE LEVER
LAV-D	WALL	GRID	X					X		SINGLE HANDLE LEVER
LAV-E	SELF- RIMMIN G	GRID			X	X	X	X		MANUAL/METERING/ BATTERY/HARDWIRED
LAV-F	SELF- RIMMIN G	GRID	X	X						GOOSENECK W/WRIST BLADES
LAV-G	UNDER- MOUNT	GRID								MANUAL/METERING/ BATTERY/HARDWIRED
LAV-H	UNDER- MOUNT	GRID	X							MANUAL/METERING/ BATTERY/HARDWIRED

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TAG	MANUF.	MODEL #	FLOW RATE (GPM)	TYPE	ADA	LEED	REMARKS
LAVATORY FAUCETS							
F-A	CHICAGO						
F-B	CHICAGO						
F-C	CHICAGO						
F-D	CHICAGO						
F-E	CHICAGO						
F-F	CHICAGO						
F-G	CHICAGO						
F-H	CHICAGO						

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TAG	MANUF.	MODEL #	FLOW RATE (GPM)	TYPE	ADA	LEED	REMARKS
LAVATORY FAUCETS							
F-I	CHICAGO						
F-J	CHICAGO						
F-K	CHICAGO						
F-L	CHICAGO						
F-M	CHICAGO						
F-N	CHICAGO						
F-O	CHICAGO						

TAG	MOUNT TYPE	DRAIN STYLE	ADA	HEALTH CARE	K-12	HIGHER ED	COMMERCIAL	RES. .	LEED	FAUCET STYLE & TYPE

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SINKS										
SK-A	SELF-RIMMING SINGLE BOWL	GRID/BASKET		X	X	X	X	X		MANUAL, SINGLE & DUAL HANDLE
SK-B	SELF-RIMMING SINGLE BOWL	GRID/BASKET	X	X	X	X	X	X		MANUAL, SINGLE & DUAL HANDLE
SK-C	SELF-RIMMING DOUBLE BOWL	GRID/BASKET		X	X	X	X	X		MANUAL, SINGLE HANDLE
SK-D	SELF-RIMMING SINGLE BOWL	BASKET	X	X	X	X	X	X		MANUAL, SINGLE HANDLE

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TAG	MOUNT TYPE	AD A	HEALTH CARE	K-12	HIGHER ED	COMMERCIAL	RES .	LEED	REMARKS
SERVICE SINKS									
SS-A	WALL/TRAP STANDARD	X	X	X	X	X			ENAMELED CAST IRON

TAG	MOUNT TYPE	AD A	HEALTH CARE	K-12	HIGHER ED	COMMERCIAL	RES .	LEED	REMARKS
MOP BASINS									
MB-A	FLOOR	X	X	X	X	X			TERAZZO
MB-B	FLOOR	X	X	X	X	X			MOLDED STONE

TAG	MOUNT TYPE	AD A	HEALTH CARE	K-12	HIGHER ED	COMMERCIAL	RES .	LEED	REMARKS
ELECTRIC WATER COOLERS									
EWC-A	WALL, SURFACE	X	X	X	X	X			SINGLE LEVEL

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EWC-B	WALL, SURFACE	X	X	X	X	X			BI-LEVEL
EWC-C	WALL, RECESSED	X	X	X	X	X			BI-LEVEL
EWC-C	WALL, RECESSED	X	X	X	X	X			SINGLE LEVEL

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SECTION 22 70 10 - NATURAL GAS SYSTEMS

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Provide labor, materials, equipment and services to perform operations required for the complete installation and related Work as required in Contract Documents.

1.2 SUBMITTALS

- A. Provide manufacturer's data sheets and installation instructions for all equipment and accessories in this section in accordance with Basic Mechanical/Electrical Requirements and Division 01.

1.3 QUALITY ASSURANCE

- A. Follow all requirements, recommendations, and appendices to comply with the following publications, codes, standards, and listings:
 - 1. 2020 Fuel Gas Code of New York State. American Gas Association.
 - 2. Local Utility Company.
- B. Provide equipment and accessories that are listed and labeled by a nationally recognized testing laboratory.

1.4 GAS SERVICE

- A. The existing gas service will be reused.

1.5 GAS PRESSURE

- A. The maximum allowable gas pressure inside the building is 1/2 psi.

PART 2 - PRODUCTS

2.1 GAS PIPING

- A. Piping Materials: Refer to Specification Section 221010, "Piping Systems and Accessories"
- B. All exposed exterior and interior piping shall be primed and painted with one coat of alkyd primer and two coats of exterior acrylic latex gloss enamel. Color shall be as selected.

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2.2 VALVES

- A. Refer to Specification Section 220523, "Valves".

2.3 FLEXIBLE CONNECTORS

- A. Stainless steel construction and in accordance with ANSI Z21.24.

PART 3 - EXECUTION

3.1 ARRANGEMENTS

- A. Coordinate all service requirements with the utility company.
- B. The contractor shall arrange for the plumbing inspector to inspect the gas piping and vent installations upon completion including underground and rough-ins, as well as installation of gas-fired appliances

3.2 GAS DISTRIBUTION SYSTEM

- A. Provide distribution system from existing piping, including mains, risers, branches, drips, shut-offs and other required parts. Connect to appliances indicated or specified as requiring gas for their operation.

3.3 PIPING INSTALLATION

- A. Install gas piping at a uniform slope of 1/4 in. in 15 ft. to prevent traps. Horizontal lines shall slope upward to risers to the equipment.
- B. Drips and Sediment Traps: Install drips at points where condensate may collect. Locate where readily accessible to permit cleaning and emptying. Do not install where condensate would be subject to freezing.
- C. Make reductions in pipe sizes using eccentric reducer fittings installed with the level side down. Connect branch piping from top or side of horizontal piping.
- D. Install unions in pipes 2 in. and smaller, adjacent to each valve, regulator and at final connection to each piece of equipment. Unions are not required on flanged devices.
- E. Provide pressure regulator in supply to each gas fired appliance as required.
- F. Install valve and strainer on the supply side of each gas pressure regulator.

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- G. Install vent piping for gas pressure regulators and gas trains, extend outside building and vent to atmosphere. Terminate vents with turned-down reducing elbow fittings with corrosion-resistant insect screens in large end.
- H. Install containment conduits for buried gas piping within building in gas-tight conduits extending 12 in. minimum outside building and vented to atmosphere. Terminate vents with turned-down, reducing elbow fittings with corrosion-resistant insect screens in large end. Prepare and paint outside of conduits with coal tar epoxy.
- I. Install pressure-relief or pressure-limiting devices so they can be readily operated to determine if valve is free; test to determine pressure at which they will operate; and examine for leakage when in closed position.
- J. Install gas piping across exit corridors within an airtight conduit constructed of Schedule 40 seamless black steel pipe with welded joints. Vent conduit to outside of exit corridor.

3.4 WELDING

- A. Welding shall be performed in compliance with the welding procedure specifications prepared by the National Certified Pipe Welding Bureau. Welded pipe fabricated by certified welder. Contractor shall submit proof of current certification of each welder if requested by the Owner. Use full-length pipe where possible; minimum distance between welds, 18 in. on straight runs. Welds must be at least full thickness of pipe with inside smooth; remove cutting beads, slag and excess material at joints; chamfer ends. Minimum gap 1/8 in., maximum 1/4 in. for butt welds. Overlaps on position and bench welds to be not less than 3/4 in. One internal pass and one external pass minimum required on slip-on flanges. Do not apply heat to rectify distorted pipe due to concentrated welding; replace distorted pipe. Exercise caution to prevent heat related damage to plastic parts within the gas meter or regulators.
- B. Welder qualifications: Welded piping fabricated by certified welder. Welder shall be certified under ASME or API Code III.

3.5 CONNECTIONS

- A. Install gas piping next to gas-utilizing equipment and appliances for servicing and maintenance. Connect gas piping to gas-utilizing equipment and appliances with shutoff valves and unions. Make connections to equipment downstream of valves and unions with flexible connectors. Valves, unions and flexible connectors shall be same size as the gas supply piping to the equipment.
- B. Install a gas valve upstream within 6 ft. of each gas-utilizing appliance. Install a union connection downstream from the valve to permit removal of controls.

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- C. Sediment Traps: Install full size tee fittings forming drips, as close as practical to gas appliance inlets. Cap or plug bottom outlet.

3.6 GAS PIPING TESTS

- A. Test natural gas systems according to 2020 Fuel Gas Code of New York State and the local utility requirements unless otherwise noted:
 - 1. Test pressure shall be 1-1/2 times working pressure, but not less than 3 psi for two (2) hours for steel piping.
 - 2. Pressure testing of plastic piping shall be per utility's requirements.
- B. Tests shall be witnessed by utility company. Make arrangements, provide all necessary items to complete testing and pay all costs.
- C. All tests shall be performed prior to the connection of equipment. Regulator shall be isolated from test pressures. Soap test shall be conducted on all joints. Repair leaks and defects with new materials. Retest system until satisfactory results are obtained.
- D. Verify correct pressure settings for pressure regulators.
- E. Provide written certification that tests have been conducted and satisfactorily completed. Submit to Owner's Representative.

3.7 GAS LINE PURGING

- A. At completion of pressure test, purge all natural gas systems according to 2020 Fuel Gas Code of New York State and the utility company requirements.
- B. Provide three (3) days notice to utility company to have the meter unlocked for service and equipment start up. Make all arrangements and pay all fees as required by the Utility Company.

END OF SECTION

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SECTION 23 05 00 - BASIC MECHANICAL REQUIREMENTS

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Provide all labor, tools, materials, accessories, parts, transportation, taxes, and related items, essential for installation of the work and necessary to make work, complete, and operational. Provide new equipment and material unless otherwise called for. References to codes, specifications and standards called for in the specification sections and on the drawings mean, the latest edition, amendment and revision of such referenced standard in effect on the date of these contract documents. All materials and equipment shall be installed in accordance with the manufacturer's recommendations.

1.2 LICENSING

- A. The Contractor shall hold a license to perform the work as issued by the authority having jurisdiction.
- B. Plumbing contract work shall be performed by, or under, the direct supervision of a licensed master plumber.
- C. Electrical contract work shall be performed by, or under, the direct supervision of a licensed electrician.

1.3 PERMITS

- A. Apply for and obtain all required permits and inspections, pay all fees and charges including all service charges. Provide certificate of approval from the Authorities Having Jurisdiction prior to request for final payment.
- B. Provide electrical inspection certificate of approval from Middle Department Inspection Agency, Commonwealth Inspection Agency, or an Engineer approved Inspection Agency prior to request for final payment.

1.4 CODE COMPLIANCE

- A. Provide work in compliance with the following:
 - 1. 2020 Building Code of New York State.
 - 2. 2020 Existing Building Code of New York State.
 - 3. 2020 Fire Code of New York State.
 - 4. 2020 Plumbing Code of New York State.

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5. 2020 Mechanical Code of New York State.
6. 2020 Fuel Gas Code of New York State.
7. 2020 Property Maintenance Code of New York State.
8. 2020 Energy Conservation Code of New York State
9. Accessible and Usable Buildings and Facilities, ICC A117.1 (2009).
10. New York State Department of Labor Rules and Regulations.
11. New York State Department of Health.
12. 2017 National Electrical Code (NEC)
13. Occupational Safety and Health Administration (OSHA).
14. Local Codes and Ordinances.
15. Life Safety Code, NFPA 101.

1.5 GLOSSARY

ACI	American Concrete Institute
AGA	American Gas Association
AGCA	Associated General Contractors of America, Inc.
AIA	American Institute of Architects
AISC	American Institute of Steel Construction
AFBMA	Anti-Friction Bearing Manufacturer's Association
AMCA	Air Moving and Conditioning Association, Inc.
ANSI	American National Standards Institute
ARI	Air Conditioning and Refrigeration Institute
ASHRAE	American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc.
ASME	American Society of Mechanical Engineers
ASPE	American Society of Plumbing Engineers
ASTM	American Society for Testing Materials
AWSC	American Welding Society Code
AWWA	American Water Works Association

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FM	Factory Mutual Insurance Company
IBR	Institute of Boiler & Radiation Manufacturers
IEEE	Institute of Electrical and Electronics Engineers
IRI	Industrial Risk Insurers
NEC	National Electrical Code
NEMA	National Electrical Manufacturer's Association
NESC	National Electrical Safety Code
NFPA	National Fire Protection Association
NYS/DEC	New York State Department of Environmental Conservation
SBI	Steel Boiler Institute
SMACNA	Sheet Metal and Air Conditioning Contractors National Association
UFPO	Underground Facilities Protective Organization
UL	Underwriter's Laboratories, Inc.
OSHA	Occupational Safety and Health Administration
XL - GAP	XL Global Asset Protection Services

1.6 DEFINITIONS

Acceptance	Owner acceptance of the project from Contractor upon certification by Owner's Representative.
As Specified	Materials, equipment including the execution specified/shown in the contract documents.
Basis of Design	Equipment, materials, installation, etc. on which the design is based. (Refer to the article, Equipment Arrangements, and the article, Substitutions.)
Code Requirements	Minimum requirements.
Concealed	Work installed in pipe and duct shafts, chases or recesses, inside walls, above ceilings, in slabs or below grade.
Coordination Drawings	Show the relationship and integration of different construction elements and trades that require careful coordination during fabrication or installation, to fit in the space provided or to function as intended.
Delegated-Design Services	Performance and Design criteria for Contractor provided professional services. Where professional design services or certifications by a design professional are specifically required of a Contractor, by the

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	Contract Documents. Provide products and systems with the specific design criteria indicated. If criteria indicated is insufficient to perform services or certification required, submit a written request for additional information to the Engineer. Submit wet signed and sealed certification by the licensed design professional for each product and system specifically assigned to the Contractor to be designed or certified by a design professional. Examples: structural maintenance ladders, stairs and platforms, pipe anchors, seismic compliant system, wind, structural supports for material equipment, sprinkler hydraulic calculations.
Equal, Equivalent, Equal To, Equivalent To, As Directed and As Required	Shall all be interpreted and should be taken to mean "to the satisfaction of the Engineer".
Exposed	Work not identified as concealed.
Extract	Carefully dismantle and store where directed by Owner's Representative and/or reinstall as indicated on drawings or as described in specifications.
Furnish	Purchase and deliver to job site, location as directed by the Owner's Representative.
Inspection	Visual observations by Owner's site Representative.
Install	Store at job site if required, proper placement within building construction including miscellaneous items needed to affect placement as required and protect during construction. Take responsibility to mount, connect, start-up and make fully functional.
Labeled	Refers to classification by a standards agency.
Manufacturers	Refer to the article, Equipment Arrangements, and the article, Substitutions.
Prime Professional	Architect or Engineer having a contract directly with the Owner for professional services.
Product Data	Illustrations, standard schedules, performance charts, instructions, brochures, wiring diagrams, finishes, or other information furnished by the Contractor to illustrate materials or equipment for some portion of the work.
Provide (Furnish and Install)	Contractor shall furnish all labor, materials, equipment and supplies necessary to install and place in operating condition, unless otherwise specifically stated.
Relocate	Disassemble, disconnect, and transport equipment to new locations,

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	then clean, test, and install ready for use.
Remove	Dismantle and take away from premises without added cost to Owner, and dispose of in a legal manner.
Review and Reviewed	Should be taken to mean to be followed by "for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents".
Roughing	Pipe, duct, conduit, equipment layout and installation.
Samples	Physical full scale examples which illustrate materials, finishes, coatings, equipment or workmanship, and establishes standards by which work will be judged.
Satisfactory	As specified in contract documents.
Shop Drawings	Fabrication drawings, diagrams, schedules and other instruments, specifically prepared for the work by the Contractor or a Sub-contractor, manufacturer, supplier or distributor to illustrate some portion of the work.
Site Representative	Owner's Inspector or "Clerk of Works" at the work site.
Submittals Defined (Technical)	Any item required to be delivered to the Engineer for review as requirement of the Contract Documents. The purpose of technical submittals is to demonstrate for those portions of the work for which a submittal is required, the manner in which the Contractor proposes to conform to the information given and design concepts expressed and required by the Contract Documents.

1.7 EXISTING CONDITIONS

- A. Contractor shall review all available record documents of existing construction or other existing conditions and hazardous material information. Owner does not guarantee that existing conditions are the same as those indicated in these documents. Contractor shall record existing conditions via measured drawings and preconstruction photographs or video. Inventory and record the condition of items to be removed and salvaged. Provide photographs or video of conditions that might be misconstrued as damage caused by salvage, removal or construction operations.
- B. Owner will occupy portions of the building immediately adjacent to the area(s) of removals. Conduct removals so Owner's operations are not disrupted. Contractor shall locate, identify, disconnect and seal or cap mechanical, plumbing, fire protection and/or electrical systems serving areas of removals, unless noted otherwise in the contract documents. Contractor shall arrange shut-down of systems with the Construction Manager. Piping and ductwork indicated to be removed shall be removed and capped or plugged with compatible materials. If services/systems are required to be removed, relocated

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or abandoned, provide temporary services/systems the bypass area(s) of removals to maintain continuity of services/systems to other parts of the building, as required.

1.8 SHOP DRAWINGS/PRODUCT DATA/SAMPLES

- A. Provide submittals on all items of equipment and materials to be furnished and installed. Submittals shall be accompanied by a transmittal letter, stating name of project and contractor, name of vendor supplying equipment, number of drawings, titles, specification sections (name and number) and other pertinent data called for in individual sections. Submittals shall have individual cover sheets that shall be dated and contain: Name of project; name of prime professional; name of prime contractor; description or names of equipment, materials and items; and complete identification of locations at which materials or equipment are to be installed. Individual piecemeal or incomplete submittals will not be accepted. Similar items, (all types specified) shall be submitted at under one cover sheet per specification section (e.g. lighting fixtures, valves, plumbing fixtures, etc.). Submittals shall include all required documentation for each product listed in the specification section at the same time as a complete package. Number each submittal by trade. Indicate deviations from contract requirements on Letter of Transmittal. Submittals will be given a general review only. Corrections or comments made on the Submittals during the review do not relieve Contractor from compliance with requirements of the drawings and specifications. The Contractor is responsible for: confirming and correcting all quantities; checking electrical characteristics and dimensions; selecting fabrication processes and techniques of construction; coordinating his work with that of all other trades; and performing his work in a safe and satisfactory manner. If submitting hard copies, submit four (4) copies for review.
- B. The Engineer will review up to two (2) submissions of any single submittal. The Contractor will be invoiced on an hourly rate basis for the time spent reviewing the same shop drawing in excess of twice.
- C. If submittals are to be submitted electronically, all requirements in Item A apply. Submittals shall be emailed in PDF format to specific email address provided by the Construction Manager, General Contractor, Architect or Project Manager. Name of project shall be in subject line of email. Send emails to mealbasubmittalclerk@meengineering.com.
- D. Refer to Division 01 for additional requirements.

1.9 PROTECTION OF PERSONS AND PROPERTY

- A. Contractor shall assume responsibility for construction safety at all times and provide, as part of contract, all trench or building shoring, scaffolding, shielding, dust/fume protection, mechanical/electrical protection, special grounding, safety

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railings, barriers, and other safety feature required to provide safe conditions for all workmen and site visitors.

1.10 EQUIPMENT ARRANGEMENTS

- A. The contract documents are prepared using one manufacturer as the Basis of Design, even though other manufacturers' names are listed. If Contractor elects to use one of the listed manufacturers other than Basis of Design, submit detailed drawings, indicating proposed installation of equipment. Show maintenance clearances, service removal space required, and other pertinent revisions to the design arrangement. Make required changes in the work of other trades, at no increase in any contract. Provide larger motors, feeders, breakers, and equipment, additional control devices, valves, fittings and other miscellaneous equipment required for proper operation, and assume responsibility for proper location of roughing and connections by other trades. Remove and replace doorframes, access doors, walls, ceilings, or floors required to install other than Basis of Design. If revised arrangement submittal is rejected, revise and resubmit specified Basis of Design item which conforms to Contract Documents.

1.11 SUBSTITUTIONS

- A. If Contractor desires to bid on any other kind, type, brand, or manufacture of material or equipment than those named in specifications, secure prior approval. To request such approval, Contractor shall submit complete information comparing (item-for-item) material or equipment offered with design material or equipment. Include sufficient information to permit quick and thorough comparison, and include performance curves on same basis, capacities, power requirements, controls, materials, metal gauges, finishes, dimensions, weights, etc., of major parts. If accepted, an addendum will be issued to this effect ahead of bid date. Unless such addendum is issued, substitution offered may not be used.
- B. Refer to Division 01 for additional requirements.

1.12 CONTINUITY OF SERVICES

- A. The building will be in use during construction operations. Maintain existing systems in operation within all rooms of building at all times. Refer to "General Conditions of the Contract for Construction" for temporary facilities for additional contract requirements. Schedules for various phases of contract work shall be coordinated with all other trades and with Owner's Representative. Provide, as part of contract, temporary mechanical and electrical connections and relocations as required to accomplish the above. Obtain approval in writing as to date, time, and location for shutdown of existing mechanical/electrical facilities or services.

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1.13 ROUGHING

- A. The Contract Drawings have been prepared in order to convey design intent and are diagrammatic only. Drawings shall not be interpreted to be fully coordinated for construction.
- B. Due to small scale of Drawings, it is not possible to indicate all offsets, fittings, changes in elevation, interferences, etc. Make necessary changes in contract work, equipment locations, etc., as part of a contract to accommodate work to avoid obstacles and interferences encountered. Before installing, verify exact location and elevations at work site. **DO NOT SCALE** plans. If field conditions, details, changes in equipment or shop drawing information require an important rearrangement, report same to Owner's Representative for review. Obtain written approval for all major changes before installing.
- C. Install work so that items both existing and new are operable and serviceable. Eliminate interference with removal of coils, motors, filters, belt guards and/or operation of doors. Provide easy, safe, and code mandated clearances at controllers, motor starters, valve access, and other equipment requiring maintenance and operation. Provide new materials, including new piping and insulation for relocated work.
- D. Coordinate work with other trades and determine exact route or location of each duct, pipe, conduit, etc., before fabrication and installation. Coordinate with Architectural Drawings. Obtain from Owner's Representative exact location of all equipment in finished areas, such as thermostat, fixture, and switch mounting heights, and equipment mounting heights. Coordinate all work with the architectural reflected ceiling plans and/or existing Architecture. Mechanical and electrical drawings show design arrangement only for diffusers, grilles, registers, air terminals, lighting fixtures, sprinklers, speakers, and other items. Do not rough-in contract work without reflected ceiling location plans.
- E. Before roughing for equipment furnished by Owner or in other Divisions, obtain from Owner and other Divisions, approved roughing drawings giving exact location for each piece of equipment. Do not "rough in" services without final layout drawings approved for construction. Cooperate with other trades to insure proper location and size of connections to insure proper functioning of all systems and equipment. For equipment and connections provided in this contract, prepare roughing drawing as follows:
 - 1. Existing Equipment: Measure the existing equipment and prepare for installation in new location.
 - 2. New Equipment: Obtain equipment roughing drawings and dimensions, then prepare roughing-in-drawings. If such information is not available in time, obtain an acknowledgement in writing, then make space arrangements as required with Owner's Representative.

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1.14 COORDINATION DRAWINGS

- A. Before construction work commences, Divisions for all trades shall submit coordination drawings in the form of CAD drawing files, drawn at not less than 1/4 in. scale. Such drawings will be required throughout all areas, for all Contracts. These drawings shall show resolutions of trade conflicts in congested areas. Mechanical Equipment Rooms shall be drawn early in coordination drawing process simultaneous with all other congested areas. Prepare Coordination Drawings as follows:
1. Division 23 shall prepare the base plan CAD coordination drawings showing all ductwork, all pertinent heating piping, and equipment. These drawings may be CAD files of the required Ductwork Shop Drawings. The drawings shall be coordinated with lighting fixtures, sprinklers, air diffusers, other ceiling mounted items, ceiling heights, structural work, maintenance clearances, electric code clearance, reflected ceiling plans, and other contract requirements. Reposition proposed locations of work after coordination drawing review by the Owner's Representative. Provide adjustments to exact size, location, and offsets of ducts, pipes, conduit, etc., to achieve reasonable appearance objectives. Provide these adjustments as part of contract. Minor revisions need not be redrawn.
 2. Division 23 shall provide CAD files and submit the base plan CAD Coordination Drawings to all Divisions.
 3. Divisions 21 and 22 shall draw the location of piping and equipment on the base plan CAD Coordination Drawings, indicating areas of conflict and suggested resolutions.
 4. Divisions 26, 27 and 28 shall draw the location of lighting fixtures, cable trays, and feeders over 1-1/2 in. on the base plan CAD Coordination Drawings, indicating areas of conflict and suggested resolution.
 5. The General Construction Trade shall indicate areas of architectural/structural conflicts or obstacles on the CAD Coordination Drawings, and coordinate to suit the overall construction schedule.
 6. The Construction Manager shall expedite all Coordination Drawing work and coordinate to suit the overall construction schedule. In the case of unresolved interferences, he shall notify the Owner's Representative. The Owner's Representative will then direct the various trades as to how to revise their drawings as required to eliminate installation interferences.
 7. If a given trade proceeds prior to resolving conflicts, then if necessary, that trade shall change its work at no extra cost in order to permit others

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to proceed with a coordinated installation. Coordination approval will be given by areas after special site meetings involving all Divisions.

- B. The purpose of the coordination drawing process is to identify and resolve potential conflicts between trades, and between trades and existing or new building construction, before they occur in construction. Coordination drawings are intended for the respective trade's use during construction and shall not replace any Shop Drawings, or record drawings required elsewhere in these contract documents.

1.15 REMOVAL WORK

- A. Where existing equipment removals are called for, submit complete list to Owner's Representative. All items that Owner wishes to retain that do not contain asbestos or PCB material shall be delivered to location directed by Owner. Items that Owner does not wish to retain shall be removed from site and legally disposed of. Removal and disposal of material containing asbestos, lead paint, mercury and PCB's shall be in accordance with Federal, State and Local law requirements. Where equipment is called for to be relocated, contractor shall carefully remove, clean and recondition, then reinstall. Remove all abandoned piping, wiring, equipment, lighting, ductwork, tubing, supports, fixtures, etc. Visit each room, crawl spaces, and roofs to determine total Scope of Work. The disturbance or dislocation of asbestos-containing materials causes asbestos fibers to be released into the building's atmosphere, thereby creating a health hazard to workmen and building occupants. Consistent with Industrial Code Rule 56 and the content of recognized asbestos-control work, the Contractor shall apprise all of his workers, supervisory personnel, subcontractors, Owner and Consultants who will be at the job site of the seriousness of the hazard and of proper safeguards and work procedures which must be followed, as described in New York State Department of Labor Industrial Code Rule 56.
- B. For materials indicated to contain lead, that are being affected by demolition or construction, the contractor shall comply with all Federal, State and Local law requirements regarding worker exposure to lead disturbance and abatement procedures.
- C. Refer to the Owner's Lead Paint Survey. The Survey identifies the surfaces within the buildings that were tested for lead by collecting paint samples and performing laboratory analysis. If any unidentified surfaces are to be impacted the lead content shall be tested by analytical determinations conducted by a qualified laboratory approved by the Owner. The contractor shall review the current owner's lead paint reports on file before starting any work which may disturb existing surfaces.
- D. Refer to Division 02 for additional information regarding hazardous materials.

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1.16 REFRIGERANT RECOVERY

- A. Existing equipment to be removed, as shown on the plans may contain refrigerant and refrigerant oils. This refrigerant and refrigerant oil must be handled in accordance with Federal, State and Local law requirements.
- B. Removal and recovery of refrigerant shall be in accordance with the current edition of Section 608 of the Clean Air Act of 1990, including all final regulations.
- C. Refrigerant recovery must be performed by a technician, certified by an EPA-approved certification program, using refrigerant recovery and recycling equipment certified by an EPA-approved testing organization.
- D. Owner "reserves the right of first refusal" on ownership of recovered refrigerant. Should Owner choose to maintain ownership of refrigerant, refrigerant shall be reclaimed, cleaned by this Contractor to ARI 700-1993 Standard of Purity, by an EPA certified refrigerant reclaimer. Refrigerant shall be turned over to the Owner in suitable marked containers to be stored on site, at a place of the Owner's choosing.

1.17 EQUIPMENT AND MATERIAL REQUIREMENTS

- A. Provide materials that meet the following minimum requirements:
 - 1. Materials shall have a flame spread rating of 25 or less and a smoke developed rating of 50 or less, in accordance with NFPA 255.
 - 2. All equipment and material for which there is a listing service shall bear a UL label.
 - 3. Potable water systems and equipment shall be built according to AWWA Standards.
 - 4. Gas-fired equipment and system shall meet AGA Regulations and shall have AGA label.
 - 5. All electrical equipment and systems, as a whole, shall be tested and listed by an OSHA approved Nationally Recognized Testing Laboratory (NRTL) for the intended use in accordance with the applicable standards and have a physical label indicating such.
 - 6. Fire protection equipment shall be UL listed and FM approved.
- B. Exterior and wet locations shall utilize materials, equipment supports, mounting, etc. suitable for the intended locations. Metals shall be stainless steel, galvanized or with baked enamel finish as a minimum. Finishes and coatings shall be continuous and any surface damaged or cut ends shall be field corrected

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in accordance with the manufacturer's recommendations. Hardware (screws, bolts, nuts, washers, supports, fasteners, etc.) shall be:

1. Stainless steel where the associated system or equipment material is stainless steel or aluminum.
2. Hot dipped galvanized or stainless steel where the associated system or equipment is steel, galvanized steel or other.

1.18 CUTTING AND PATCHING

- A. Each trade shall include their required cutting and patching work unless shown as part of the General Construction Contract. Refer to General Conditions of the Contract for Construction, for additional requirements. Cut and drill from both sides of walls and/or floors to eliminate splaying. Patch cut or abandoned holes left by removals of equipment or fixtures. Patch adjacent existing work disturbed by installation of new work including insulation, walls and wall covering, ceiling and floor covering, other finished surfaces. Patch openings and damaged areas equal to existing surface finish. Cut openings in prefabricated construction units in accordance with manufacturer's instructions.

1.19 PAINTING

- A. Paint all insulated and bare piping, pipe hangers and supports exposed to view in mechanical equipment rooms, penthouse, boiler rooms and similar spaces. Paint all bare piping, ductwork and supports exposed to the out-of-doors with rust inhibiting coatings. Paint all equipment that is not factory finish painted (i.e. expansion tanks, etc.).
- B. All painting shall consist of one (1) prime coat and two (2) finish coats of non-lead oil base paint, unless otherwise indicated herein. Provide galvanized iron primer for all galvanized surfaces. All surfaces must be thoroughly cleaned before painting. Review system color coding prior to painting with the Owner's Representative or Architect.
- C. All items installed after finished painting is completed and any damaged factory finish paint on equipment furnished under this contract must be touched up by the Contractor responsible for same.
- D. Include painting for patchwork with color to match adjacent surfaces. Where color cannot be adequately matched, paint entire surface. Provide one (1) coat of primer and two (2) finish coats or as called for in the Specifications.
- E. All primers and paint used in the interior of the building shall comply with the maximum Volatile Organic Compound (VOC) limits called for in the current version of U.S. Green Building Council LEED Credits EQ 4.1 and EQ 4.2.

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- F. Refer to Division 9 - Finishes, for additional information.

1.20 EXISTING CEILING REMOVAL AND RE-INSTALLATION

- A. In a renovation project, any existing ceiling removal and re-installation work required for the completion of a Contractors or Subcontractors work, shall be removed and re-installed by that Contractor or Subcontractor. This applies in any areas not called for to have a new ceiling installed.
- B. The ceiling removal and re-installation shall include lay-in ceiling tile and grid, to the extent necessary to accomplish the work. Removed ceiling tile and grid shall be safely stored during the course of the work, and it shall be re-installed to the original existing condition.
- C. The ceiling removal and re-installation shall include gypsum board or plaster ceilings and the associated suspension systems. Removed ceiling areas shall be patched with materials to match the existing ceiling, and painted to match. If paint cannot be matched exactly, paint the entire ceiling a similar color.

1.21 CONCEALMENT

- A. **Conceal all contract work** above ceilings and in walls, below slabs, and elsewhere throughout building. If concealment is impossible or impractical, notify Owner's Representative before starting that part of the work and install only after their review. In areas with no ceilings, install only after Owner's Representative reviews and comments on arrangement and appearance.

1.22 CHASES

- A. New Construction:
 - 1. Certain chases, recesses, openings, shafts, and wall pockets will be provided as part of General Construction Trade. Mechanical and Electrical trades shall provide all other openings required for their contract work.
 - 2. Check Architectural and Structural Design and Shop Drawings to verify correct size and location for all openings, recesses and chases in general building construction work.
 - 3. Assume responsibility for correct and final location and size of such openings.
 - 4. Rectify improperly sized, improperly located or omitted chases or openings due to faulty or late information or failure to check final location.

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5. Provide 18 gauge galvanized sleeves and inserts. Extend all sleeves 2 in. above finished floor. Set sleeves and inserts in place ahead of new construction, securely fastened during concrete pouring. Correct, by drilling, omitted or improperly located sleeves. Assume responsibility for all work and equipment damaged during course of drilling. Firestop all unused sleeves.
 6. Provide angle iron frame where openings are required for contract work, unless provided by General Construction trade.
- B. In Existing Buildings:
1. Drill holes for floor and/or roof slab openings.
 2. Multiple pipes smaller than 1 in. properly spaced and supported may pass through one 6 in. or smaller diameter opening.
 3. Seal voids in fire rated assemblies with a fire-stopping seal system to maintain the fire resistance of the assembly. Provide 18 gauge galvanized sleeves at fire rated assemblies. Extend sleeves 2 in. above floors.
 4. In wall openings, drill or cut holes to suit. Provide 18 gauge galvanized sleeves at shafts and fire rated assemblies. Provide fire-stopping seal between sleeves and wall in drywall construction. Provide fire stopping similar to that for floor openings.
- 1.23 PENETRATION FIRESTOPPING
- A. Refer to Division 07 for project-wide fire stopping information.
- 1.24 NON-RATED WALL PENETRATIONS
- A. Each trade shall be responsible for sealing wall penetrations related to their installed work, including but not limited to ductwork, piping, conduits, etc. See individual specification sections for requirements.
- 1.25 SUPPORTS
- A. Provide required supports, beams, angles, hangers, rods, bases, braces, and other items to properly support contract work. Modify studs, add studs, add framing, or otherwise reinforce studs in metal stud walls and partitions as required to suit contract work. If necessary, in stud walls, provide special supports from floor to structure above.
- B. For precast panels/planks and metal decks, support mechanical/electrical work as determined by manufacturer and the Engineer. Provide heavy gauge steel

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mounting plates for mounting contract work. Mounting plates shall span two or more studs. Size, gauge, and strength of mounting plates shall be sufficient for equipment size, weight, and desired rigidity.

- C. For finished areas without a finished ceiling system such as classrooms, offices, conference rooms, etc., where decking and structure is exposed, and ductwork/piping/conduit is exposed: All mounting brackets, channel support systems and mounting hardware for ductwork, piping, lighting, etc. shall be concealed and approved by the Architect/Engineer prior to the installation. AirCRAFT cable style hanging for ductwork is required. It is recommended that room mockups be done and receive Architect/Engineer approval prior to proceeding with installation.
- D. Equipment, piping, conduit, raceway, etc. supports shall be installed to minimize the generation and transmission of vibration.
- E. Materials and equipment shall be solely supported by the building structure and connected framing. Gypboard, ceilings, other finishes, etc. shall not be used for support of materials and equipment.

1.26 ACCESS PANELS

- A. Provide access panels for required access to respective trade's work. Location and size shall be the responsibility of each trade. Access panels provided for equipment shall provide an opening not smaller than 22 in. by 22 in. Panels shall be capable of opening a minimum of 90 degrees. Bear cost of construction changes necessary due to improper information or failure to provide proper information in ample time. Access panels over 324 square inches shall have two cam locks. Provide proper frame and door type for various wall or ceiling finishes. Access panels shall be equal to "Milcor" as manufactured by Inland Steel Products Co., Milwaukee, Wisconsin. Provide General Construction trade with a set of architectural plans with size and locations of access panels.

1.27 CONCRETE BASES

- A. Provide concrete bases for all floor mounted equipment. Provide 3,000 lb. concrete, chamfer edges, trowel finish, and securely bond to floor by roughening slab and coating with cement grout. Bases 4 in. high (unless otherwise indicated); shape and size to accommodate equipment. Provide anchor bolts in equipment bases for all equipment provided for the project, whether mounted on new concrete bases or existing concrete bases.

1.28 HVAC EQUIPMENT CONNECTIONS

- A. Contractor is responsible for draining, filling, venting, chemically treating and restarting any systems which are affected by work shown on the Contract Documents unless specifically noted otherwise.

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- B. Provide final steam, condensate, hot water, glycol, chilled and condenser water, drain, vent, oil line and gas connections to all equipment as required by the equipment. Provide final connections, including domestic water piping, wiring, controls, and devices from equipment to outlets left by other trades. Provide equipment waste, drip, overflow and drain connections extended to floor drains.
- C. Provide for Owner furnished and Contractor furnished equipment all valves, piping, piping accessories, traps, pressure reducing valves, gauges, relief valves, vents, drains, insulation, sheet metal work, controls, dampers, as required.
- D. Refer to manufacturer drawings and specifications for requirements of medical equipment, laboratory equipment and special equipment. Verify connection requirements before bidding.

1.29 PLUMBING EQUIPMENT CONNECTIONS

- A. Contractor is responsible for draining, filling, venting, chemically treating and restarting any systems which are affected by work shown on the Contract Documents unless specifically noted otherwise.
- B. Provide roughing and final water, waste, vent, gas, air, vacuum, diesel and/or oxygen connections to all equipment. Provide loose key stops, sanitary "P" traps, tailpiece, adapters, gas or air cocks, and all necessary piping and fittings from roughing point to equipment. Provide installation of sinks, faucets, traps, tailpiece furnished by others. Provide cold water line with gate valve and backflow prevention device at locations called for. Provide continuation of piping and connection to equipment that is furnished by others. Provide relief valve discharge piping from equipment relief valves.
- C. Provide valved water outlet adjacent to equipment requiring same. Provide equipment type floor drains, or drain hubs, adjacent to equipment.
- D. Install controls and devices furnished by others.
- E. Refer to Contract Documents for roughing schedules, and equipment and lists indicating scope of connections required.
- F. Provide for Owner furnished and Contractor furnished equipment all valves, piping, piping accessories, traps, pressure reducing valves, gauges, relief valves, vents, drains, as required.
- G. Refer to Manufacturer drawings and specifications for requirements of medical equipment, laboratory equipment and special equipment. Verify connection requirements before bidding.

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1.30 ELECTRICAL EQUIPMENT CONNECTIONS

- A. Provide complete power connections to all electrical equipment. Provide control connections to equipment. Heavy duty NEC rated disconnect ahead of each piece of equipment. Ground all equipment in accordance with NEC.
- B. Provide for Owner furnished and Contractor furnished equipment all power wiring, electric equipment, control wiring, switches, lights, receptacles, and connections as required.
- C. Refer to Manufacturer's drawings/specifications for requirements of medical equipment, laboratory equipment, radiological equipment and special equipment. Verify connection requirements before bidding.

1.31 STORAGE AND PROTECTION OF MATERIALS AND EQUIPMENT

- A. Store Materials on dry base, at least 6 in. aboveground or floor. Store so as not to interfere with other work or obstruct access to buildings or facilities. Provide waterproof/windproof covering. Remove and provide special storage for items subject to moisture damage. Protect against theft or damage from any cause. Replace items stolen or damaged, at no cost to Owner.
- B. Refer to Division 01 for additional information.
- C. Division 23 shall provide airtight plastic covers over all supply and return air openings prior to the start of construction by any trade. The plastic shall be maintained airtight throughout the project construction and removed only with the approval of the Owner's Representative.
- D. Ductwork shall be delivered to the site from the fabrication shop with air tight plastic covers over all ends of the ducts. The plastic covers shall be in place during transportation and shall be removed prior to installation.

1.32 FREEZING AND WATER DAMAGE

- A. Take all necessary precautions with equipment, systems and building to prevent damage due to freezing and/or water damage. Repair or replace, at no change in contract, any such damage to equipment, systems, and building. Perform first seasons winterizing in presence of Owner's operating staff.

1.33 LUBRICATION CHART

- A. Provide lubrication chart, 8-1/2 in. x 11 in. minimum size, typed in capital letters, mounted under clear laminated plastic; secure to wall in area of equipment. List all motors and equipment in contract. Obtain and list necessary information by name/location of equipment, manufacturer recommended types of lubrication and schedule. Lubricate motors as soon as installed and perform lubrication

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maintenance until final acceptance. Divisions 22 and 26 shall add contract items to the chart provided by Division 23 or provide separate charts.

1.34 OWNER INSTRUCTIONS

- A. Before final acceptance of the work, furnish necessary skilled labor to operate all systems by seasons. Instruct designated person on proper operation, and care of systems/equipment. Repeat instructions, if necessary. Obtain written acknowledgement from person instructed prior to final payment. Contractor is fully responsible for system until final acceptance, even though operated by Owner's personnel, unless otherwise agreed in writing. List under clear plastic, operating, maintenance, and starting precautions procedures to be followed by Owner for operating systems and equipment.

1.35 OPERATION AND MAINTENANCE MANUALS

- A. Submit by email (preferred) or digital media, thru the normal project submittal process. Include a copy of each final approved Shop Drawing, wiring diagrams, piping diagrams, spare parts lists, final testing and balancing report, as-built drawings and manufacturer's instructions. Include typewritten instructions, describing equipment, starting/operating procedures, emergency operating instructions, summer-winter changeover, freeze protection, precautions and recommended maintenance procedures. Include name, address, and telephone number of installing contractor and of supplier manufacturer Representative and service agency for all major equipment items. Provide a table of contents page and dividers based upon specification section numbers. Submit in a compiled and bookmarked PDF format as outlined below.
- B. Provide content for Operation and Maintenance Manuals as specified in individual Specification Sections, and as reviewed and approved at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.
 - 1. Engineer and Commissioning Agent will comment on whether content of operation and maintenance submittals is acceptable.
 - 2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.
- C. Submit Operation and Maintenance Manuals in the following format:
 - 1. Submit by uploading to web-based project software site, or by email to Architect, as a formal project submittal in conformance with the project specific submittal procedures. Enable reviewer comments on draft submittals.

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2. 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.
 3. File Names and Bookmarks: Bookmark individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in the 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.
- D. Initial Manual Submittal: Submit draft copy of each manual at least 30 days before commencing Owner training. Engineer and Commissioning Agent will comment on whether general scope and content of manual are acceptable.
- E. Final Manual Submittal: Submit O&M manual in final form prior to requesting inspection for Substantial Completion and at least 2 weeks before commencing Owner training. Engineer and Commissioning Agent will return copy with review comments.
1. Correct or revise O&M manual to comply with Engineer's and Commissioning Agent's comments. Submit copies of each corrected manual within 2 weeks of receipt of Engineer's and Commissioning Agent's comments.
- F. Refer to Division 01 for additional requirements.

1.36 RECORD DRAWINGS

- A. The Contractor shall obtain at his expense one (1) set of construction Contract Drawings, (including non-reproduction black and white prints or electronic files) for the purpose of recording as-built conditions.
- B. The Contractor shall perform all survey work required for the location and construction of the work and to record information necessary for completion of the record drawings. Record drawings shall show the actual location of the constructed facilities in the same manner as was shown on the bid drawings. All elevations and dimensions shown on the drawings shall be verified or corrected so as to provide a complete and accurate record of the facilities as constructed.
- C. It shall be the responsibility of the Contractor to mark **EACH** sheet of the contract documents in red and to record thereon in a legible manner, any and all approved field changes and conditions as they occur. A complete file of approved field sketches, diagrams, and other changes shall also be maintained. At completion of the work, the complete set of red marked contract documents,

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plus all approved field sketches and diagrams shall be submitted to the engineer and used in preparation of the record drawings.

- D. A complete set of red marked contract drawings shall be submitted, at one time, as the "Record" set. If there are no changes to a specific drawing, the contractor shall indicate "NO CHANGES" on that drawing. ALL drawings shall be included in the "Record" set.
- E. The complete set of red marked Contract Documents or electronic files shall be certified by the Contractor as reflecting record conditions and submitted to the engineer for review.
- F. The Contractor shall have the marked up set scanned, if they are not already electronic files, and then submit them to the Engineer as the "Record Set".
- G. Refer to Division 01 for additional requirements.

1.37 FINAL INSPECTION

- A. Upon completion of all Engineering Site Observation list items, the Contractor shall provide a copy of the Engineering Site Observation Report back to the Engineer with each items noted as completed or the current status of the item.

1.38 COMMISSIONING

- A. Refer to General Commissioning Requirements in Division 01 for additional requirements

1.39 TEMPORARY HEATING AND COOLING

- A. Refer to the General Conditions of the Contract for Construction and Supplemental General Conditions.
- B. Systems and equipment installed as part of this project shall not be used for temporary heating or cooling.

1.40 MAINTENANCE OF HVAC SYSTEMS DURING TEMPORARY USE PERIODS

- A. Provide each air handling system with a set of prefilters in addition to the permanent filters. Furnish four sets of prefilters for each system for use when system is operated for temporary heating or cooling. During such use, change prefilters as often as directed by Owner's Representative. Provide MERV-8 filters in all open ended ducts, return grilles and registers to keep dust out of ductwork. Change as often as necessary. Remove all such temporary filters upon completion. Use supply fans only. Do not operate return fans.

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- B. Blank-off outside air intake opening during temporary heating period. Install first set of permanent filters and prefilters.
- C. Adjust dampers on supply system.
- D. Set all heating coil control valves for manual operation.
- E. Do not install any grilles or diffusers at room terminal ends of ducts until permission is given.
- F. Assume responsibility for systems and equipment at all times, even though used for temporary heat or ventilating. Repair or replace all dented, scratched or damaged parts of systems prior to final acceptance.
- G. Remove concrete, rust, paint spots, other blemishes, then clean.
- H. Just prior to final acceptance, remove used final filter and install new set. Deliver all unused sets of prefilters to the Owner and obtain written receipt. Properly lubricate system bearings before and during temporary use. Maintain thermostats, freeze stats, overload devices, and all other safety controls in operating condition.

1.41 TEMPORARY FACILITIES

- A. Refer to the Division 01 Sections, General Conditions and Supplemental General Conditions.

1.42 TEMPORARY LIGHT AND POWER

- A. Refer to the Division 01 Sections, General Conditions and Supplemental General Conditions.

1.43 CLEANING

- A. It is the Contractor's responsibility to keep clean all equipment and fixtures provided under this contract for the duration of the project. Each trade shall keep the premises free from an accumulation of waste material or rubbish caused by his operations. The facilities require an environment of extreme cleanliness, and it is the Contractor's responsibility to adhere to the strict regulations regarding procedures on the existing premises. After all tests are made and installations completed satisfactorily:
 - 1. Thoroughly clean entire installation, both exposed surfaces and interiors.
 - 2. Remove all debris caused by work.
 - 3. Remove tools, surplus, materials, when work is finally accepted.

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1.44 SYSTEM START-UP AND TESTING

- A. Prior to commencement of work, the Division(s) effecting such system shall survey all building mechanical, plumbing, fire protection and electrical systems and components and make written notice to the Owner regarding any damage, missing items and/or incomplete systems. Prior to the conclusion of this project, the Contractor shall verify with the Owner's Representative that all building systems have been returned to their original conditions.
- B. Start-up and testing of HVAC systems shall occur while the building is not occupied by Owner and only after notice to the Owner's Representative is made at least 24 hours in advance. Division 23 shall be responsible for providing temporary filter media over all supply air registers and diffusers during the HVAC system start-up procedure. Division 23 shall provide airtight plastic covers over all supply and return air openings prior to the start of construction by any contractor. The plastic shall be maintained airtight throughout the project construction and removed only with the approval of the Owner's Representative.

1.45 TRANSFER OF ELECTRONIC FILES

- A. M/E Engineering, P.C. will provide electronic files for the Contractor's use in the preparation of sheet metal shop drawings, coordination drawings, or record drawings related to the project, subject to a \$50.00 charge per drawing file and the following terms and conditions:
 - 1. The Contractor shall submit a formal request for electronic drawing files on the M/E Engineering, P.C. website, by utilizing the following website link: <http://www.meengineering.com/contact-pages/contractor-request>.
 - 2. M/E Engineering, P.C. makes no representation as to the compatibility of these files with the Contractor's hardware or the Contractor's software beyond the specific release of the referenced specifications.
 - 3. M/E Engineering can only provide CAD files of M/E/P/FP drawing levels for which we are the Engineer of Record. CAD files of Architectural backgrounds, reflected ceiling plans, structural plans, etc. must be obtained separately from the Architect of Record.
 - 4. Data contained on these electronic files is part of M/E Engineering, P.C.'s instruments of service shall not be used by the Contractor or anyone else receiving data through or from the Contractor for any purpose other than as convenience in the preparation of shop drawings for the referenced project. Any other use or reuse by the Contractor or by others will be at the Contractor's sole risk and without liability or legal exposure to M/E Engineering, P.C. The Contractor agrees to make no claim and hereby waive, to the fullest extent permitted by law, any claim or cause of action of any nature against M/E Engineering, P.C., its officers, directors,

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employees, agents or sub-consultants which may arise out of or in connection with the Contractor's use of the electronic files.

5. Furthermore, the Contractor shall, to the fullest extent permitted by law, indemnify and hold harmless, M/E Engineering, P.C. from all claims, damages, losses and expenses, including attorney's fees arising out of or resulting from the Contractor's use of these electronic files.
6. These electronic files are not contract documents. Significant difference may arise between these electronic files and corresponding hard copy contract documents due to addenda, change orders or other revisions. M/E Engineering, P.C. makes no representation regarding the accuracy or completeness of the electronic files the Contractor receives. In the event that a conflict arises between the signed contract documents prepared by M/E Engineering, P.C. and electronic files, the signed contract documents shall govern. The Contractor is responsible for determining if any conflicts exist. By the Contractor's use of these electronic files the Contractor is not relieved of the Contractor's duty to comply with the contract documents, including and without limitation, the need to check, confirm and coordinate all dimensions and details, take field measurements, field verify conditions and coordinate the Contractor's work with that of other contractors for the project.

1.46 VIDEO RECORDING OF TRAINING SESSIONS

- A. The contractor shall video record all training sessions required by their discipline. Video shall be in Windows Media Player video format saved on flash drives. Two (2) copies on flash drives are to be provided as a formal submittal. . Flash drives are to be tagged with project name, training session name(s), installing Contractor and date of training. The flash drive shall include a scanned version of the training session sign in list(s), including the presenter and the owner's participants.

1.47 ENERGY INCENTIVES

- A. The Contractor, his Subcontractors and Suppliers shall provide to the Owner all paperwork necessary to support the Owners pursuit of incentives related to energy conservation as offered by the utility company or state sponsored incentive programs. This shall include at a minimum, receipts, and quantities and data sheets for energy efficient equipment such as: lighting, motors, variable frequency drives, etc.

1.48 INFECTION CONTROL

- A. Construction procedures, temporary partitions, negative air systems, cleaning procedures, HVAC system isolation, dust control, etc. shall be in accordance with

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the infection control standards set forth by the Facility. A copy of the facilities standards are available from the Owner upon request.

END OF SECTION

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SECTION 23 05 04 - ELECTRIC WIRING

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Provide labor, materials, equipment and services for the complete installation of motor control wiring and temperature control wiring as required in Contract Documents. Provide wiring and conduit, required to connect devices furnished as part of or adjunctive to the automatic temperature control system and for motor control regardless of the source of supply. Control wiring includes 120 volt and lower voltage wiring for control signals directing equipment operation. Control circuits shall be 120 volt maximum. Provide wiring in accordance with requirements specified in Division 26, "Electrical" and the National Electrical Code. Provide devices required for proper system operation, including special electrical switches, transformers, disconnect switches, relays, and circuit breaker protection.
- B. Coordinate all work with Division 26, "Electrical".

1.2 WORK NOT INCLUDED

- A. Power wiring for motors, motor starters and associated starting and control equipment, as well as the motor starters (except in the case of equipment specified to have packaged control/starters), are included in Division 26, "Electrical", unless otherwise called for.

1.3 QUALIFICATIONS

- A. Wiring shall be installed in compliance with all requirements of Division 26, "Electrical".

1.4 SUBMITTALS

- A. Provide complete wiring diagrams for equipment systems. Deliver wiring diagrams to proper trades in time for roughing of conduit, equipment connections, and avoid delay in construction schedule. Wiring diagrams and roughing information to be wired as part of the Work of Division 26, "Electrical", shall be clearly indicated.

PART 2 - PRODUCTS

2.1 PRODUCTS

- A. Refer to Division 26 specifications for required wiring materials.

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PART 3 - EXECUTION

3.1 GENERAL

- A. Check electrical wiring pertaining to equipment for completeness and correctness of connections. Correct any misapplied motor and/or motor starter, improper thermal overload device, or device which fails to function and resultant damage, whether due to incorrect connections or improper information on wiring diagrams.

3.2 WIRING FOR CONTROL SYSTEMS

- A. Provide motor control and temperature control wiring for equipment. All wiring shall be in conduit, unless otherwise noted. Refer to Section 260501 for type of conduit to be used in specific applications. Provide 18 in. length flexible conduit at motors and devices subject to vibration. Conduit supported on 5 ft. centers. Do not attach directly to hot surfaces, piping, or ductwork. Control wiring shall be in separate conduit from all other wiring. Provide green grounding wire circuited from starter, and run ground wire through conduit to each remote auxiliary relay, pushbutton station, remote panel heating device, thermostat, or device with potentials in excess of 50 volts. Size ground wire as required by NEC.
- B. All temperature control wiring shall be plenum rated type, meeting the requirements of NEC Article 300.
- C. Provide pushbutton stations, pilot lights, selector switches, auxiliary starter contacts, and other devices required to provide specified functions.
- D. Where allowable by Code and contract documents, temperature control wiring may be installed without conduit. Installation and wire insulation types shall be as described by NEC, Article 725. All low voltage wiring circuits 50 volt and under shall:
 - 1. Be adequately supported using bridle rings spaced a maximum of 3 ft. on centers or other approved method when installed horizontally above accessible ceilings or run exposed in unfinished areas.
 - 2. Be installed in conduit when run in wall cavity or surface metal raceway where no access is available to wall cavity, in finished areas.
 - 3. Be installed in conduit when installed vertically in Mechanical/Utility Rooms from panels and devices up to above ceiling, or 10 ft. above finished floor if no ceiling.
 - 4. Be installed in conduit in all cases not specifically covered by the above cases, or where subject to physical damage.

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3.3 EQUIPMENT WIRING

- A. Provide power and control wiring between sections of electrical radiation units, between shipping splits, and between remote panels, thermostats, disconnect switches, and their respective units. Provide control wiring from the package control system, to each respective electric heat coil, reheat coil or motor. Properly mount control package. Power wiring to and including disconnect switch shall be by Division 26 "Electrical".

3.4 FIELD WIRING IN STARTERS, CONTROLLERS AND PANELS

- A. Wiring within starters, controllers, and temperature control panels, shall be routed neatly in gutter space, away from moving and/or heat producing parts. Provide suitably rated terminal blocks. Do not place more than two wire connections on pilot device or relay terminal. Where more than two circuit connections are required, use terminal blocks. Provide nylon insulated, ring spade terminal for all control wires. Cables and wires shall be neatly bundled and lashed with nylon cable straps.

END OF SECTION

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SECTION 23 05 13 - MOTORS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Provide labor, materials, equipment and services as required for the complete installation designed in Contract Documents.

1.2 SUBMITTALS

- A. Submit manufacturer's product data on all motors.
- B. Product Data: For each motor, provide dimensions; mounting arrangements; frame type, enclosure type, location for conduit entries; shipping and operating weights; and manufacturer's technical data on features, performance, electrical ratings and characteristics.
- C. Motor Performance Data: For each motor, include the following manufacturers' data:
 - 1. Motor Performance: Percent Efficiency, Power Factor, Torque, RPM, Duty Rating and Design Category.

1.3 QUALITY ASSURANCE

- A. Manufacturer Qualifications:
 - 1. Motor manufacturer shall be based and headquartered in the United States of America and shall design and manufacture motors in the United States.
 - 2. Motor manufacturer shall have over fifteen (15) years-experience in the motor industry and shall maintain active company-wide quality assurance program.
 - 3. Motor manufacturer shall maintain an authorized service center within 60 miles of the project site, capable of providing training, parts and emergency maintenance and repairs.
- B. Motor performance shall be warranted against material and workmanship defects by manufacturer's limited warranty and service policy for the period of at least 18 months from the day of shipment from the factory or the manufacturer's warehouse.
 - 1. Premium efficiency motors shall be warranted for 36 months.

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2. Severe duty motors (as applicable) shall be warranted for 60 months.
3. Extended warranty shall be offered for certain products or as agreed by additional terms and specified elsewhere.

PART 2 - PRODUCTS

2.1 MOTORS

A. General Requirements:

1. Motors built for 60 Hz operation, three phase for 1/2 HP and larger; single phase for 1/3 HP and smaller.
 - a. In compliance with NEMA Standards, wound specifically for nameplate voltage, and selected for appropriate duty and environment.
 - b. 1.15 minimum service factor at rated voltage and frequency. 1.0 service factor for inverter duty motors.
 - c. Bearings: Bearings shall have a rated fatigue life of L-10 (B-10) of 150,000 hours for direct-coupled applications and 50,000 hours for belted applications minimum. Belted rating shall be based on radial loads and pulley sizes called out in NEMA MG 1-14.43. The calculation will be determined from the pulley centerline being at the end of the motor shaft.
 - d. V-belt connected motors with adjustable slide rail bases and pulleys.
 - e. Motors shall have Class F insulation system, with Class B temperature rise, insulation meeting NEMA MG 1 Part 31. Maximum allowable motor temperature rise for open drip-proof (ODP) or totally enclosed fan cooled (TEFC) type at 1.15 service factor shall be 105°C above 40°C ambient with a total temperature rating of 155°C.
 - f. NEMA locked rotor kVA code as required to match unit equipment torque characteristics.
 - g. Single-phase motors shall be capacitor start, induction run, or split phase type.
 - h. Polyphase motors shall be constant speed, squirrel cage, unless otherwise specified.

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- i. Nameplates shall have as a minimum, all information as described in NEMA Standard MG-1-20.60. Motor nameplate shall be mounted on enclosure with stainless steel fastening pins.
2. Motors for use with adjustable speed drive applications shall be premium efficiency inverter duty rated in accordance with NEMA and be capable of a 20:1 turndown.
 - a. These motors shall meet NEMA corona inception voltage requirements, withstanding peak voltages up to 1600 volts, and be manufactured in accordance with NEMA MG 1 Part 30 and 31.
 - b. All motors controlled by adjustable speed drives shall be equipped with circumferential micro-fiber shaft grounding rings to provide protection from electrical bearing damage, to meet NEMA MG 1, 31.4.4.3. Provide AEGIS Bearing Protection Ring Kit (or equal), installed in accordance with the manufacturer's recommendation. For motors controlled by adjustable speed drives and 50hp or greater the motor shall have a ceramic electrically insulating bearing assembly on the opposite end of the grounding brushes.
3. Three phase motors rated 1 HP and greater shall be copper winding, re-lubable ball bearings, 1.15 service factor (1.0 service factor for inverter duty motors), premium efficiency, energy-saver type with a guaranteed NEMA nominal full-load efficiency, by IEEE Standard 112 Test Method "B". Efficiency rating shall appear on nameplate, and shall be not less than as follows; per NEMA MG 1 Part 12, Table 12-12, nominal minimum efficiencies:

MINIMUM NOMINAL FULL-LOAD MOTOR EFFICIENCY						
HP	ODP MOTORS (RPM)			TEFC MOTORS (RPM)		
	1200	1800	3600	1200	1800	3600
1.0	82.5	85.5	77.0	82.5	85.5	77.0
1.5	86.5	86.5	84.0	87.5	86.5	84.0
2.0	87.5	86.5	85.5	88.5	86.5	85.5
3.0	88.5	89.5	85.5	89.5	89.5	86.5
5.0	89.5	89.5	86.5	89.5	89.5	88.5
7.5	90.2	91.0	88.5	91.0	91.7	89.5
10	91.7	91.7	89.5	91.0	91.7	90.2
15	91.7	93.0	90.2	91.7	92.4	91.0
20	92.4	93.0	91.0	91.7	93.0	91.0
25	93.0	93.6	91.7	93.0	93.6	91.7
30	93.6	94.1	91.7	93.0	93.6	91.7
40	94.1	94.1	92.4	94.1	94.1	92.4
50	94.1	94.5	93.0	94.1	94.5	93.0
60	94.5	95.0	93.6	94.5	95.0	93.6

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MINIMUM NOMINAL FULL-LOAD MOTOR EFFICIENCY						
HP	ODP MOTORS (RPM)			TEFC MOTORS (RPM)		
	1200	1800	3600	1200	1800	3600
75	94.5	95.0	93.6	94.5	95.4	93.6
100	95.0	95.4	93.6	95.0	95.4	94.1
125	95.0	95.4	94.1	95.0	95.4	95.0
150	95.4	95.8	94.1	95.8	95.8	95.0
200	95.4	95.8	95.0	95.8	96.2	95.4

4. Nominal Motor Voltage Table:

Nominal System Voltage	Motor Nameplate
480V - 3 phase	460 volt
240V - 1 phase and 3 phase	230 volt
208V - 1 phase and 3 phase	200 volt
120V - 1 phase	115 volt

5. Motor Application; Provide the following enclosure types unless noted otherwise:

Environment/Location	Motor Enclosure Type
General Purpose	Open drip-proof, TEFC with cast iron frame, or encapsulated
Outdoors, below grade or high humidity	TEFC with cast iron frame
Hazardous	Explosion-proof
Packaged Refrigeration Compressors	Hermetic or semi-hermetic

6. Acceptable Manufacturers: Motors need not all be of the same manufacturer. Subject to the requirements of this section provide products by the following:
- General Electric Energy & Saver NEMA Premium Efficiency/(ODP); General Electric X\$D Ultra NEMA Premium Efficiency (TEFC).
 - Century/A.O. Smith Speed Plus
 - Baldor-Reliance Super E.
 - Lincoln Ultimate E CTAC.
 - Marathon XRI.
 - Siemens GO100A.

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- g. Nidec Motor Co. (U.S. Motors) Premium Efficient.

PART 3 - EXECUTION

3.1 MOTORS

- A. Furnished by equipment manufacturer and especially manufactured and/or selected, mounted, and installed for intended use. Install motors accessible for maintenance and belt adjustment.

3.2 REPLACEMENT OF EXISTING MOTORS

- A. Verify motor characteristics, including voltage, shaft length, speed, rotation, horsepower and frame type, and provide motors as called for. Modify or replace existing motor mounts and bases to accommodate the replacement motors.

END OF SECTION

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SECTION 23 05 14 - MOTOR CONTROLLERS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Provide labor, materials, equipment and services as required for the complete installation and full operation of separately enclosed, preassembled, motor controls, rated 600V and less.

1.2 DEFINITIONS

- A. ASD: Adjustable speed drive motor controller.
- B. CPT: Control power transformer.
- C. DDC: Direct digital control. Building management/control system.
- D. EMI: Electromagnetic interference.
- E. PWM: Pulse width modulated.
- F. RFI: Radio-frequency interference.

1.3 SUBMITTALS

- A. Submit manufacturer's product data for each type and rating of motor controller indicated.
 - 1. Include dimensions, weights, enclosure types, rating capacities, operating characteristics, electrical characteristics, furnished specialties and accessories, mounting and attachment details, method of field assembly, components, and location / size of each field connection.
 - 2. Include diagrams for power, signal, and control wiring.
- B. As part of Operation and Maintenance Data, provide manufacturer's written instructions for testing, adjusting, and reprogramming microprocessor control modules, setting field-adjustable timers, controls, and status and alarm points, and setting field-adjustable overload relays.

1.4 QUALITY ASSURANCE

- A. All methods of construction, details of workmanship, that are not specifically described or indicated in the contract documents, shall be subject to the control and approval of the Owner's Representative. Equipment and materials shall be of the quality and manufacture indicated in their respective sections of the

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specifications. The equipment specified is based upon the acceptable manufacturers listed. Equipment types, device ratings, dimensions, etc., correspond to the nomenclature dictated by those manufacturers. Where "or equal" is stated, equipment shall be equivalent in every way to that of the equipment specified and subject to approval. All equipment shall be tested at the factory. Unless specified elsewhere, standard factory inspection and operational tests will be acceptable.

- B. Installation shall be in accordance with the manufacturer's recommendations, NFPA-70 (National Electrical Code), National Electrical Safety Code (NESC), state codes, local codes, and requirements of authority having jurisdiction.
- C. Equipment shall be designed, manufactured, assembled, and tested in accordance with the latest revisions of applicable published ANSI, NEMA, UL and IEEE Standards.
- D. Equipment and systems shall be NRTL tested and labeled.

1.5 WARRANTY

- A. Provide full system warranty (labor, travel, equipment, etc.) in accordance with Division 1 with a minimum of one (1) year from acceptance.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable manufacturers include:

2.2 MOTOR STARTERS

- A. Provide motor starters as listed on the Electric Equipment and Control Schedule on the drawings.
- B. Starters, contactors and controllers shall comply with NEMA standards having general purpose NEMA 1 or 1B enclosure unless otherwise called for. Provide explosion proof, weather resistant or watertight construction as required. Starters shall be minimum NEMA size 0 with solid state overloads in each phase sized per NEC, motor full load amperage, service factor, and motor operating conditions.
- C. Packaged Control Unit: Shall be furnished and mounted by others, and connected by Electrical Contractor. Generally consists of one or more starters, disconnect switches and additional control devices prewired.

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2.3 ENCLOSURES

- A. Enclosures: NEMA 250, to comply with environmental conditions at installed location. Provide Type 1 for dry and clean indoor locations, Type 3R for outdoor locations, Type 4X stainless steel for kitchen and wash-down areas, and Type 12 for areas subject to dust, falling dirt, and dripping non corrosive liquids.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas, surfaces, and substrates to receive motor controllers, with installer present, for compliance with requirements for installation tolerances, and other conditions affecting performance of the Work.
- B. Examine motor controllers before installation. Reject motor controllers that are wet, moisture damaged, or mold damaged.
- C. Examine roughing-in for conduit systems to verify actual locations of conduit connections before motor controller installation.
- D. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Wall-Mounted ASDs: Install with tops at uniform height and with disconnect operating handles not higher than 79 inches above finished floor, unless otherwise indicated, and by bolting units to wall or mounting on lightweight structural-steel channels bolted to wall. For controllers not on walls, provide freestanding racks.
- B. Wall-Mounted Manual and Magnetic Controllers: Install on walls with tops at uniform height, and by bolting units to wall or mounting on lightweight structural-steel channels bolted to wall. For controllers not at walls, provide freestanding racks.
- C. Floor-Mounting Controllers: Install ASDs on 4-inch nominal thickness concrete base.
 - 1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.

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2. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
 3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 4. Install anchor bolts to elevations required for proper attachment to supported equipment.
- D. Roof-Mounting Controllers: Install ASD on roofs with tops at uniform height and with disconnect operating handles not higher than 79 inches above finished roof surface unless otherwise indicated, and by bolting units to curbs or mounting on freestanding, lightweight, structural-steel channels bolted to curbs. Seal roof penetrations after raceways are installed.
- E. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.
- F. Install fuses, heaters in thermal-overload relays (based on actual nameplate full-load amperes) after motors are installed, and install, connect, and fuse thermal-protector monitoring relays furnished with motor-driven equipment.
- G. Maintain minimum clearances and workspace at equipment according to manufacturer's written instructions and NFPA 70.
- H. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.
- I. Setting of Overload Relays: Select and set overloads on the basis of full-load current rating as shown on motor nameplate. Adjust setting value for special motors as required by NFPA 70 for motors that are high-torque, high-efficiency, and so on.
- J. Comply with NECA 1.

3.3 CONTROL WIRING INSTALLATION

- A. Install wiring between ASDs and remote devices and facility's central-control system.
- B. Bundle, train, and support wiring in enclosures.
- C. Connect selector switches and other automatic-control devices where applicable.

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- D. Connect selector switches to bypass only those manual- and automatic-control devices that have no safety functions when switches are in manual-control position.
- E. Connect selector switches with control circuit in both manual and automatic positions for safety-type control devices such as low- and high-pressure cutouts, high-temperature cutouts, and motor-overload protectors.

3.4 IDENTIFICATION

- A. Identify motor controllers, components, and control wiring. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs. Label each ASD with engraved nameplate. Label each enclosure-mounted control and pilot device. Identify all items as described in Section 260501

3.5 FIELD QUALITY CONTROL

- A. Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- B. Motor controllers will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports, including a certified report that identifies the ASD and describes results. Include notation of deficiencies detected, remedial action taken, and observations made after remedial action.

3.6 STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform startup service. Complete installation and startup checks according to manufacturer's written instructions.

3.7 ADJUSTING

- A. Program microprocessors for required operational sequences, status indications, alarms, event recording, and display features. Clear events memory after final acceptance testing and prior to Substantial Completion.
- B. Set field-adjustable switches, auxiliary relays, time-delay relays, timers, and overload-relay pickup and trip ranges.
- C. Adjust carrier frequency for optimal operation with load and conditions.
- D. Adjust the trip settings of instantaneous-only circuit breakers and thermal-magnetic circuit breakers with adjustable, instantaneous trip elements. Initially adjust to 6 times the motor nameplate full-load amperes and attempt to start

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motors several times, allowing for motor cool-down between starts. If tripping occurs on motor inrush, adjust settings in increments until motors start without tripping. Do not exceed 8 times the motor full-load amperes (or 11 times for NEMA Premium Efficient motors if required). Where these maximum settings do not allow starting of a motor, notify Construction Manager before increasing settings.

3.8 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, reprogram, and maintain motor controllers.

END OF SECTION

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SECTION 23 05 19 - GAUGES AND THERMOMETERS

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Provide labor, materials, equipment and services to perform operations required for the complete installation and related Work as required in Contract Documents.

1.2 SUBMITTAL

- A. Submit product data for gauges, thermometers and thermowells.

PART 2 - PRODUCTS

2.1 WATER PRESSURE GAUGES

- A. Construction to be Bourdon tube type; 4-1/2 in. diameter minimum, dial face, in cast aluminum case, replaceable glass lens, with snap-on rings. Phosphor bronze tube, bronze bushed rotary movement, silver brazed or soldered to brass socket and brass tip. 1/4 in. bottom connection. Accuracy, one (1.0) percent of included scale range. White dial face with black numerals, graduated in pounds; equipped with bronze pulsation dampener or snubber.
- B. Make: American, Ashcroft, Crosby, Duro, Marsh, Moeller, Trerice, Weiss, Weksler, Winters.

2.2 PIPING SYSTEM THERMOMETERS

- A. Industrial type, plastic, aluminum or steel case, glass or plastic front, non-toxic organic liquid filled, red reading column, white or silver V-shaped scale, black numerals. Union flange mounted, separable socket with thermowell, extension necks where required; range as called for service. Universal adjustable type, 9 in. scale. For installation in hot water systems, graduations of 2°F., accurate to within 1°F. For installation in water systems where the maximum temperature is less than 120°F, graduations of 1°F, accurate to within 1/2°F.
- B. Make: American, Moeller, Trerice, Weiss, Weksler, Winters.

2.3 PRESSURE/TEMPERATURE TEST PLUGS

- A. 1/4 in. NPT plug shall be capable of reading either a pressure or temperature. 1/8 in. o.d. dual seal core of Nordel 275°F with zero leakage from vacuum to 500 psig.

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- B. Makes: Peterson Equipment Company, Sisco P/T plugs.

PART 3 - EXECUTION

3.1 GENERAL

- A. Provide where called for in the drawings and as noted below.
- B. All gauges and thermometers shall be provided with pressure and temperature ranges appropriate for the system in which they are installed. Select to operate in the middle third of the range under normal operating conditions. Gauges and thermometers shall be suitable for the environment of their installed location, and if installed outdoors shall be acceptable for operation down to an ambient temperature of -20°F.

3.2 WATER PRESSURE GAUGES

- A. Heating water and chilled water coils: 0 to 60 psi range.
- B. Provide 1/4 in. ball valve in each pump inlet and outlet tapping, or in piping adjacent to same. Range 30 in. vacuum to 100 psi.
- C. Heat exchangers: 0 to 60 psi range.
- D. Compression tanks: 0 to 100 psi range.
- E. Each water make-up valve assembly: 0 to 60 psi range.

3.3 THERMOMETERS

- A. Provide thermowells mounted in oversize tee, or elbow if necessary, to provide as little restriction as possible to fluid flow. Provide thermometer stems and thermowell depths of proper length to allow accurate reading. Locate adjacent to control sensing equipment. Install and adjust angles so as to be easily read from floor.
- B. Heating Coil: Inlet and outlet; range 0° to 220°F.

3.4 TEST PLUG

- A. Provide test plugs at locations as called for.

END OF SECTION

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SECTION 23 05 23 - VALVES

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Provide labor, materials, equipment and services as required for the complete installation and related Work designed in Contract Documents.

1.2 SUBMITTAL

- A. Submit product data for valves and accessories.

PART 2 - PRODUCTS

2.1 VALVES

- A. General: Valves shall have following requirements:
 - 1. Working pressure stamped or cast on bodies.
 - 2. Stem packing serviceable without removing valve from line.
 - 3. Valves on insulated services shall have handle extensions so that the handle is fully beyond the insulation jacketing.
 - 4. Where possible, all valves of like type shall be of a single manufacturer.
- B. Acceptable Manufacturers:
 - 1. Gate, Globe, and Check Valves: Apollo, Hammond, Milwaukee, Nibco, Watts, Victaulic.
 - 2. Ball Valves: Apollo, Hammond, Jamesbury, Milwaukee, Watts, Nibco, Victaulic.
 - 3. Butterfly Valves: Apollo, DeZurik, Jamesbury, Keystone, Milwaukee, Watts, Nibco, Victaulic.
 - 4. High Performance Butterfly Valves: Keystone, Bray, Velan, Milwaukee.
 - 5. To establish a standard of quality and to identify features, certain manufacturer's numbers are given in the following paragraphs.

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C. Gate Valves:

1. 2-1/2 in. and Larger: Iron body, bronze solid wedge disc. OS&Y, flanged ends, rising stem, bolted bonnet, 125 lb. SWP, Milwaukee F-2885A.
2. 2 in. and Smaller: Bronze body, bronze solid wedge disc, rising stem, threaded or union bonnet, threaded ends, 125 SWP, Milwaukee 1152.

D. Globe Valves:

1. 2-1/2 in. and Larger: Iron body, bronze solid wedge disc, 125 SWP, flanged ends, bolted bonnet, Milwaukee F-2981-A.
2. 2 in. and Smaller: Bronze body, renewable composition or bronze disc, union bonnet, rising stem, threaded or soldered ends, 150 SWP, Milwaukee 590.

E. Check Valves:

1. 2-1/2 in. and Larger: Iron body, cast iron disc with bronze disc face rings and bronze seat ring, bolted flange cap, flanged ends, 125 SWP, Milwaukee F-2974-A.
2. 2 in. and Smaller: Bronze, swing check, threaded or soldered ends, 125 SWP, Milwaukee 1509.
3. Grooved End Spring-Loaded Check Valves:
 - a. 2 in. through 3 in.: Ductile iron body, stainless steel disc and spring, brass shaft, nickel-plated seat, 365 psi CWP. Victaulic Series 716H.
 - b. 4 in. through 12 in.: Ductile iron body, EPDM coated ductile iron disc, stainless steel spring and shaft, welded-in nickel seat, 300 psi CWP, Victaulic Series 716 or 779 with venture taps.
 - c. 14 in. through 24 in.: Ductile iron body, dual disc design, stainless steel disc, spring and shaft, EPDM seat bonded to the valve body, 230 psi CWP. Victaulic Series W715.

F. Ball Valves for Water Service:

1. For chilled and hot water systems 3 in. and under: Bronze body with hardened chrome-plated brass ball PTFE seats, standard porting, 600 lb., W.O.G., adjustable packing gland, insulated handle, screwed or soldered ends, blowout proof stem. Provide handle extension on insulated services.

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2. Grooved end valves for chilled, hot and condenser water systems 1-1/2 in. through 6 in. ductile iron body, chrome plated carbon steel ball and stem, standard port, blowout proof, 800 psi CWP, lever handle or gear operator with hand wheel. Victaulic Series 726.
- G. Valves for Gauges and Instruments:
1. 1/4 in., bronze body, hardened chrome plated brass ball, glass reinforced carbon impregnated seats, standard porting, 400 lb. W.O.G., adjustable packing gland, screwed ends, tee handle, Watts B6000TH.
- H. Grooved Butterfly Valves for Water Service:
1. Bi-directional bubble tight shutoff against working pressure of 300 psi.
 2. Body: Grooved type, coated ductile iron.
 3. Disc: Nickel coated ductile iron.
 4. Seat: EPDM; pressure responsive in sizes through 12 inch.
 5. Stem: Stainless steel with EPDM seals. Stem shall be offset from the disc centerline to provide complete 360 degree circumferential seating.
 6. Operators: Valves up to 6 in. with lever operators; valves 8 in. and larger with heavy duty manual gear actuators.
 7. Victaulic VIC-300 Master Seal (2 in. to 12 in.).
- I. Lug Type Butterfly Valves for Water Service:
1. Rated for working pressure 200 psi, bi-directional dead end service, bubble-tight.
 2. Body: Lug type, cast iron ASTM A126, or ductile iron.
 3. Disc: Aluminized bronze.
 4. Seat: EPDM, resilient seat. Rated to 250°F.
 5. Stem: 316 or 416 stainless steel. Single offset.
 6. Operator: Lockable Lever for sizes through 6 in. Manual hand wheel gear actuator for sizes 8 in. and larger.
 7. Milwaukee CL223E (2 in. - 6 in.), CL323E (8 in. and larger), or Watts BF-03.

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- J. Hose Thread Drain Valves:
 - 1. Ball valve, bronze body, hardened chrome ball with hose thread end, cap and chain.
- K. Fusible Link Valves:
 - 1. Level type gate valve for emergency closing of oil supply line. Spring-operated, self closing type, with spring and 165°F fusible link. Bronze valve with malleable iron handle. Port full line size. Preferred Utilities Type 110.
- L. Liquid or Vacuum Relief Valves:
 - 1. Bronze base and bronze working parts except steel cadmium-plated springs; suitable for pressure up to 250 psi; non-pop valve suitable for use on boiler feed pump discharge, Lunkenheimer #658.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General:
 - 1. Provide valves of type called for and where required to service equipment.
 - 2. Provide at major building and systems sections.
 - 3. Provide chain wheels, guides, and chain loops for valves, where called for or in Mechanical Rooms where valves are mounted higher than 8'-0" AFF.
 - 4. Isolating valves for individual fan convectors, room units, terminal units, or other similar apparatus may be inside cabinet or at connection to branch mains where accessible.
 - 5. Locate valves with handles at horizontal position when 5 ft. or more above the floor, for greater visibility and easier use. Otherwise, locate valves with handles at or above horizontal position. Swing check valves in upright position only.
 - 6. Butterfly valves may be used for water service over 2 in. unless otherwise noted.
 - 7. Ball valves may be used for water service through 3 in., unless otherwise noted.

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8. Provide hose threaded valves at low points, strainers, equipment, and as called for.

END OF SECTION

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SECTION 23 05 25 - HYDRONIC COIL PIPING PACKAGE

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Provide Hydronic Coil Piping Packages as shown on drawings and as specified herein.
- B. Type, size, and rating compatible with intended service.
- C. Suitable for use in Chilled Water and Hot Water Systems.

1.2 SUBMITTALS

- A. Submittals shall include the following:
 - 1. Drawing of coil package showing product arrangement with end connection type and size listed. Components shall be clearly labeled.
 - 2. Written description of all components provided in package.
 - 3. Manufacturer's system component specifications.
 - 4. Computer generated, job specific package schedule indicating package part number, end connection size and types, control valve Cv, flow cartridge spring range, design flow rate, and location tag for each coil package.

1.3 DELIVERY, STORAGE, AND HANDLING

- A. All equipment provided under this specification shall be shipped to the job site clearly labeled for intended use and in shrink-wrapped plastic per coil assembly. Manufacturer shall factory mount actuators (supplied by others) to actuated ball valve prior to shrink-wrap and shipment.
- B. Manufacturer's representative shall coordinate with valve actuator supplier to develop common schedule of actuator type, size, and location. This schedule will be used by coil piping package factory to mount actuators prior to shrink-wrap and shipping.

1.4 WARRANTY

- A. Manufacturer shall warrant all components for eighteen (18) months from date of final acceptance. The flow limiting cartridge shall be warranted by manufacturer for no less than five (5) years from date of final acceptance.

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- B. Manufacturer shall provide replacement flow limiting cartridges (installation by others) at no charge for up to 10% of total quantity of purchased packages in the event that flow conditions (gpm) are modified by Engineer after packages have shipped to the jobsite.

1.5 ACCEPTABLE MANUFACTURER

- A. Griswold "Automizer" CPP-2A (Basis of Design).
- B. Griswold PIC-V.
- C. Delta Controls "Auto Touch".
- D. Belimo "PICCV".
- E. FCI - Delta P Valve.
- F. Danfoss/Nexus Coil Pak
- G. Flow Design/IMI
- H. Victaulic Koil-Kit Coil Pack.

PART 2 - PRODUCTS

2.1 COMBINATION VALVES (RETURN SIDE) 10 GPM AND BELOW

- A. Combination valve shall include a flow limiting cartridge, actuated ball valve, and manual isolation ball in a single valve housing to prevent opportunity for leakage with union end connection. Separate assembled components shall not be acceptable.
- B. Valve housing shall consist of forged brass, rated at no less than 360 psi at 250°F.
- C. Valve shall have a union end connection that includes a factory installed manual air vent to allow for venting of the coil or heat pump.
- D. Automatic Flow Limiting Cartridge (FLC):
 - 1. FLC shall automatically control flow rates with $\pm 5\%$ accuracy over an operating pressure differential range of at least 14 times the minimum required for control. Three (3) operating pressure ranges shall be available with the minimum range requiring no more than 2 PSID to actuate the mechanism.

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2. Valve internal control mechanism shall consist of a stainless steel one-piece cartridge with segmented port design and full travel linear coil spring. Plated steel cartridges shall not be acceptable.
 3. Dual pressure/temperature test valves for verifying the pressure differential across the cartridge and system shall be standard.
 4. Manufacturer shall be able to provide certified independent laboratory tests verifying accuracy of performance.
- E. Actuated Ball Valve:
1. Valve ball shall consist of chemically plated nickel brass.
 2. Actuator stem shall be removable/replaceable without removing valve from line.
 3. Manufacturer shall be able to provide ball insert to make flow control equal percentage. Insert shall be constructed of a glass-filled polymer.
 4. Valve shall have EPDM O-rings behind Reinforced Teflon (PTFE) ball seals to allow for a minimum close-off pressure of 100 psi with 35 in.-lbs. of torque for 1/2 in. to 2 in. sizes.
 5. Actuator shall provide minimum torque required for full valve shutoff position.
 6. Coordinate specific details of actuator with BMS provider. BMS provider shall mount and wire actuators in the field.
- F. Control Valves: All pressure independent valves for individual coil control shall be provided as part of Hydronic Coil Piping/Hose Kit Packages as specified herein. Control valve actuators will be supplied and installed by the Controls Contractor. The Controls Contractor is responsible for wiring and testing the valve actuators.
- G. Isolation Ball Valve:
1. Valve shall include a 600 WOG manual isolation ball valve.
- 2.2 COMBINATION VALVES (RETURN SIDE) LARGER THAN 10 GPM
- A. The modulating control valves shall be pressure independent.
- B. The pressure independent modulating control valve shall include a pressure compensating cartridge, actuated ball valve, and manual isolation ball in a single valve housing.

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- C. Valve housing shall consist of forged brass, rated at no less than 360 psi at 250°F.
- D. Valve shall have a fixed end or union end connection with factory installed air vent to allow for venting of the coil or heat pump.
- E. The control valve shall accurately control the flow from 0 to 100% full rated flow.
- F. A flow tag shall be furnished with each valve.
- G. A universal mounting plate shall allow installation of actuators meeting the system electrical requirements and valve torque requirements as provided by Belimo, ELO Drive, Honeywell, Invensys, Johnson Controls, KMC, Neptronics, or Siemens.
- H. The actuator and plate can be rotated after mounting.
- I. Pressure Compensating Cartridge (PCC):
 - 1. PCC shall automatically compensate for pressure changes in valve and shall maintain a constant pressure drop across the flow limiting actuated ball.
 - 2. The operating pressure range shall be available with the minimum range requiring 5.8 PSID to actuate the mechanism.
 - 3. Valve internal control mechanism includes a diaphragm and full travel linear coil spring.
 - 4. Valves shall include an accessible/replaceable cartridge.
 - 5. Dual pressure/temperature test valves for verifying the pressure differential across the cartridge and flow limiting ball shall be standard.
- J. Actuated Ball Valve:
 - 1. Valve ball shall consist of chemically plated nickel brass or stainless steel.
 - 2. Actuator stem shall be removable/replaceable without removing valve from line.
 - 3. Manufacturer shall be able to provide ball insert to limit flow to maximum flow rate with $\pm 5\%$ accuracy.
 - 4. Valve shall have EPDM O-rings behind the seals to allow for a minimum close-off pressure of 100 psi with 35 in.-lbs. of torque for 1/2 in. to 2 in. sizes.

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5. Actuator shall provide minimum torque required for full valve shutoff position.

K. Isolation Ball Valve:

1. Valve shall include a 600 WOG manual isolation ball valve.

2.3 COMBINATION VALVE (SUPPLY SIDE)

- A. Combination valve shall include a manual isolation ball and integrated strainer, including drain valve with 3/4 in. hose connection with cap, in a single valve housing to prevent opportunity for leakage. Separate assembled components shall not be acceptable. Dual pressure/temperature test valve shall be standard.
- B. Valve housing shall consist of forged brass rated at no less than 360 psi at 250°F.
- C. Valve shall have one (1) fixed end and one (1) union end connection.
- D. Integrated Strainer:
 1. Shall be 20 mesh stainless steel and can be removed from housing without disturbing pipe connections for inspection or replacement.
 2. Drain valve shall consist of nickel-plated ball in a brass housing rated for 275 psi at 250°F.
- E. Isolation Ball Valve:
 1. Valve shall include a 600 WOG manual isolation ball valve.

2.4 SUPPLY/RETURN HOSES (AS REQUIRED)

- A. All hoses shall be equipped with swivel end connections at terminal unit. All end connections shall be crimped to meet standard pressure ratings. Serrated/slip fit connections shall not be acceptable.
- B. Flame Retardant Hoses:
 1. Hose material shall be stainless steel braided over a synthetic polymer liner.
 2. Hoses shall meet or exceed the ASTM D380-00 standard.
 3. Hoses shall meet or exceed flame retardant testing per standards per ANSI/UL 723, NFPA 255, UBC 42-1, and ASTM E84-00.

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C. Insulated Hoses:

1. Hose materials shall be high quality polyethylene pipe insulation over a stainless steel braided inner core.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install per manufacturer's recommendations and instructions.

END OF SECTION

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SECTION 23 05 48 - VIBRATION ISOLATION OF MECHANICAL SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Furnish and install vibration control devices, materials, and related items. Perform all work as shown on the Drawings and as specified herein to provide complete vibration isolation systems in proper working order.

1.2 RELATED SECTIONS

- A. See Specification Section 230550 - Wind Restraint for Mechanical Systems.

1.3 MATERIAL AND EQUIPMENT

- A. All vibration isolation mounts shall be supplied by one of the following approved manufacturers:
 - 1. Mason Industries Inc. (Hauppauge, NY) M.I.
 - 2. Kinetics Noise Control Inc. (Dublin, OH) K.N.C.
 - 3. Vibration Mountings & Controls Group. (Butler, NJ) VMC Group
 - 4. Vibration Eliminator Co. (Long Island City, NY) V.E.C.

1.4 QUALITY ASSURANCE

- A. Coordinate the size, location and special requirements of vibration isolation equipment and systems with other trades. Coordinate plan dimensions with size of housekeeping pads.
- B. Provide vibration isolators of the appropriate sizes, with the proper loading to meet the specified deflection requirements.
- C. Supply and install any incidental materials such as mounting brackets, attachments and other accessories as may be needed to meet the requirements stated herein even if not expressly specified or shown on the Drawings, without claim for additional payment.
- D. Verify correctness of equipment model numbers and conformance of each component with manufacturer's specification.
- E. Should any rotating equipment cause excessive noise or vibration when properly installed on the specified isolators, the Contractor shall be responsible for re-balancing, realignment, or other remedial work required to reduce noise and

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vibration levels. Excessive is defined as exceeding the manufacturer's specifications for the unit in question.

- F. Upon completion of work, the Architect or the Architect's Representative shall inspect the installation and shall inform the installing contractor of any further work that must be completed. Make all adjustments as directed by the Architect that result from the final inspection. This work shall be done before vibration isolation systems are accepted.

1.5 SUBMITTALS

- A. Refer to related sections elsewhere for procedural instruction for submittals.
- B. Before ordering any products, submit shop drawings of the items listed below. The shop drawings must be completed when submitted and must be presented in a clear, easily understood form. Incomplete or unclear presentation of shop drawings may be reason for rejection of the submittal.
- C. A complete description of products to be supplied, including product data, dimensions, specifications, and installation instructions.
- D. Detailed selection data for each vibration isolator supporting equipment, including:
 - 1. The equipment identification mark.
 - 2. The isolator type.
 - 3. The actual load.
 - 4. The static deflection expected under the actual load.
 - 5. The specified minimum static deflection.
 - 6. Steel rails, steel base frames, and concrete inertia bases showing all steel work, reinforcing, vibration isolator mounting attachment method, and location of equipment attachment bolts.
 - 7. Special details necessary to convey complete understanding of the work to be performed.
- E. Submission of samples may be requested for each type of vibration isolation device. After approval, samples will be returned for installation at the job if requested. All costs associated with submission of samples shall be borne by the Contractor.

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PART 2 - PRODUCTS

2.1 VIBRATION ISOLATOR TYPES

A. General:

1. All springs installed out-of-doors shall be zinc electroplated or powder-coated after fabrication. Hardware and other metal parts shall be cadmium-plated or galvanized. Galvanizing shall meet ASTM Salt Spray Test Standards and Federal Test Standard No. 14.
2. All isolators installed out-of-doors shall have base plates with bolt holes for fastening the isolators to the support members.
3. Isolator types are scheduled to establish minimum standards. At the Contractor's option, labor-saving accessories can be an integral part of isolators supplied to provide initial lift of equipment to operating height, hold piping at fixed elevations during installation and initial system filling operations, and similar installation advantages. Accessories and seismic restraint features must not degrade the isolation performance of the isolators.
4. Static deflection of isolators shall be as provided in the EXECUTION section and as shown on the Drawings. All static deflections stated are the minimum acceptable deflection for the mounts under actual load. Isolators selected solely on the basis of rated deflections are not acceptable and will be disapproved.

B. Type FSN (Floor Spring and Neoprene):

1. Spring isolators shall be freestanding and laterally stable without any housing. Spring diameter shall be not less than 0.8 of the compressed height of the spring at the rated load. Springs shall have a minimum additional travel-to-solid equal to 50% of the rated deflection. Springs shall be so designed that the ratio of horizontal stiffness to vertical stiffness is approximately 1 (one). All mounts shall have leveling bolts. The spring element in the isolator shall be set in a neoprene cup and have a steel washer or a flat surface in contact with the neoprene to distribute the load evenly over the bearing surface of the neoprene. Alternatively, each isolator shall be mounted on a Type NP isolator. If the NP isolator is used, a rectangular bearing plate of appropriate size shall be provided to load the pad uniformly within the manufacturer's recommended range. If the isolator is to be fastened to the building and the NP isolator is used, grommets shall be provided for each bolt hole in the base plate. If the basic spring isolator has a neoprene friction pad on its base and a NP isolator is to be added to the base, a galvanized steel,

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stainless steel or aluminum bearing plate shall be used between the friction pad and the NO isolator. If the isolator is outdoors, bearing plates shall not be made of galvanized steel. The NP isolator, bearing plate and friction pad shall be permanently adhered to one another and to the bottom of the isolator base plate.

2. Type FSN isolators shall be one of the following products with the appropriate neoprene pad (if used) selected from Type NP or approved equal:
 - a. Type SLF M.I.
 - b. Type FDS K.N.C.
 - c. Series A VMC Group

2.2 EQUIPMENT BASES

A. Type BSF (Base-Steel Frame):

1. Steel base frames shall consist of structural steel section sized, spaced, and connected to form a rigid base which will not twist, rack, deform, or deflect in any manner which will negatively affect the operation of the supported equipment or the vibration isolation mounts. Frames shall be adequately sized to support basic equipment units and motors plus any associated pipe elbow supports, duct elbow supports, electrical control elements, or other components closely related and requiring resilient support in order to prevent vibration transfer to the building structure. The depth of steel frame shall be at least 1/10 the longest dimension of the base and not less than 6 in. The base footprint shall be large enough to provide stability for supported equipment.
2. Frame bases shall include side mounting brackets for attachment to vibration isolators. Mounting brackets shall be located on the sides of the base that are parallel to the axis of rotation of the supported equipment.
3. Type BSF bases shall be supplied by the isolator manufacturer and shall be one of the following products or approved equal:
 - a. Type WFSL M.I.
 - b. Type SFB or SRB K.N.C.
 - c. Series WFB VMC Group

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2.3 RESILIENT PENETRATION SLEEVE/SEAL

- A. Resilient penetration sleeve/seals shall be field-fabricated from a pipe or sheet metal section that is 1/2 in. to 3/4 in. larger than the penetrating element in all directions around the element, and shall be used to provide a sleeve through the construction penetrated. The sleeve shall extend 1 in. beyond the penetrated construction on each side. The space between the sleeve and the penetrating element shall be packed with glass fiber or mineral wool to within 1/4 in. of the ends of the sleeve. The remaining 1/4 in. space on each end shall be filled with acoustical sealant to form an airtight seal. The penetrating element shall be able to pass through the sleeve without contacting the sleeve. Refer to details on Drawings.

2.4 RESILIENT LATERAL SUPPORTS

- A. These units shall either be a standard product of the vibration isolation mounting manufacturer, or be custom fabricated from standard components. These units shall incorporate neoprene isolation elements similar to Type FN that are specifically designed to provide resilient lateral bracing of ducts or pipe.
- B. Resilient lateral supports shall be one of the following products or approved equal:
 - 1. Type ADA M.I.
 - 2. Type RGN K.N.C.
 - 3. Type MDPA VMC Group

2.5 FLEXIBLE DUCT CONNECTIONS

- A. Flexible duct connections shall be heavy glass fabric, double neoprene coated, approximately 30 oz. per sq. yd. The clear space between connected parts shall be a minimum of 3 in. and the connection shall have a minimum of 1.5 in. of slack material. Materials for flex connection shall be fire retardant, water and milder resistant, and comply with UL standard 214.
- B. Flexible duct connections shall be one of the following products or approved equal:
 - 1. Ventfabrics, Inc. "Ventglass".

2.6 THRUST RESTRAINTS

- A. Thrust restraints shall consist of a spring element in series with a neoprene pad. The unit shall be designed to have the same deflection due to thrust-generated loads as specified for the isolators supporting the equipment. The spring

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element shall be contained within a steel frame and be designed so it can be pre-compressed at the factory to allow for a maximum of 1/4 in. movement during starting or stopping of the equipment. Allowable movement shall be field-adjustable. The assembly shall be furnished complete with rods and angle brackets for attachment to both equipment and the adjacent fixed structural anchor. The thrust restraints shall be installed on the discharge of the fan so that the restraint rods are in tension. Assemblies that place the rods in compression are not acceptable. The holes in the spring restraint brackets through which the restraint rods pass must be oversized to prevent contact between the brackets and rods.

B. Thrust restraints shall be one of the following products or an approved equal:

1.	Type WB	M.I.
2.	Type HSR	K.N.C.
3.	Type HTR	VMC Group

2.7 GROMMETS

A. Grommets shall be specially formed to prevent bolts from directly contacting the isolator base plate, and shall be sized so that they will be loaded within the manufacturer's recommended load range.

B. Grommets shall either be custom made by combining a neoprene washer and sleeve, or be one of the following products or an approved equal:

1.	Type Isogrommets	MBIS, Inc. (Bedford Heights, OH)
2.	Type WB	Barry Controls (Brighton, MA)
3.	Type HG	Mason Industries Inc., (Hauppauge, NY)

2.8 ACOUSTICAL SEALANT

A. Sealants for acoustical purposes as described in this specification shall be silicone or one of the non-setting sealants indicated below:

1.	Acoustical sealant	D.A.P.
2.	BR-96	Pecora
3.	Acoustical sealant	Tremco
4.	Acoustical sealant	U.S.G.

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PART 3 - EXECUTION

3.1 APPLICATION

A. General:

1. Refer to the PRODUCTS section of this specification for vibration isolation devices identified on the Drawings or specified herein.
2. The static deflection of all isolators specified herein are the minimum acceptable deflections for the mounts under actual load. Isolators selected solely on the basis of rated deflection are not acceptable and will be disapproved.

B. Major Equipment:

1. Unless otherwise shown or specified on Drawings, all floor-mounted major equipment shall be set on 6 in. high concrete housekeeping pads.
2. Types and minimum static deflections of vibration isolation devices for major equipment items shall be as specified hereunder.
3. Flexible duct connections shall be installed at all fan unit intakes, fan unit discharges, and wherever else shown on the Drawings.
4. Electrical connections to vibration-isolated equipment shall be flexible, as called for in the electrical portion of the specification.
5. Thrust restraints shall be installed on all suspended fans and on all floor-mounted fans developing 4 in. or more of static pressure, unless the horizontal component of the thrust force can be demonstrated to be less than 10% of the equipment weight.

C. Equipment Vibration Isolation Schedule:

TYPE	VIBRATION ISOLATOR TYPE	MINIMUM STATIC DEFLECTION (In.)	EQUIPMENT BASE
Air Handling Units	FSN	2.5	BSF

NOTE 1: Concrete Pad for Air Handling Units included on drawings.

D. Miscellaneous Mechanical Equipment:

1. Miscellaneous pieces of mechanical equipment such as converters, pressure reducing stations, dryers, strainers, storage tanks, condensate receiver tanks and expansion tanks which are connected to isolated

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piping systems shall be vibration-isolated from the building structure by Type NP or Type HN isolators (selected for .01 in. static deflection) unless their position in the piping system requires a higher degree of isolation as called for under "Pipe Isolation".

E. Pipes:

1. All chilled water, condenser water, hot water, steam main and engine exhaust piping shall be isolated from the building structure within the following limits:
 - a. Within mechanical rooms.
 - b. Within 50 ft. total pipe length of connected vibration-isolated equipment (chillers, pumps, air handling units, pressure reducing stations, etc.).
 - c. Piping shall be isolated from the building structure by means of vibration isolators, resilient lateral supports, and resilient penetration sleeve/seals.
 - d. Isolators for the first three support points adjacent to connected equipment shall achieve one half the specified static deflection of the isolators supporting the connected equipment. When the required static deflection of these isolators is greater than 1/2 in., Type FSN or Type HSN isolators shall be used. When the required static deflection is less than or equal to 1/2 in., Type FN or Type HN isolators shall be used. All other pipe support isolators within the specified limits shall be either Type FN or Type HN achieving at least 1/4 in. static deflection.
 - e. Where lateral support of pipes is required within the specified limits, this shall be accomplished by use of resilient lateral supports.
 - f. Pipes penetrating the building construction shall be isolated from the building structure by use of resilient penetration sleeve/seals.

3.2 INSTALLATION OF VIBRATION ISOLATION EQUIPMENT

A. General:

1. Locations of all vibration isolation devices shall be selected for ease of inspection and adjustment as well as for proper operation.
2. Installation of vibration isolation equipment shall be in accordance with the manufacturer's instructions.

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B. Isolators:

1. All vibration isolators shall be aligned squarely above or below mounting points of the supported equipment.
2. Isolators for equipment with bases shall be located on the sides of the bases which are parallel to the equipment shaft unless this is not possible because of physical constraints.
3. Locate isolators to provide stable support for equipment, without excess rocking. Consideration shall be given to the location of the center of gravity of the system and the location and spacing of the isolators. If necessary, a base with suitable footprint shall be provided to maintain stability of supported equipment, whether or not such a base is specifically called for herein.
4. If a housekeeping pad is provided, the isolators shall bear on the housekeeping pad and the isolator base plates shall rest entirely on the pad.
5. Hanger rods for vibration-isolated support shall be connected to structural beams or joists, not the floor slab between beams and joists. Provide suitable intermediate support members as necessary.
6. Vibration isolation hanger elements shall be positioned as high as possible in the hanger rod assembly, but not in contact with the building structure, and so that the hanger housing may rotate a full 360° about the rod axis without contacting any object.
7. Parallel running pipes may be hung together on a trapeze, when allowed by Section 232010 that is isolated from the building. Isolator deflections must be the greatest required by the provisions for pipe isolation for any single pipe on the trapeze. Do not mix isolated and un-isolated pipes on the same trapeze.
8. Pipes, ducts and equipment shall not be supported from other pipes, ducts and equipment.
9. Resiliently isolated pipes, ducts and equipment shall not come in rigid contact with the building construction or rigidly supported equipment.
10. The installed and operating heights of equipment vibration-isolated with Type FSNTL isolators shall be identical. Limit stops shall be out of contact during normal operation. Adjust isolators to provide 1/4 in. clearance between the limit stop brackets and the isolator top plate, and between the travel limit nuts and travel limit brackets.

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11. Adjust all leveling bolts and hanger rod bolts so that the isolated equipment is level and in proper alignment with connecting ducts or pipes.

C. Bases:

1. No equipment unit shall bear directly on vibration isolators unless its own frame is suitable rigid to span between isolators and such direct support is approved by the equipment manufacturer. This provision shall apply whether or not a base frame is called for on the schedule. In the case that a base frame is required for the unit because of the equipment manufacturer's requirements, and is not specifically called for on the equipment schedule, a base frame recommended by the equipment manufacturer shall be provided at no additional expense.
2. Unless otherwise indicated, there is to be a minimum operating clearance of 1 in. between steel rails, steel frame base or inertia bases and the floor beneath the equipment. The isolator mounting brackets shall be positioned and the isolators adjusted so that the required clearance is maintained. The clearance space shall be checked by the Contractor to ensure that no construction debris has been left to short circuit or restrict the proper operation of the vibration isolation system.

D. Flexible Duct Connections:

1. Sheet metal ducts and plenum openings shall be squarely aligned with the fan discharge, fan intake, or adjacent duct section prior to installation of the flexible connection, so that the clear length is approximately equal all the way around the perimeter. Flexible duct connections shall not be installed until this provision is met. There shall be no metal-to-metal contact between connected sections, and the fabric shall not be stretched taut.

E. Thrust Restraints:

1. Thrust restraints shall be attached on each side of the fan at the vertical centerline of thrust. The two rods of the thrust restraints shall be parallel to the thrust force. This may require custom brackets or standoffs. The body of the thrust restraint shall not come in contact with the connected elements. Thrust restraints shall be adjusted to constrain equipment movement to the specified limit.

F. Grommets:

1. Where grommets are required at hold down bolts of isolators, bolt holes shall be properly sized to allow for grommets. The hold down bolt

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assembly shall include washers to distribute load evenly over the grommets. Bolts and washers shall be galvanized.

G. Resilient Penetration Sleeve/Seals:

1. Maintain an airtight seal around the penetrating element and prevent rigid contact between the penetrating element and the building structure. Fit the sleeve tightly to the building construction and seal airtight on both sides of the construction penetrated with acoustical sealant.

END OF SECTION

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SECTION 23 05 50 - WIND RESTRAINT FOR HVAC SYSTEMS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Support and brace mechanical and electrical systems, as called for, to resist directional wind forces (lateral, longitudinal and vertical).

1.2 APPLICABLE CODES AND STANDARDS

- A. Provide work in compliance with the following codes and standards:
 - 1. 2015 Building Code of New York State (Section 1609 and 1613).
 - 2. 2015 Mechanical Code of New York State (Section 301, Item 301.15).
 - 3. American Society of Civil Engineers (ASCE) Minimum Design Loads for Buildings and Other Structures with Supplement No. 1 - Standard ASCE/SEI7-16.

1.3 QUALITY ASSURANCE

- A. General:
 - 1. The contractor shall provide Professional Engineer stamped and signed engineering calculations and details of wind restraint systems to meet total design lateral force requirements for support and restraint of mechanical systems. Engineer shall be licensed to practice in the state in which the project is located.
 - 2. The wind restraint engineering calculations and details shall provide the quantity of attachments and size/type of attachments for the mounting of an equipment curb or support rail to the building structure, and for attachment of the equipment or system to the equipment curb or support rail. It is not the intent for manufactured equipment curbs or support rails to be certified by their respective manufacturers, nor is it the intent for them to be certified by the Professional Engineer who is providing the wind restraint calculations and connection methodology.
 - 3. Systems requiring wind restraint including, but not limited to:
 - a. Air handling units.
 - b. Louvered intake or relief penthouses

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1.4 SUBMITTALS

- A. Submit wind force level (F_p) calculations from applicable building code. Submit pre-approved restraint selections, installation details, and plans indicating locations of restraints.
- B. Calculations, plans, restraint selection, and installation details shall be stamped and signed by a professionally licensed engineer experienced in wind restraint design.
- C. Submit manufacturer's product data.
- D. For each piece of equipment that requires wind restraint as outlined in this section, include the following:
 - 1. Dimensioned Outline Drawings of Equipment Unit: Identify the center of gravity and locate and describe mounting and anchoring provisions.
 - 2. Anchorage: Provide detailed description of equipment anchorage devices on which the calculations are based and their installation requirements. Identify anchor bolts, studs and other mounting devices. Provide information on the size, type and spacing of mounting brackets, holes and other provisions.
- E. The Contractor shall provide photographs of the installed roof mounted equipment, showing the fully installed wind restraint anchoring, prior to the roofing material installation, as a formal submittal for verification that the work has been completed.

PART 2 - PRODUCTS

2.1 CODE INFORMATION

- A. This project is subject to the wind bracing requirements of the codes listed above. The following criteria are applicable to this project:
 - 1. Basic Design Wind Speed (V): 120 mph.
 - 2. Risk Category: III
 - 3. Exposure Category: B
 - 4. Height and Exposure Adjustment Coefficient: N/A - Building height is less than 60 ft.

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2.2 WIND BRACING AND SUPPORT OF SYSTEMS AND COMPONENTS

A. General:

1. Design analysis shall include calculated dead loads, wind loads, and capacity of materials utilized for the connection of the equipment or system to the structure.
2. Analysis shall detail anchoring methods, fastener sizes and spacing, etc.
3. All wind restraint devices shall be designed to accept without failure the forces calculated per the applicable building code and as summarized in Section 2.1.

B. Friction from gravity loads shall not be considered resistance to wind forces.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Wind Restraint of Piping:

1. All restraint systems shall be installed in strict accordance with the wind restraint design submittal.
2. Installation of restraints shall not cause any change in position of equipment or piping, resulting in stresses or misalignment.

B. Wind Restraint of Ductwork and Equipment:

1. All restraint systems shall be installed in strict accordance with the wind restraint design submittal.
2. The interaction between mechanical and electrical equipment and the supporting structures shall be designed into the restraint systems.
3. Installation of restraints shall not cause any change in position of equipment or ductwork, resulting in stresses or misalignment.
4. Exhaust fans with hinge kits shall have wind restraint fasteners installed on the hinged side, same as the three (3) non-hinged sides.
5. No rigid connections between equipment and the building structure shall be made that degrade the noise and vibration-isolation system specified.
6. Do not install any equipment or duct that makes rigid connections with the building unless isolation is not specified.

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7. Prior to installation, bring to the Architect's/Engineer's attention any discrepancies between the specifications and the field conditions, or changes required due to specific equipment selection.

END OF SECTION

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SECTION 23 05 53 - MECHANICAL IDENTIFICATION

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Provide labor, materials, equipment and services as required for the complete installation designed in Contract Documents.

1.2 QUALIFICATION

- A. All identification devices shall comply with ANSI/ASME A13.1 for lettering size, length of color field, colors and viewing angles.

1.3 SUBMITTALS

- A. Submit manufacturer's technical product data and installation instructions for each identification material and device. Submit valve schedule for each piping system typewritten on an 8-1/2 in. x 11 in. (minimum) indicating valve number, location, and valve function. Submit schedule of pipe, equipment and name identification for review before stenciling or labeling.

1.4 MAKES

- A. Allen Systems, Inc.; Brady (W.H.) Co.; Signmark Div.; Industrial Safety Supply Co., Inc.; Seton Name Plate Corp.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Provide manufacturer's standard products of categories and types required for each application. In cases where this is more than one type specified for an application, selection is installer's option, but provide single selection for each product category.
- B. All adhesives used for labels in the interior of the building shall comply with the maximum Volatile Organic Compound (VOC) limits as called for in the current version of U.S. Green Building Council LEED Credits EQ 4.1 and EQ 4.2.
- C. For work within an existing building, the mechanical identification shall meet the intent of this section, but match the Owner's existing identification symbology.

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2.2 PIPING IDENTIFICATION

A. Identification Types:

1. Pressure Sensitive Type: Provide manufacturer's standard pre-printed, permanent adhesive, color coded, pressure sensitive vinyl pipe markers complying with ANSI/ASME A13.1. Provide a 360° wrap of flow arrow tape at each end of pipe label.

O.D. Pipe or Covering	Letter Size
3/4 in., 1 in., 1-1/4 in.	1/2 in.
1-1/2 in., 2 in.	3/4 in.
2-1/2 in. and over	1 in.

B. Lettering:

1. Piping labeling shall conform to the following list:

Pipe Function	Identification
Heating Water Supply	HWS
Heating Water Return	HWR

2.3 VALVE IDENTIFICATION

A. Valve Tags:

1. Standard brass valve tags, 2 in. diameter with 1/2 in. high numerals. Identify between heating and plumbing services with 1/4 in. letters above the valve number. Lettering to be stamped and in-filled black. Seton, or equal.
 - a. Valve-tag Fasteners: Brass wire-link or beaded chain; or S-hook.

B. Valve Chart:

1. Provide valve chart for all valves tagged as a part of this project. Frame and place under clear glass. Hang in Mechanical Room.
2. Valve chart to include as a minimum, valve #, valve size, valve type, valve service description, valve location.

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2.4 EQUIPMENT LABELS

- A. Metal Labels for Equipment:
 - 1. Material and Thickness: Brass, 0.032 in. minimum thickness, and having predrilled or stamped holes for attachment hardware.
 - 2. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 in. by 3/4 in.
 - 3. Minimum Letter Size: 1/4 in. for name of units if viewing distance is less than 24 in., 1/2 in. for viewing distances up to 72 in. and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
 - 4. Fasteners: Stainless-steel rivets or self-tapping screws.
 - 5. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- B. Label Content: Include equipment's Drawing designation or unique equipment number.
- C. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2 in. x 11 in. bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.
- D. Provide for the following equipment:
 - 1. Air handling units
 - 2. Evaporative coolers

2.5 ABOVE CEILING EQUIPMENT LOCATOR

- A. 3/4 in. diameter adhesive stickers placed on ceiling grid. Color coded. Provide for the following:
 - 1. HVAC valves - ORANGE
 - 2. VAV boxes or reheat coils - GREEN

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PART 3 - EXECUTION

3.1 GENERAL

- A. Provide valve tags for all valves provided on project, except for service valves at terminal equipment.
- B. Provide equipment tags for all equipment listed above.
- C. Provide above ceiling equipment locator stickers on ceiling grid for all equipment listed above.
- D. Provide piping identification with directional flow arrows for all piping on project, at maximum intervals of 20 ft. For piping installed through rooms, provide at least one pipe label in each room, for each pipe function.

END OF SECTION

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SECTION 23 05 93 - TESTING, ADJUSTING AND BALANCING

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Provide labor, materials, equipment and services to perform operations required for complete adjusting and balancing Work as required in Contract Documents.
- B. This Section specifies the requirements and procedures of, mechanical systems testing, adjusting, and balancing. Requirements include measurement and establishment of the fluid quantities of the mechanical systems as required to meet design specifications, and recording and reporting the results.
- C. Test, adjust, and balance the following mechanical systems:
 - 1. Supply air systems, all pressure ranges; including constant volume and variable volume systems.
 - 2. Return air systems.
 - 3. Exhaust air systems; including kitchen exhaust systems.
 - 4. Hydronic systems; including constant flow and variable flow systems.
- D. This Section does not include:
 - 1. Testing boilers and pressure vessels for compliance with safety codes;
 - 2. Specifications for materials for patching mechanical systems;
 - 3. Specifications for materials and installation of adjusting and balancing devices. If devices must be added to achieve proper adjusting and balancing, refer to the respective system sections for materials and installation requirements.
 - 4. Requirements and procedures for piping and ductwork systems leakage tests.

1.2 SUBMITTALS

- A. Provide information in report form listing items required by specifications. Results shall be guaranteed. Contractor shall be subject to recall to site to verify report information before acceptance of the report by the Owner's Representative.

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- B. Strategies and Procedures Plan: Within thirty (30) days of Contractor's Notice to Proceed, submit testing and balancing strategies and step-by-step procedures as specified in Section 3.1.B, "Preparation", and consistent with those listed in Part 3 of this specification.
- C. System Readiness Checklists: Within thirty (30) days of Contractor's Notice to Proceed, AABC agency shall provide system readiness checklists as specified in Section 3.1.C, "Preparation", to be used and filled out by the installing contractors verifying that systems are ready for Testing and Balancing.
- D. Examination Report: Provide a summary report of the examination review required in Section 3.1.D to the Engineer, documenting issues that may preclude the proper testing and balancing of the systems.
- E. Certified report format shall consist of the following:
 - 1. Title sheet with job name, contractor, engineer, date, balance contractor's name, address, telephone number and contact person's name and the balancing technician's name.
 - 2. Individual test sheets for air handlers, terminal units, air distribution, exhaust fans, duct traverses, pumps, air handling coils, reheat coils, radiation, convectors, cabinet unit heaters and unit ventilators.
 - 3. Manufacturer's pump and fan curves for equipment installed with design and actual operating conditions indicated.
 - 4. TAB Report Forms: Use standard forms from AABC's "National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems" or NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" or TABB's "Testing, Adjusting and Balancing Bureau".

1.3 DEFINITIONS

- A. System testing, adjusting and balancing is the process of checking and adjusting all the building environmental systems to produce the design objectives. It includes:
 - 1. The balance of air and water distribution;
 - 2. Adjustment of total system to provide design quantities;
 - 3. Electrical measurement;
 - 4. Verification of performance of all equipment and automatic controls.

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- B. Test: To determine quantitative performance of equipment.
- C. Adjust: To regulate the specified fluid flow rate and air patterns at the terminal equipment (e.g., reduce fan speed, throttling).
- D. Balance: To proportion flows within the distribution system (submains, branches, and terminals) according to specified design quantities.
- E. Procedure: Standardized approach and execution of sequence of work operations to yield reproducible results.
- F. Report Forms: Test data sheets arranged for collecting test data in logical order for submission and review. This data should also form the permanent record to be used as the basis for required future testing, adjusting, and balancing.
- G. Terminal: The point where the controlled fluid enters or leaves the distribution system. There are supply inlets on water terminals, supply outlets on air terminals, return outlets on water terminals, and exhaust or return supply or outside air inlets or outlets on terminals such as registers, grilles, diffusers, and louvers.
- H. Main: Duct or pipe containing the system's major or entire fluid flow.
- I. Submain: Duct or pipe containing part of the systems' capacity and serving two or more branch mains.
- J. Branch Main: Duct or pipe serving two or more terminals.
- K. Branch: Duct or pipe serving a single terminal.

1.4 QUALIFICATIONS

- A. Follow procedures and methods published by one or more of the following:
 - 1. Associated Air Balance Council (AABC) or National Environmental Balancing Bureau (NEBB) or Testing, Adjusting and Balancing Bureau (TABB).
 - 2. Individual manufacturer requirements and recommendations.
- B. Maintain qualified personnel at project for system operation and trouble shooting. TAB contractor shall change sheaves and perform mechanical adjustments in conjunction with balancing procedure.
- C. Balancing contractor shall be current member of AABC or NEBB.

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- D. Instrumentation Type, Quantity, Accuracy, and Calibration: As described in the *AABC National Standards for Total System Balance and SMACNA TAB Procedural Guide*.

1.5 GENERAL REQUIREMENTS

- A. Before concealment of systems visit the job site to verify and advise on type and location of balancing devices and test points. Make changes as required to balance facilities.
- B. Place systems in satisfactory operating condition.
 - 1. Adjusting and balancing shall be accomplished as soon as the systems are complete and before Owner takes possession.
 - 2. Prior to balancing, adjust balancing devices for full flow; fill, vent and clean hydronic systems, replace temporary filters and strainers.
 - 3. Initial adjustment and balancing to quantities as called for or as directed by the engineer, to satisfy job conditions.
 - 4. All outdoor conditions (Db, Wb, and a description of the weather conditions) at the time of testing shall be documented in the report.
 - 5. Provide sheaves and belts as required to meet system performance requirements for all belt-driven fan motors 10 HP and greater. Adjust and align sheaves to obtain proper settings and operation. Verify motors are not overloading.
 - 6. Installing contractor shall replace balancing cocks, flow balancers and dampers in new systems that cannot be manipulated to satisfy balancing requirements.
 - 7. Identify flow balancers, balancing cocks and dampers in existing systems that cannot be manipulated to satisfy balancing requirements.
 - 8. Traverse main ducts to determine total system air quantities after all outlets have been set prior to final adjustment if the system does not meet design requirements. A sum of room CFM's is not acceptable.
 - 9. If duct construction and/or installation prohibits proper traverse readings, provide coil measurements at main coils and/or fresh air intake traverse with units operating in 100% outside air mode (where applicable).

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1.6 CONTRACTOR RESPONSIBILITIES

- A. Provide Testing and Balancing agency one complete set of contract documents, change orders, and approved submittals in digital and hard copy formats.
- B. Controls contractor shall provide required BAS hardware, software, personnel and assistance to Testing and Balancing agency as required to balance the systems. Controls Contractor shall also provide trending report to demonstrate that systems are complete.
- C. Coordinate meetings and assistance from suppliers and contractors as required by Testing and Balancing agency.
- D. Provide additional valves, dampers, sheaves and belts as required by Testing and Balancing agency.
- E. Flag all manual volume dampers with fluorescent or other high-visibility tape.
- F. Provide access to all dampers, valves, test ports, nameplates and other appurtenances as required by Testing and Balancing agency.
- G. Installing contractor shall replace or repair insulation as required by Testing and Balancing agency.
- H. Have the HVAC systems at complete operational readiness for Testing and Balancing to begin. As a minimum verify the following:
 - 1. Airside:
 - a. All ductwork is complete with all terminals installed.
 - b. All volume, smoke and fire dampers are open and functional.
 - c. Clean filters are installed.
 - d. All fans are operating, free of vibration, and rotating in correct direction.
 - e. ASD start-up is complete and all safeties are verified.
 - f. System readiness checklists are completed and returned to Testing and Balancing agency.
 - 2. Hydronics:
 - a. Piping is complete with all terminals installed.

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- b. Water treatment is complete.
 - c. Systems are flushed, filled and air purged.
 - d. Strainers are pulled and cleaned.
 - e. Control valves are functioning per the sequence of operation.
 - f. All shutoff and balance valves have been verified to be 100% open.
 - g. Pumps are started, and proper rotation is verified.
 - h. Pump gauge connections are installed directly at the pump inlet and outlet flange or in discharge and suction pipe prior to any valves or strainers.
 - i. ASD start-up is complete and all safeties have been verified.
 - j. System readiness checklists are completed and returned to Testing and Balancing agency.
- I. Promptly correct deficiencies identified during Testing and Balancing.
 - J. Maintain a construction schedule that allows the Testing and Balancing agency to complete work prior to occupancy.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

- A. Provide tools, ladders, recording meters, gauges, thermometers, velometers, anemometers, Pitot tubes, inclined gauge manometers, magnehelic gauges, amprobes, voltmeters, psychrometers and tachometers required.
- B. Instrumentation Calibration: Calibrate instruments at least every six (6) months or more frequently if required by instrument manufacturer.
 - 1. Keep an updated record of instrument calibration that indicates date of calibration and the name of party performing instrument calibration.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Examine Bid Documents and submittals and notify Owner's Representative and Engineer of any questions regarding balancing.

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1. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems' designs that may preclude proper Testing and Balancing of systems and equipment.
 2. Examine the approved submittals for HVAC systems and equipment.
 3. Examine equipment performance data including fan and pump curves.
- B. Prepare a Testing and Balancing Strategies and Procedures Plan that includes:
1. Equipment and systems to be tested.
 2. Strategies and step-by-step procedures for balancing the systems.
 3. Instrumentation to be used.
 4. Sample forms with specific identification for all equipment.
- C. Prepare system-readiness checklists, as described in the *AABC National Standards for Total System Balance and SMACNA TAB Procedural Guide*, for use by contractors in verifying system readiness for Testing and Balancing. These shall include, at a minimum:
1. Airside:
 - a. All ductwork is complete with all terminals installed.
 - b. All volume, smoke and fire dampers are open and functional.
 - c. Clean filters are installed.
 - d. All fans are operating, free of vibration, and rotating in correct direction.
 - e. Permanent electrical power wiring and ASD start-up is complete and all safeties are verified.
 - f. Automatic temperature-control systems are operational.
 - g. Ceilings are installed.
 - h. Windows and doors are installed.
 - i. Suitable access to balancing devices and equipment is provided.
 - j. Equipment and duct access doors are securely closed.

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2. Hydronics:
 - a. Piping is complete with all terminals installed.
 - b. Water treatment is complete.
 - c. Systems are flushed, filled and air purged.
 - d. Strainers are pulled and cleaned.
 - e. Control valves are functioning per the sequence of operation.
 - f. All shutoff and balance valves have been verified to be 100% open.
 - g. Pumps are started and proper rotation is verified.
 - h. Pump gauge connections are installed directly at the pump inlet and outlet flange or in discharge and suction pipe prior to any valves or strainers.
 - i. Permanent electrical power wiring and ASD start-up is complete and all safeties are verified.
 - j. Suitable access to balancing devices and equipment is provided.
- D. Examine construction and notify Owner's Representative and Engineer of outstanding issues related to balancing, as part of "Examination Report" submittal.
 1. Examine ceiling plenums and underfloor air plenums used for supply, return, or relief air to verify that they are properly separated from adjacent areas.
 2. Examine HVAC equipment and verify that bearings are greased, belts are aligned and tight, clean permanent filters are installed, and controls are ready for operation.
 3. Examine terminal units, such as variable-air-volume boxes, and verify that they are accessible and their controls are connected, configured by the controls contractor and functioning.
 4. Examine strainers to verify that Mechanical Contractor has replaced startup screens with permanent screens and that all strainers have been cleaned.
 5. Examine two-way valves for proper installation and function.

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6. Examine three-way valves for proper installation for their intended function of diverting or mixing fluid flows.
7. Examine heat-transfer coils for correct piping connections and for clean and straight fins.
8. Examine air vents to verify that mechanical contractor has removed all air from all hydronic systems.
9. Examine systems for installed balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, weld-o-lets, and manual volume dampers prior to pressure testing. Note the locations of devices that are not accessible for testing and balancing.

3.2 GENERAL PROCEDURES FOR TESTING AND BALANCING

- A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems" or NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" or TABB's "SMACNA TAB Procedural Guide" and this Section.
- B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary to allow adequate performance of procedures. After testing and balancing, close probe holes and patch insulation with new materials identical to those removed. Restore vapor barrier and finish according to insulation Specifications for this Project.
- C. Mark equipment and balancing device settings with paint or other suitable, permanent identification material, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, to show final settings.
- D. Take and report testing and balancing measurements in inch-pound (IP) units.

3.3 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

- A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.
- B. Prepare schematic diagrams of systems' "as-built" duct layouts.
- C. For variable-air-volume systems, develop a plan to simulate diversity.

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- D. Determine the best locations in main and branch ducts for accurate duct airflow measurements.
- E. Check airflow patterns from the outside-air louvers and dampers and the return and exhaust-air dampers, through the supply-fan discharge and mixing dampers.
- F. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.
- G. Verify that motor starters are equipped with properly sized thermal protection.
- H. Check dampers for proper position to achieve desired airflow path.
- I. Check for airflow blockages.
- J. Check condensate drains for proper connections and function.
- K. Check for proper sealing of air-handling unit components.
- L. Check for proper sealing of air duct system.

3.4 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

- A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.
 - 1. Measure fan static pressures to determine actual static pressure as follows:
 - a. Measure outlet static pressure as far downstream from the fan as practicable and upstream from restrictions in ducts such as elbows and transitions.
 - b. Measure static pressure directly at the fan outlet or through the flexible connection.
 - c. Measure inlet static pressure of single-inlet duct as near the fan as possible, upstream from flexible connection and downstream from duct restrictions.
 - d. Measure inlet static pressure of double-inlet fans through the wall of the plenum that houses the fan.
 - 2. Measure static pressure across each component that makes up an air-handling unit, rooftop unit, and other air-handling and treating equipment.

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3. Measure static pressures entering and leaving other devices such as sound traps, heat recovery equipment, and air washers, under final balanced conditions.
 4. Compare design data with installed conditions to determine variations in design static pressures versus actual static pressures. Compare actual system effect factors to identify where variations occur. Recommend corrective action to align design and actual conditions.
 5. Obtain approval from Engineer for adjustment of fan speed higher or lower than indicated speed. Make required adjustments to sheaves sizes, motor sizes, and electrical connections to accommodate fan-speed changes.
 6. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload will occur. Measure amperage in full cooling, full heating, economizer, and any other operating modes to determine the maximum required brake horsepower.
- B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows within specified tolerances.
1. Measure static pressure at a point downstream from the balancing damper and adjust volume dampers until the proper static pressure is achieved.
 - a. Where sufficient space in submain and branch ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow for that zone.
 2. Re-measure each submain and branch duct after all have been adjusted. Continue to adjust submain and branch ducts to indicated airflows within specified tolerances.
- C. Measure terminal outlets and inlets without making adjustments.
1. Measure terminal outlets using a direct-reading hood or outlet manufacturer's written instructions and calculating factors.
- D. Adjust terminal outlets and inlets for each space to indicated airflows within specified tolerances of indicated values. Make adjustments using volume dampers rather than extractors and the dampers at air terminals.

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1. Adjust each outlet in same room or space to within specified tolerances of indicated quantities without generating noise levels above the limitations prescribed by the Contract Documents.
2. Adjust patterns of adjustable outlets for proper distribution without drafts.

3.5 PROCEDURES FOR VARIABLE-AIR-VOLUME SYSTEMS

- A. Compensating for Diversity: When the total airflow of all terminal units is more than the indicated airflow of the fan, place a selected number of terminal units at a maximum set-point airflow condition until the total airflow of the terminal units equals the indicated airflow of the fan. Select the reduced airflow terminal units so they are distributed evenly among the branch ducts.
- B. Pressure-Independent, Variable-Air-Volume Systems: After the fan systems have been adjusted, adjust the variable-air-volume systems as follows:
 1. Set outside-air dampers at minimum, and return-and exhaust-air dampers at a position that simulates full-cooling load.
 2. Select the terminal unit that is most critical to the supply-fan airflow and static pressure. Measure static pressure. Adjust system static pressure so the entering static pressure for the critical terminal unit is not less than the sum of terminal-unit manufacturer's recommended minimum inlet static pressure plus the static pressure needed to overcome terminal-unit discharge system losses.
 3. Measure total system airflow. Adjust to within indicated airflow.
 4. Set terminal units at maximum airflow and adjust controller or regulator to deliver the designed maximum airflow. Use terminal-unit manufacturer's written instructions to make this adjustment. When total airflow is correct, balance the air outlets downstream from terminal units as described for constant-volume air systems.
 5. Set terminal units at minimum airflow and adjust controller or regulator to deliver the designed minimum airflow. Check air outlets for a proportional reduction in airflow as described for constant-volume air systems.
 - a. If air outlets are out of balance at minimum airflow, report the conditions but leave outlets balanced for maximum airflow.
 6. Re-measure the return airflow to the fan while operating at maximum return airflow and minimum outside airflow. Adjust the fan and balance the return-air ducts and inlets as described for constant-volume air systems.

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7. Measure static pressure at the most critical terminal unit and adjust the static-pressure controller at the main supply-air sensing station to ensure that the adequate static pressure is maintained at the most critical unit.
 8. Record the final fan performance data.
- C. Pressure-Dependent, Variable-Air-Volume Systems with Diversity: After the fan systems have been adjusted, adjust the variable-air-volume systems as follows:
1. Set system at maximum indicated airflow by setting the required number of terminal units at minimum airflow. Select the reduced airflow terminal units so they are distributed evenly among the branch ducts.
 2. Adjust supply fan to maximum indicated airflow with the variable-airflow controller set at maximum airflow.
 3. Set terminal units at full-airflow condition.
 4. Adjust terminal units starting at the supply-fan end of the system and continuing progressively to the end of the system. Adjust inlet dampers of each terminal unit to indicated airflow. When total airflow is correct, balance the air outlets downstream from terminal units as described for constant-volume air systems.
 5. Adjust terminal units for minimum airflow.
 6. Measure static pressure at the sensor.
 7. Measure the return airflow to the fan while operating at maximum return airflow and minimum outside airflow. Adjust the fan and balance the return-air ducts and inlets as described for constant-volume air systems.

3.6 GENERAL PROCEDURES FOR HYDRONIC SYSTEMS

- A. Prepare test reports for pumps, coils and heat exchangers. Obtain approved submittals and any manufacturer-recommended testing procedures. Cross check the summation of required coil and heat exchanger gpm's with pump design flow rate.
- B. Verify that hydronic systems are ready for testing and balancing:
1. Check liquid level in expansion tank and verify that tank is set to specified pressure for system fill and expansion.
 2. Check that makeup water has adequate pressure to highest vent.
 3. Check that control valves are in their proper positions.

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4. Check that air has been purged from the system.
5. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.
6. Verify that motor starters are equipped with properly sized thermal protection.

3.7 PROCEDURES FOR CONSTANT-FLOW HYDRONIC SYSTEMS

- A. Adjust pumps to deliver total design gpm.
 1. Measure total water flow.
 - a. Position valves for full flow through coils.
 - b. Measure flow by main flow meter, if installed.
 - c. If main flow meter is not installed, determine flow by pump total dynamic head (TDH) or exchanger pressure drop.
 2. Measure pump TDH as follows:
 - a. Measure discharge pressure directly at the pump outlet flange or in discharge pipe prior to any valves or fittings.
 - b. Measure inlet pressure directly at the pump inlet flange or in suction pipe prior to any valves or strainers.
 - c. Convert pressure to head and correct for differences in gauge heights.
 - d. On single stage centrifugal pumps, verify pump impeller size by measuring the TDH with the discharge valve closed. Note the point on manufacturer's pump curve at zero flow and verify that the pump has the intended impeller size.
 - e. With all valves open, read pump TDH. Adjust pump discharge valve until design water flow is achieved.
 3. Monitor motor performance during procedures and do not operate motor in an overloaded condition.
- B. Adjust flow measuring devices installed in mains and branches to design water flows.
 1. Measure flow in main and branch pipes.

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2. Adjust main and branch balance valves for design flow.
3. Re-measure each main and branch after all have been adjusted if requested by Engineer.
- C. Adjust flow measuring devices installed at terminals for each space to design water flows.
 1. Measure flow at all terminals.
 2. Adjust each terminal to design flow.
 3. Re-measure each terminal after all have been adjusted, if requested by Engineer.
 4. Position control valves to bypass the coil and adjust the bypass valve to maintain design flow.
 5. Perform temperature tests after all flows have been balanced, if requested by Engineer.
- D. For systems with pressure-independent valves at the terminals:
 1. Measure differential pressure and verify that it is within manufacturer's specified range.
 2. Perform temperature tests after all flows have been verified.
- E. For systems without pressure-independent valves or flow measuring devices at the terminals:
 1. Measure and balance coils by either coil pressure drop or temperature method.
 2. If balanced by coil pressure drop, perform temperature tests after all flows have been verified, if requested by Engineer.
- F. Verify final system conditions as follows:
 1. Re-measure and confirm that total water flow is within design.
 2. Re-measure all final pump operating data, TDH, volts, amps, static profile.
 3. Mark all final settings.
- G. Verify that all memory stops have been set.

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3.8 PROCEDURES FOR VARIABLE-FLOW HYDRONIC SYSTEMS

- A. Adjust the variable-flow hydronic system as follows:
 - 1. Verify that the differential pressure (DP) sensor is located per the Contract Documents.
 - 2. Determine if there is diversity in the system.
- B. For systems with no diversity:
 - 1. Follow procedures outlined for constant-flow hydronic systems.
 - 2. Prior to verifying final system conditions, determine the system DP setpoint.
 - 3. If the pump discharge valve was used to set total system flow with ASD at 60 Hz, at completion open discharge valve 100% and allow ASD to control system DP setpoint. Record pump data under both conditions.
 - 4. Mark all final settings and verify that all memory stops have been set.
- C. For systems with diversity:
 - 1. Determine diversity factor.
 - 2. Simulate system diversity by closing required number of control valves, as approved by the design Engineer.
 - 3. Follow procedures outlined for constant flow hydronic systems.
 - 4. Open control valves that were shut. Close a sufficient number of control valves that were previously open to maintain diversity, and balance the terminals that were just opened.
 - 5. Prior to verifying final system conditions, determine the system DP setpoint.
 - 6. If the pump discharge valve was used to set total system flow with ASD at 60 Hz, at completion open discharge valve 100% and allow ASD to control system DP setpoint. Record pump data under both conditions.
 - 7. Mark all final settings and verify that all memory stops have been set.

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- D. For systems with pressure-independent valves at the terminals:
 - 1. Measure differential pressure and verify that it is within manufacturer's specified range.
 - 2. Perform temperature tests after all flows have been verified.

3.9 PROCEDURES FOR STEAM SYSTEMS

- A. Measure and record upstream and downstream pressure of each piece of equipment using installed gauges.
- B. Measure and record upstream and downstream steam pressure of pressure-reducing valves using installed gauges.
- C. Check the setting and operation of automatic temperature -control valves, self-contained control valves, and pressure-reducing valves. Record the final setting.
- D. Check the settings and operation of each safety valve. Record settings.
- E. Verify the operation of each steam trap.

3.10 PROCEDURES FOR COMMERCIAL KITCHEN HOODS

- A. Measure, adjust and record the airflow of each kitchen hood. For kitchen hoods designed with integral make-up air, measure and adjust the exhaust and make-up airflow. Measure airflow by duct Pitot-tube traverse. If a duct Pitot-tube traverse is not possible, provide an explanation in the report of the reason(s) why and also the reason why the method used was chosen.
 - 1. Install welded test ports in the sides of the exhaust duct for the duct Pitot-tube traverse. Install each test port with a threaded cap that is liquid tight.
 - 2. Recommend means to adjust airflow to achieve design values where exhaust fans serve multiple hoods.
 - 3. Installing contractor shall provide recommendations as required by Engineer.
- B. Visually inspect the hood exhaust duct throughout its entire length in compliance with authorities having jurisdiction. Begin at the hood connection and end at the point it discharges outdoors. Report findings.
 - 1. Check duct slopes as required.
 - 2. Verify that duct access is installed as required.

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3. Perform a light test or an approved equivalent test method to determine that all welded and brazed joints are liquid tight. Test shall be performed by passing a lamp having a power rating of not less than 100 watts through the entire section of ductwork to be tested. The lamp shall be open as to emit light equally in all directions perpendicular to duct walls. Test every joint in the entire duct system, including the hood-to-duct connection. Ductwork may be tested in sections provided that every joint is tested.
 4. Verify that point of termination is as required.
 5. Verify that duct air velocity is within the range required.
 6. Prior to concealment of any portion of the grease-duct system, perform a duct leakage test in the presence of the code official.
 7. Verify that duct is within a fire-rated enclosure.
- C. After balancing is complete, do the following:
1. Measure and record the static pressure at the hood exhaust-duct connection.
 2. Measure and record the hood face velocity. Make measurements at multiple points across the face of the hood. Perform measurements at a maximum of 12 in. between points and between any point and the perimeter. Calculate the average of the measurements recorded. Verify that the hood average face velocity complies with the Contract Documents and governing codes.
 3. Field test the hood for capture and containment of smoke using a smoke emitting device. Observe the smoke pattern. Make adjustments to room airflow patterns to achieve optimum results. The field test shall be conducted with all appliances under the hood at operating temperatures, with all sources of outdoor air providing make-up air for the hood operating, and with all sources of recirculated air providing conditioning for the space in which the hood is located operating.
- D. Report deficiencies.

3.11 PROCEDURES FOR LABORATORY FUME HOODS

- A. Before performing laboratory fume hood testing, measure, adjust and record the supply airflow and airflow patterns of each supply air outlet that is located in the same room as the hood. Adjust the air outlet flow pattern to minimize turbulence and to achieve the desired airflow patterns at the face and inside the hood.

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Verify that adequate make-up air is available to achieve the indicated flow of the hood.

- B. Measure, adjust and record the airflow of each laboratory fume hood by duct Pitot-tube traverse with the laboratory fume hood sash in the design open position.
 - 1. For laboratory fume hoods installed in variable exhaust systems, measure, adjust, and record the hood exhaust airflow at maximum and at minimum airflow conditions.
 - 2. For laboratory fume hoods designed with integral make-up air, measure, adjust, and record the exhaust and make-up airflow.
- C. For laboratory fume hoods that are connected to centralized exhaust systems using automatic dampers, adjust the damper controller to obtain the indicated exhaust airflow.
- D. After balancing is complete, do the following:
 - 1. Measure and record the static pressure at the hood duct connection with the hood operating at indicated airflow.
 - 2. Measure and record the face velocity across the open sash face area. Measure the face velocity at each point in a grid pattern. Perform measurements at a maximum of 12 in. between points and between any point and the perimeter of the opening.
 - a. For laboratory fume hoods designed to maintain a constant face velocity at varying sash positions, also measure and record the face velocity at 50 and 25 percent of the design open sash position.
 - b. Calculate and report the average face velocity by averaging all velocity measurements.
 - c. Calculate and report the exhaust airflow by multiplying the calculated average face velocity by the sash open area. Compare this quantity with the exhaust airflow measured by duct Pitot-tube traverse. Report differences.
 - d. If the average face velocity is less than the indicated face velocity, retest the average face velocity and adjust hood baffles, fan drives, and other parts of the system to provide the indicated average face velocity.

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3. Check each laboratory fume hood for the capture and containment of smoke by using a hand-held emitting device. Observe the capture and containment of smoke flow pattern across the open face and inside the hood. Make adjustments necessary to achieve the desired results.
- E. With the room and laboratory fume hoods operating at indicated conditions all fume hoods installed shall be tested to current ASHRAE 110 Standard. Field test reports must be performed and prepared by an independent third party organization having no affiliation with the manufacturer. Results must indicate tracer gas performance ratings of 4.0 AI 0.05 or better for all tests. Manufacturer must have a representative on-site for all tests and must assist in trouble-shooting and correcting all non-conforming hoods.
- F. Mannequin-as-Person Test: This test is intended to simulate real-world laboratory conditions in which a real person manipulates real objects in the hood. This test is performed with the investigator standing in front of the ejector while repeatedly moving five (5) objects from one side of the ejector to the other, then rotating the body away from the hood with the elbows next to the body and the arms horizontal in front. This series of movements is repeated for the duration of the tracer gas test. The air sampling is performed with a sampling probe at the same height as the breathing zone of the mannequin. Results must indicate tracer gas performance ratings of 4.0 AI 0.10 or better for all tests.
- G. Testing Contractor to provide a complete report of the results of the testing program including an executive summary, an outline of the test procedures and equipment used, a table of the results of each test conducted on each hood and a conclusion and recommendation section discussing the results and (if necessary) recommendations to improve fume hood performance.

3.12 TOLERANCES

- A. Set HVAC system's air flow rates and water flow rates within the following tolerances:
 1. Supply, Return, and Exhaust Fans: Zero to plus 10 percent.
 2. Air Outlets and Inlets: Plus or minus 10 percent.
 3. Minimum Outside Air: Zero to plus 10 percent.
 4. Maintaining pressure relationships as designed shall have priority over the tolerances specified above.
 5. Heating-Water Flow Rate: Plus or minus 10 percent.
 6. Cooling-Water Flow Rate: Plus or minus 10 percent.

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3.13 FINAL TEST AND BALANCE REPORT

- A. The report shall be a complete record of the HVAC system performance, including conditions of operation, items outstanding, and any deviations found during the Testing and Balancing process. The final report also provides a reference of actual operating conditions for the owner and/or operations personnel. All measurements and test results that appear in the reports must be made on site and dated by the technicians or Test and Balance Engineers.
- B. The report must be organized by systems and shall include the following information as a minimum:
 - 1. Title Page:
 - a. AABC or NEBB Certified Company Name.
 - b. Company Address.
 - c. Company Telephone Number.
 - d. Project Identification Number.
 - e. Location.
 - f. Project Architect.
 - g. Project Engineer.
 - h. Project Contractor.
 - i. Project Number.
 - j. Date of Report.
 - k. Certification Statement.
 - l. Name, Signature, and Certification Number.
 - 2. Table of Contents.
 - 3. National Performance Guaranty.
 - 4. Report Summary:
 - a. The summary shall include a list of items that do not meet design tolerances, with information that may be considered in resolving deficiencies.

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5. Instrument List:
 - a. Type
 - b. Manufacturer
 - c. Model
 - d. Serial Number
 - e. Calibration Date

C. Required air side data - Test, adjust and record the following:

1. Motors:
 - a. RPM
 - b. BHP
 - c. Full load amps
 - d. Sheave sizes, number and size of belts
 - e. Shaft diameter
 - f. Complete nameplate data
2. Fans:
 - a. Cfm
 - b. RPM
 - c. Suction static pressure
 - d. Discharge static pressure
 - e. Sheave sizes, number and size of belts, key sizes, shaft, diameter
 - f. Complete nameplate data
 - g. Sketch of system's inlet and outlet connections
 - h. Location of test port
3. Duct: Traverse Zones:
 - a. Cfm
 - b. Static Pressure
4. AHU - (In both minimum O.A. and economizer modes):
 - a. Minimum outdoor air Cfm
 - b. Total discharge and return Cfm
 - c. Static profile thru unit
 - d. Complete nameplate data
5. VAV Boxes:
 - a. Minimum Cfm
 - b. Maximum Cfm

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6. Registers/Grilles/Diffusers:
 - a. Cfm
 - b. Set, adjust and record air flow pattern
7. Filter Banks:
 - a. Nameplate data
 - b. Static pressure drop
- D. Required Fluid Data: Test, adjust and record the following:
 1. Heat Transfer Devices: Including, but not limited to air handlers, convectors, fin tube radiation sections, unit ventilators, fan coils, cabinet heaters, unit heaters, heat pumps, heat exchangers.
 - a. GPM (coil and bypass)
 - b. Entering water temperature
 - c. Leaving water temperature
 - d. Water pressure drop
 - e. Complete nameplate data
 2. Pumps:
 - a. Check rotation
 - b. GPM
 - c. Pump off pressures (suction and discharge)
 - d. Running suction pressure
 - e. Running discharge pressure
 - f. Running load amps
 - g. RPM - motor
 - h. Complete nameplate motor and pump
 - i. Marked up pump curve illustrating final operating conditions
 3. Heat Exchanger:
 - a. GPM
 - b. Entering water temperature and pressure
 - c. Leaving water temperature and pressure
 - d. Complete nameplate data
 - e. Entering steam pressure
- E. The final test and balance report shall be provided as a formal project submittal for review by the Engineer of Record.

END OF SECTION

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SECTION 23 07 10 - INSULATION

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Provide labor, materials, equipment and services to perform operations required for the complete installation and related Work as required in Contract Documents.

1.2 SUBMITTAL

- A. Submit product data, product description, manufacturer's installation instructions, types and recommended thicknesses for each application, and location of materials.

1.3 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 232010 - Piping Systems and Accessories.
- B. Section 233100 - Sheet Metal and Ductwork Accessories Construction.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Insulation, jackets, adhesive, and coatings shall comply with the following:
 - 1. Treatment of jackets or facing for flame and smoke safety must be permanent. Water-soluble treatments not permitted.
 - 2. Insulation, including finishes and adhesives on the exterior surfaces of ducts, pipes, and equipment, shall have a flame spread rating of 25 or less and a smoke developed rating of 50 or less, when tested in accordance with ASTM E84 or UL 723.
 - a. Plenums: Insulation materials shall be non-combustible or listed and labeled per ASTM E84 or UL 723.
 - 3. Asbestos or asbestos bearing materials are prohibited.
 - 4. Comply with 2020 Energy Conservation Construction Code of New York State.
 - 5. All adhesives, coatings and sealants used for insulation in the interior of the building shall comply with the maximum Volatile Organic Compound

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(VOC) limits as called for in the current version of U.S. Green Building Council LEED Credits EQ 4.1 and EQ 4.2.

6. Provide materials which are the standard products of manufacturers regularly engaged in the manufacture of such products and that essentially duplicate items that have been in satisfactory use for at least two (2) years prior to bid opening. Provide insulation systems in accordance with the approved MICA or NAIMA Insulation Standards.
7. Insulation shall be clearly marked with manufacturer's name, identification of installed thermal resistance (R) value, out-of-package R value, flame spread and smoke developed indexes in accordance with Energy Code requirements.

2.2 ACCEPTABLE MANUFACTURERS

- A. Fiberglass: Knauf/Manson, Johns Manville, Owen-Corning, Certainteed. (Board, Blanket and Liner)
- B. Polyisocyanurate: Dow Trymer 2000XP, HyTherm.
- C. Calcium Silicate: Industrial Insulation Group (ILG).
- D. Flexible Elastomeric: Armacell, K-Flex.
- E. Adhesives, Coatings, Mastics, Sealants: Childers, Foster.

2.3 PIPE INSULATION (RIGID FIBERGLASS TYPE)

- A. Product meeting ASTM C 547, ASTM C 585, and ASTM C 795; rigid, molded, noncombustible.
- B. 'K' Value: ASTM C 335, 0.23 at 75°F mean temperature installed value. Maximum Service Temperature: 1000°F.
- C. Vapor Retarder Jacket: ASJ/SSL conforming to ASTM C 1136 Type I, secured with self-sealing longitudinal laps and butt strips.
- D. Field-Applied PVC Fitting Covers with Flexible Fiberglass Insulation: Proto Corporation 25/50 or Indoor/Outdoor, UV-resistant fittings, jacketing and accessories, white or colored. Fitting cover system consists of pre-molded, high-impact PVC materials with blanket type fiberglass wrap inserts. Blanket fiberglass wrap inserts shall have a thermal conductivity ('K') of 0.26 at 75°F mean temperature. Closures to be stainless steel tacks, matching PVC tape, or PVC adhesive per manufacturer's recommendations.

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- E. Prefabricated Thermal Insulating Fitting Covers: Comply with ASTM C 450 for dimensions used in pre-forming insulation to cover valves, elbows, tees, and flanges.

2.4 PIPE INSULATION (RIGID POLYISOCYANURATE TYPE)

- A. Preformed Rigid Polyisocyanurate Insulation: Cellular foam complying with ASTM C591, rigid molded, non-combustible. 2 lb./ft³ nominal density. Maximum thermal conductivity (k) shall be 0.19 BTU-in/ft² hr. °F at 75°F mean temperature. Maximum Service Temperature; 300°F.
- B. Vapor Retarder Jacket; Dow Saran Vapor Retarder Film and Tape.
- C. Covering Jacket; White Kraft outer surface bonded to aluminum foil and reinforced with fiberglass yarn.

2.5 FLEXIBLE TYPE INSULATION

- A. Flexible Elastomeric Thermal Insulation: Closed-cell, foam material. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials. Maximum thermal conductivity (k) shall be 0.27 BTU-in/ft² hr. °F at 75°F mean temperature. Adhesive: As recommended by insulation material manufacturer.

2.6 DUCT INSULATION

- A. Duct insulation shall have a thermal resistance (R) value identification mark by the manufacturer applied no less than every 10 ft., as per Energy Code requirements.
- B. Flexible Fiber Glass Blanket:
 - 1. Product meeting ASTM C 553 Types I, II and III, and ASTM C 1290; Greenguard compliant.
 - 2. 'K' Value of 0.27 at 75°F mean temperature. Maximum Service Temperature (Faced): 250°F.
 - 3. Vapor Retarder Jacket: FSK conforming to ASTM C 1136 Type II.
 - 4. Installation: Maximum allowable compression is 25%. Securement: Secured in place using outward cinching staples in combination with appropriate pressure-sensitive aluminum foil tape.
 - 5. Density: 0.75 or 1.0 PCF. See Exhibit II for the thickness requirement at each density.

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- C. Rigid Fiber Glass Board:
1. Product meeting ASTM C 612 Type IA and IB.
 2. 'K' Value of 0.23 at 75°F mean temperature. Maximum Service Temperature: 450° F.
 3. Vapor Retarder Jacket: ASJ conforming to ASTM C 1136 Type I, or FSK or PSK conforming to ASTM C 1136 Type II.
 4. Securement: Secured in place using adhesive and mechanical fasteners spaced a minimum of 12 in. on center with a minimum of 2 rows per side of duct. Insulation shall be secured with speed washers and all joints, breaks and punctures sealed with appropriate pressure-sensitive foil tape.
 - a. Concealed Areas: Minimum 3 lb./ft.³.
 - b. Exposed Areas: 6 lb./ft.³ minimum density for duct less than 8 ft. - 0 in. above finished floor.

2.7 FIELD-APPLIED JACKETS

- A. Piping:
1. PVC Pipe Jacket: High-impact, ultraviolet-resistant PVC; 20 mils thick; roll stock ready for shop or field cutting and forming. Adhesive: As recommended by insulation material manufacturer. PVC Jacket Color: White.
 2. Aluminum Jacket: Factory cut and rolled to indicated sizes. Comply with ASTM B 209, 3003-alloy, and H-14 temper. Finish and Thickness: Corrugated finish, 0.010 inch thick. Moisture Barrier: 1-mil- thick, heat-bonded polyethylene and kraft paper. Elbows: Preformed, 45- and 90-degree, short- and long-radius elbows; same material, finish, and thickness as jacket.
 3. Stainless-Steel Jacket: ASTM A 666, Type 304 or 316; 0.10 inch thick; and factory cut and rolled to indicated sizes. Moisture Barrier: 3-mil-thick, heat-bonded polyethylene and kraft paper. Elbows: Gore type, for 45- and 90-degree elbows in same material, finish, and thickness as jacket. Jacket Bands: Stainless steel, Type 304, 3/4 inch wide.
 4. Alumaguard Jacketing: Self adhesive, 60 mil thick, rubberized bitumen, foil faced membrane. Polyguard Products, Inc. Alumaguard 60, or equal.
 5. Venture Guard Jacketing: 26.6 mil thick, Hypalon self adhesive membrane. Venture Tape Corp. Venture Guard, or equal.

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B. Ductwork:

1. Aluminum Jacket: Deep corrugated sheets manufactured from aluminum alloy complying with ASTM B 209, and having an integrally bonded moisture barrier over entire surface in contact with insulation. Metal thickness and corrugation dimensions are scheduled at the end of this Section. Finish: Cross-crimp corrugated or stucco embossed finish. Moisture Barrier: 1-mil- thick, heat-bonded polyethylene and kraft paper.
2. Stainless-Steel Jacket: Deep corrugated sheets of stainless steel complying with ASTM A 666, Type 304 or 316; 0.10 inch thick; and roll stock ready for shop or field cutting and forming to indicated sizes. Moisture Barrier: 1-mil- thick, heat-bonded polyethylene and kraft paper. Jacket Bands: Stainless steel, Type 304, 3/4 inch wide.
3. Alumaguard Jacketing: Self adhesive, 60 mil thick, rubberized bitumen, foil faced membrane. Polyguard Products, Inc. Alumaguard 60, or equal.
4. Venture Guard Jacketing: 26.6 mil thick, Hypalon self adhesive membrane. Venture Tape Corp. Venture Guard, or equal. To be used on the bottom surface of rectangular ducts greater than 24 in. wide, due to lesser jacket weight that will avoid sagging issues over time.

2.8 COATINGS, MASTICS, ADHESIVES AND SEALANTS

- A. Vapor Barrier Coatings: Used in conjunction with reinforcing mesh to coat insulation on below ambient services temperatures. Permeance shall be no greater than 0.08 perms at 45 mils dry as tested by ASTM F1249. Foster 30-65 Vapor Fas; Childers CP-34, or approved equal.
- B. Lagging Adhesives: Used in conjunction with canvas or glass lagging cloth to protect equipment/piping indoors. Foster 30-36 Sealfas; Childers CP-50AMV1 Chil Seal, or approved equal.
- C. Weather Barrier Mastic: Used outdoors to protect above ambient insulation from weather. Foster 46-50 Weatherite; Childers CP-10 Vi Cryl, or approved equal.
- D. Fiberglass Adhesive: Used bond low density fibrous insulation to metal surfaces. Shall meet ASTM C916 Type II. Foster 85-60; Childers CP-127, or approved equal.
- E. Elastomeric Insulation Adhesive: Used to bond elastomeric insulation. Foster 85-75; Childers CP-82, or approved equal.

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- F. Elastomeric Insulation Coating: Manufacturer's recommended water based coating used to protect outside of elastomeric insulation. ArmaFlex WB Finish, Foster 30-65, Childers CP-34 or approved equal.
- G. Insulation Joint Sealant: Used as a vapor sealant on below ambient piping with polyisocyanurate and cellular glass insulation. Foster 95-50; Childers CP-76, or approved equal.
- H. Metal Jacketing Sealant: Used as a sealant on metal jacketing seams to prevent water entry. Foster 95-44; Childers CP-76, or approved equal.
- I. Reinforcing Mesh: Used in conjunction with coatings/mastics to reinforce. Foster Mast A Fab; Childers Chil Glass #10, or approved equal.

2.9 MATERIALS AND SCHEDULES

- A. See Exhibits at the end of this section.

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

- A. All materials shall be installed by skilled labor regularly engaged in this type of work. All materials shall be installed in strict accordance with manufacturer's recommendations, building codes, and industry standards.
- B. Locate insulation and cover seams in the least visible location. All surface finishes shall be extended in such a manner as to protect all raw edges, ends and surfaces of insulation. No glass fibers shall be exposed to the air.
- C. All pipe and duct insulation shall be continuous through hangers, walls, ceiling and floor openings, and through sleeves, unless not allowed by Fire Stop System. Refer to Section 230500 "Basic Requirements" for Fire Stop Systems.
- D. Provide thermal insulation on clean, dry surfaces and after piping, ductwork and equipment (as applicable) have been tested. Do not cover pipe joints with insulation until required tests are completed.
- E. All cold surfaces that may "sweat" must be insulated. Vapor barrier must be maintained; insulation shall be applied with a continuous, unbroken moisture and vapor seal. All hangers, supports, anchors, or other projections that are secured to cold surfaces shall be insulated and vapor sealed to prevent condensation. Cover valves, fittings and similar items in each piping system with insulation as applied to adjoining pipe run. Extra care must be taken on piping appurtenances to insure a tight fit to the piping system. For permeable insulation types, piping systems with fluid temperatures below ambient, all vapor retarder jacket (ASJ) seams must be coated with vapor barrier coating. All associated elbows, fittings,

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valves, etc. must be coated with vapor barrier coating and reinforcing mesh to prevent moisture ingress. Valve extension stems require Elastomeric insulation that is tight fitting to the adjoining fiberglass system insulation. Pumps, strainers, air separators, drain valves, etc. must be totally encapsulated with Elastomeric insulation.

- F. Items such as boiler manholes, handholds, clean-outs, ASME stamp, and manufacturers' nameplates, may be left un-insulated unless omitting insulation would cause a condensation problem. When such is the case, appropriate tagging shall be provided to identify the presence of these items. Provide neatly beveled edges at interruptions of insulation.
- G. Provide protective insulation as required to prevent personnel injury: Piping from zero to seven feet above all floors and access platforms including hot (above 140°F) piping and any other related hot surface.
- H. All pipes shall be individually insulated.
- I. 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.

3.2 PIPE INSULATION

- A. Insulate piping systems including fittings, valves, flanges, unions, strainers, and other attachments installed in piping system, whether exposed or concealed
- B. Insulation installed on piping operating below ambient temperatures must have a continuous vapor retarder. All joints, seams and fittings must be sealed.
- C. Hanger Shields: Refer to Section 232010 "Piping Systems and Accessories".
- D. Metal shields shall be installed between hangers or supports and the piping insulation. Rigid insulation inserts shall be installed as required between the pipe and the insulation shields. Inserts shall be of equal thickness to the adjacent insulation and shall be vapor sealed as required.
 - 1. Pre-Insulated Type: Butt insulation to hanger shields and apply a wet coat of vapor barrier cement to the joints and seal with 3 in. wide vapor barrier tape.
 - 2. Field Insulated Type: Provide Hamfab Co. "H" blocks per manufacturers recommended spacing between pipe and shield.
 - 3. Tape shields to insulation.

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- E. Joints in section pipe covering made as follows:
1. All ends must be firmly butted and secured with appropriate butt-strip material. On high-temperature piping, double layering with staggered joints may be appropriate. When double layering, the inner layer should not be jacketed.
 2. Standard: Longitudinal laps and butt joint sealing strips cemented with white vapor barrier coating, or factory supplied pressure sensitive adhesive lap seal.
 3. Vapor Barrier: For cold services, Longitudinal laps and 4 in. vapor barrier strip at butt joints shall be sealed with white vapor barrier coating. Seal ends of pipe insulation at valves, flanges, and fittings with white vapor barrier coating. When using polyisocyanurate or cellular glass on below ambient piping/duct, seal all insulation joints with insulation joint sealant.
- F. Fittings, Valves and Flanges:
1. Chilled Water: Flexible fitting insulation of the same material and thickness as the adjacent pipe insulation.
 2. Hot Services and Domestic Cold Water: Flexible fitting insulation of the same material and thickness as the adjacent pipe insulation.
 3. White PVC jacketing, with continuous solvent weld of all seams. Tape all fittings.
- G. Flexible Pipe Insulation:
1. Split longitudinal joint and seal with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
 2. Insulation shall be pushed onto the pipe, never pulled. Stretching of insulation may result in open seams and joints.
 3. Insulation must be installed in compression to allow for expansion and contraction.
 4. For below-ambient systems, adhere the insulation to the pipe at least every 18 feet (5.5-m) using manufacturer's adhesive. Completely terminate joints at critical points such as flanges, T-sections, elbows, supports, and similar fittings.

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5. Fittings made from miter-cut pieces properly sealed with adhesive, or ells may be continuous.
 6. Where exposed outdoors, provide with Alumaguard jacketing.
- H. For piping exposed to the elements, jacketing shall be aluminum with a factory applied moisture barrier. Fitting covers shall be of similar materials. The insulation and jacketing shall be held firmly in place with a friction type Z lock or a minimum 2 in. overlap joint. All joints shall be sealed completely along the longitudinal seam and installed so as to shed water. All circumferential joints shall be sealed by use of preformed butt strips; minimum 2 in. wide or a minimum 2 in. overlap. Butt strips shall overlap the adjacent jacketing a minimum 1/2 in. and be completely weather sealed. Jacket at ells and tees shall be mitered, or pre-manufactured fitting jackets shall be provided, with additional aluminum holding bands, as required. All joints shall be sealed watertight using specified metal jacketing sealant as recommended by the manufacturer.
- I. Apply PVC jacket where indicated, with 1 in. overlap at longitudinal seams and end joints. Seal with manufacturers recommended adhesive.
- J. Apply either aluminum or PVC jacketing to exposed insulated pipe, valves, fittings, and specialties, at an elevation of 8 feet or less above finished floor in mechanical/electrical rooms, penthouses, and services aisles/pipe chases. Fittings of aluminum-jacketed piping may be either aluminum or standard PVC fitting covers.

3.3 DUCTWORK INSULATION

- A. Provide external thermal insulation for duct. Not required where ducts have internal acoustical insulation. Make special provisions at dampers, damper motors, thermometers, instruments, and access doors. Apply as follows:
1. Rigid Board Type: Impale board over mechanical fasteners, welded pins or adhered clips, 12 in. to 18 in. centers; minimum of two (2) rows per side. Secure insulation with washer clips. Self-adhesive clips are not acceptable. Staple all joints. Seal breaks and joints in vapor barrier with 4 in. wide matching tape and 4 in. glass-fab applied with specified vapor barrier coating. Apply tape over corner beading where exposed.
 2. Flexible Blanket Type: Install Duct Wrap to obtain specified R-value using a maximum compression of 25%. Installed R-value shall be per energy code requirements. Firmly butt all joints. The longitudinal seam of the vapor retarder must be overlapped a minimum of 2 in. Where vapor retarder performance is required, all penetrations and damage to the facing shall be repaired using pressure-sensitive foil tape, and coated with vapor barrier coating prior to system startup. Pressure-sensitive foil

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tapes shall be a minimum 3 in. wide and shall be applied with moving pressure using a squeegee or other appropriate sealing tool. Closure shall have a 25/50 Flame Spread/Smoke Developed Rating per UL 723. Duct wrap shall be additionally secured to the bottom of rectangular ductwork over 18 in. wide using mechanical fasteners on 18 in. centers. Self-adhesive clips are not acceptable. Care should be exercised to avoid over-compression of the insulation during installation.

3. Exterior Ductwork: Finish with an aluminum jacket. All joints shall be positioned so as to shed water; with a minimum 3 in. overlap, and completely weather sealed with specified metal jacketing sealant.

3.4 EXISTING INSULATION

- A. Patch existing insulation damaged during the course of the work.
- B. Insulate existing piping, ductwork, and equipment as called for.

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EXHIBIT "I" - PIPE INSULATION MATERIALS

<u>SERVICE</u>	<u>INSULATION MATERIAL</u>	<u>THICKNESS</u>	<u>REMARKS</u>
Hot water and glycol/hot water (200°F and lower)	Glass fiber	1-1/2 in. and Larger: 2 in. 1-1/4 in. and Smaller: 1-1/2 in.	
Chilled water, glycol/chilled water	Glass fiber Flexible	1-1/2 in. and Larger: 1 in. 1-1/4 in. and Smaller: 1/2 in.	
Concealed AC unit condensate drains	Flexible	All Sizes: 1/2 in.	

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EXHIBIT "II" - DUCT INSULATION MATERIALS

<u>SERVICE</u>	<u>INSULATION MATERIAL</u>	<u>THICKNESS</u>	<u>REMARKS</u>
HVAC Supply	Within mechanical rooms or exposed at 8 feet or less above finished floor: Rigid fiberglass	1-1/2 in.	Min. installed R value of 6
		2 in. at 1.0 PCF or	
	Concealed: Flexible fiberglass	2.2 in. at 0.75 PCF	Min. installed R value of 6
Supply or Return ducts in cold attic spaces or other un-conditioned spaces	Flexible fiberglass	5 in	Min. installed R value of 12
Exhaust ducts in cold attic spaces or other un-heated spaces	Flexible fiberglass	 3 in	Min. installed R value of 8
Interior ductwork indicated to be lined		...NOT INSULATED...	
Return and exhaust ducts within heated building envelope		...NOT INSULATED...	
Neutral ventilation air supply (between 65°F and 80°F)		... NOT INSULATED ...	
Outside air ducts and plenums, connections and mixing boxes	Rigid fiberglass	 2 in.	Min. installed R value of 8
			Provide neat fit at intake plenum

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<u>SERVICE</u>	<u>INSULATION MATERIAL</u>	<u>THICKNESS</u>	<u>REMARKS</u>
Exhaust, relief or vent ducts and plenums	Exposed: Rigid fiberglass	1-1/2 in.	Min. installed R value of 6
	Concealed: Flexible fiberglass	2 in.	
			Insulate 15 ft. from exterior opening and plenums
Outdoor Ductwork (unlined)	Polyisocyanurate board Rigid Fiberglass	2-1/2 in.	Min. installed R value of 12
		3 in.	
			Cover with Alumaguard jacketing applied per manufacturer's recommendation s.

END OF SECTION

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SECTION 23 09 23 - BUILDING MANAGEMENT SYSTEM - DDC LOGIC

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Provide labor, materials, equipment and services as required for the complete installation designed in Contract Drawings. Extend existing Building Management System (BMS), to perform the functions described in this Section. All new equipment shall be compatible with the existing system. Provide wiring and conduit required to connect devices furnished as a part of, or accessory to, this automatic control system. Control wiring is defined as wiring up to and including 120 volts. Install wiring in accordance with requirements of "Electrical Wiring" in Section 230504, and the National Electrical Code. Provide all required devices for proper system operation, including special electrical switches, transformers, relays, pushbutton stations, etc.
 - 1. All Actuation of valves and dampers shall be electric unless specifically called out elsewhere in the specifications or drawings.
- B. The BMS System shall have the following capabilities as described in these specifications:
 - 1. The network controllers and operator's workstations shall be connected directly to the Owner's Ethernet Network. The network controller shall also contain SNMP for integration to the Owner's Network Controllers System.
 - 2. Off site access for Owner's personnel shall be provided and shall have full workstation capability from remote location. Identical graphical displays shall be provided for offsite access to match the displays at the on-site Operator's Workstation. Connection to the site shall be via a high speed Ethernet connection.
 - 3. The Network Controller must act directly as the WEB server. It must directly generate the HTML code to the requesting user (i.e. WEB browser), eliminating the need and reliance on any PC-based WEB server hardware or software.

1.2 QUALITY ASSURANCE

- A. The complete automatic temperature control system shall be comprised of electric control devices with a microprocessor based Direct Digital Control System. All work shall be installed only by skilled mechanics employed by the BMS Contractor or Subcontractor.

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- B. The BMS Contractor/Subcontractor shall have a minimum of five (5) years experience in systems of similar size, type and complexity installed within a 100 mile radius.
- C. The BMS Contractor/Subcontractor shall have a local service department (within a 50 mile radius) and have available a minimum of three (3) factory trained technicians within a 24 hour period.
- D. All components shall be fully tested and documented to operate as a complete system.
- E. Supplier must guarantee that all replacement parts will be carried in stock for a period of ten (10) years minimum from the date that the system is commissioned.
- F. Electrical standards: Provide electrical products that comply with the following agency approvals:
 - 1. UL 916; Energy Management Systems for Temperature Control components and ancillary equipment.
 - 2. UL 873; Temperature Indication and Regulating Equipment.
 - 3. FCC, Part 15, Subpart J, Class A Computing Devices.
- G. All products shall be labeled with the appropriate approval markings. System installation shall comply with NFPA, NEMA, Local and National codes.

1.3 ACCEPTABLE MAKES

- A. The complete Building Management System is designed and based on that manufactured by Siemens. Acceptable Make: Andover, Siemens Building Technologies, Siebe Environment Controls, Johnson Controls, Automated Logic, Alertron.

1.4 SUBMITTALS

- A. Submit for review, a brochure containing the following:
 - 1. Detailed piping and wiring control diagrams and systems description for each system under control.
 - 2. Detailed layout and nameplate list for component control panels and DDC panels.
 - 3. Submit a valve and damper schedule showing size, pressure drop configuration, capacity, and locations. Provide apparatus bulletins and data sheets for all control system components.

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4. A complete listing of input and output points, control loops and/or routines, including time of day functions, and facilities management system functions for each controlled system. This listing shall include point logical names, identifiers, and alarmable ranges.
5. Provide as part of a separate submittal a hard copy of all graphics showing system components, sensor locations, setpoints and fixed/variable data. Engineer shall review and approve graphic format prior to final acceptance of system.

1.5 SCOPE OF WORK

- A. Except as otherwise noted, the control system shall consist of all Ethernet Network Controllers, Standalone Digital Control Units, workstations, software, sensors, transducers, relays, valves, dampers, damper operators and other accessory equipment, along with a complete system of electrical interlocking wiring as required to fill the intent of the specification and provide for a complete and operable system.
- B. The BMS Contractor/Subcontractor shall review and study all HVAC drawings and the entire specification to familiarize themselves with the equipment and system operation and to verify the quantities and types of dampers, operators, alarms, etc. to be provided.
- C. All interlocking, wiring and installation of control devices associated with the equipment shall be provided under this Contract. The BMS Contractor/Subcontractor shall demonstrate the operation of the system to the Owner and prove that it complies with the intent of the drawings and specifications.

1.6 WORK INCIDENTAL TO TEMPERATURE CONTROL CONTRACTOR

- A. The BMS Contractor/Subcontractor shall furnish the following materials, installation by the HVAC Contractor:
 1. For piping work:
 - a. Control valves in piping.
 - b. Immersion sensing wells in piping systems.
 - c. Valved pressure taps.
 2. For sheet metal work:
 - a. All automatic dampers, the BMS Contractor/Subcontractor shall assemble multiple section dampers with required interconnecting

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linkages and extend required number of shafts through duct for external mounting of damper and motors.

- b. The HVAC Contractor shall provide access doors or other means of access through ducts or ceilings and walls for service and adjustment of controllers, valves, and dampers.
- B. Control manufacturer shall furnish written details, instructions and supervision for the above trades to ensure proper installation size, and location of any equipment furnished for installation by others.

1.7 CONTROL SYSTEM GUARANTEES

- A. Guarantee the new control system to be free from defects in material and workmanship, for a period of one (1) year after final acceptance. Guarantee system to:
 - 1. Maintain temperatures within 1°F above and below setting.
 - 2. Humidity devices shall maintain relative humidity conditions within 3% of span 0-100% RH.
- B. Provide one (1) year maintenance service of control components, to start concurrently with the guarantee specified above. Such service shall include software updates and 24 hour, 7 day emergency and seasonal inspection and adjustment of operating controls and replacement of parts or instruments found deficient and defective during this period.
- C. Provide monitoring of the DDC system as soon as the system is operating and then for a minimum of one (1) year (24 hours/day, 7 days/week) after the acceptance date. A monthly report will be sent to the Owner with a description of general system status and any alarms or off-normal conditions.
- D. Guarantee future availability of continuous, 24 hour, 7 day a week service for the systems through available maintenance contracts.

1.8 SYSTEM ADJUSTMENT AND CALIBRATION

- A. When the Work has been completed, completely adjust and calibrate the control system. Review the operation of each system input and output, control loops and/or software routings, timing functions, operator entered constants and facilities management functions and observe that they perform their intended functions. Provide a complete values and points log, printed every hour, for one week to demonstrate control functions and programming. Provide one point log for summer operation and one winter. Points to be trended shall be selected by the Engineer. When above procedure has been completed and the control system is operating satisfactorily, submit a letter with one (1) copy of completed

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values and points log to the Owner's Representative advising them that the control system is 100% complete and operates in accordance with the Contract Documents.

- B. After review and approval of points log by the Engineer, the BMS Contractor shall schedule a technician on site for field review of system components, operation and graphics as part of final system appearance.

PART 2 - PRODUCTS

2.1 CONTROL DEVICES

A. Control Valves:

1. Sized by BMS Contractor/Subcontractor and guaranteed to meet the heating and cooling requirements. Water valves shall be sized on the basis of 15% of the total system pressure drop, but not more than 10 ft. of head drop. Steam valves shall be sized for no more than a 5 psig pressure drop, or 30% (max.) of design steam pressure, whichever is smaller. Pressure drop for valves shall be submitted for review, including all CV values.
2. Valves shall be equal percentage type, equipped with characteristic type throttling plug, #316, stainless steel or Monel stem, removable composition discs, and rubber diaphragms. Provide with necessary features to operate in sequence with other valves or damper operators and adjustable throttling range as required by the sequence of operations.
3. Valves in 2 in. and smaller shall be screwed bodies; 2-1/2 in. and larger shall be flanged bodies; designed for 125 psi operating pressure. Arranged to fail-safe as called for; tight closing and quiet operating.
4. Electric Operators:
 - a. Provide 24 VAC control operators which are 0-10 VDC input proportional with spring return as needed by control sequence and designed for water service valve bodies. Operator shall be synchronous motor driven with up to 150 in. lb. force and force sensor safety stop.

B. Temperature Sensors:

1. All temperature devices shall use precision thermistors accurate to $\pm 0.36^{\circ}\text{F}$ over a range of -30 to 230°F .
2. Standard space sensors shall be provided in an off white, or white, enclosure for mounting on a standard electrical box.

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3. Provide manual adjustment slider with $\pm$ programmable scale. Programmable scale shall have the capability to be limited via the DDC System.
 4. Provide a local LCD display for viewing the space temperature.
 5. Duct temperature sensors shall incorporate a thermistor bead embedded at the tip of a stainless steel tube. Probe style duct sensors shall be used in air handling applications where the air stream temperature is consistent and is not stratified. Averaging sensors shall be employed in all mixing plenum and coil discharge applications and in any other application where the temperature might otherwise be stratified. The averaging sensor tube shall contain at least four thermistor sensors.
 6. Immersion sensors shall be employed for measurement of temperature in all chilled water, hot water and glycol applications. Thermal wells shall be brass or stainless steel for non-corrosive fluids below 250°F and 300 series stainless steel for all other applications.
- C. Electric Thermostats:
1. Provide a low voltage thermostat for control of single zone heating and air conditioning unit as specified in the sequence of operation. Electric thermostats shall include a display of the current space temperature as well as a mechanism for adjusting the setpoint locally. Aquastats on unit heaters shall stop the fan when the water temperature is below 100°F.
- D. Temperature Sensor, Humidistat Sensor or Thermostat Guards:
1. Provide heavy duty acrylic lockable guard to prevent damage and tampering.
- E. Electric Operators (Damper):
1. Provide 24 VAC control operators which are 0-10 VDC input proportional or two position with spring return as needed by control sequence and designed to operate control dampers. Operator shall be synchronous motor driven with up to 150 in. lb. force sensor safety stop and return as required.
- F. Control (Motorized) Dampers:
1. Provide control dampers as shown on the drawings and diagrams, to meet the following minimum construction standards.

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2. Leakage: Class 1, 4 CFM/sq. ft. at 1 in. W.C., tested per AMCA Standard 500-D-98 and AMCA Standard 511 and bearing AMCA's Certified Ratings for both air performance and air leakage.
3. Frame: 16 gauge galvanized steel structural hot channel with tabbed corners for reinforcement to meet 13 gauge criteria.
4. Blades: 14 gauge (equivalent thickness galvanized steel) roll forward air foil type for low pressure drop and low noise generation. Blades shall be parallel for two-position dampers and opposed, for modulating dampers.
5. Blade Seals: Ruskiprene, suitable for -72°F to +275°F mechanically locked into the blade edge.
6. Jamb Seals: Flexible metal, compression type.
7. Blade Axles: 1/2 in. plated steel hexagonal positively locked into the damper blade. Linkage conceded out of the air stream.
8. Bearings: Corrosion resistant, permanently lubricated stainless steel sleeve.
9. Dampers subject to corrosive fumes or humidity shall be constructed of stainless steel.
10. Dampers over 48 in. length and height shall be made in multiple sections.
11. Where damper sizes are not specifically indicated, they shall be sized by the Temperature Control Contractor. Maximum velocity shall be 1500 fpm and maximum pressure drop 0.1 in. w.g.
12. Dampers shall be as manufactured by Ruskin CD60 Control Damper, or equivalent Tamco or Greenheck.

G. Pressure Sensors:

1. Air pressure or differential air pressure measurements in the range of 0 to 10 in. water column shall be accurate to $\pm 1\%$ of range using a solid-state sensing element. The range of the instrument selected shall be 2 times the operating pressure of the sensed variable. Acceptable manufacturer shall be Setra model C-264.
2. Liquid pressure or differential liquid pressure measurements shall be accurate to $\pm 0.25\%$ of range using a solid-state sensing element. The range of the instrument selected shall be 2 times the operating pressure of the sensed variable. Unit shall be provided with isolation and bypass

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manifold for start-up and maintenance operations. Acceptable manufacturer shall be Setra Model C-230.

3. Steam pressure measurements shall be accurate to $\pm 0.13\%$ of range using a solid-state sensing element. The range of the instrument selected shall be 2 times the operating pressure of the sensed variable. Unit shall be provided with isolation and bypass manifold for start-up and maintenance operations. Acceptable manufacturer shall be Setra Model C-207.
4. Room pressure sensors shall be bi-directional, bleed airflow thermistor type. Sensor assembly shall contain three (3) individually wired, hermetically sealed bead-in-glass thermistors. The operating range shall be +3,000 FPM to -3,000 FPM, and device shall have an accuracy of $\pm 2\%$ of readings over the entire operating airflow range. Acceptable manufacturer shall be Ebtron Model GTC116-B.

H. Current Measurement Devices:

1. Measurement of three-phase power shall be accomplished with a kW/kWh transducer. The instrument shall utilize direct current transformer inputs to calculate the instantaneous value (kW) and a pulsed output proportional to the energy usage (kWh). Provide Veris Model 6000 Power Transducer or approved equal.

I. Carbon Dioxide Sensing Devices:

1. Space or outside air carbon dioxide (CO₂) sensors shall be an infrared technology based detector, and shall contain an on board relay with field adjustable trip point and adjustable time delay. The sensor shall monitor CO₂ over a range of 0 - 2000 PPM. Space CO₂ sensors shall operate within the range of 32-122°F and 0-95% RH. Outside air CO₂ sensors shall have an operation range of -40° to 122°F and 0-95% RH. The sensor shall have an accuracy of no more than 50 PPM in the expected range of measurement, and a drift of no more 20 ppm. The sensors shall be self-calibrating. Provide an LCD display for displaying PPM level and field adjustable settings. Greystone Product # CDD4 Series, Honeywell C7232, Siemens QPA20, GE Ventostat.

J. Combination CO₂, RH, Temperature Sensors

1. Provide BACnet combination CO₂/RH/Temperature measuring devices for mounting where indicated on the plans.
2. Each BACnet combination sensor shall consist of an integrated system of three or more environment sensing functions in a wall mounted package,

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with an integral microprocessor-based design capable of operating at least two (2) independent sensor nodes per measurement location.

3. BACnet combination sensors shall have an environmental operating range of no less than 32 – 122° F (0 – 50° C) and 0 – 95% RH, non-condensing.
4. CO₂ Sensor Design and Performance:
 - a. CO₂ measurement shall be accomplished with Non-Dispersive Infrared (NDIR) technology using gold plated optics and diffusion sampling.
 - b. CO₂ measurement uncertainty shall be no greater than ±75 ppm (or ±7% of Reading <500 ppm and ±7.5% for 800 – 1,200 ppm) at 77° F (25° C) for a CO₂ measurement range of at least 400 – 2,000 ppm.
 - c. CO₂ measurement stability shall be <2% FS over the expected 15 year life of the typical sensor.
 - d. Each CO₂ sensor node shall be factory calibrated, shall automatically self-calibrate during operation and shall not require routine recalibration throughout its normal service life.
5. Relative Humidity (RH) Sensor Design and Performance:
 - a. Each RH sensor node shall measure ambient RH using planar laminated, electrolytic polymer capacitor technology.
 - b. RH measurement range shall be 0 – 100% RH, non-condensing.
 - c. RH measurement accuracy shall be ±2% from 20% – 80%RH at 77° F (25° C). Outside of this normal RH operating range, accuracy shall be ±3%.
 - d. RH output resolution shall be at least 0.4% of Reading.
6. Temperature Sensor Design and Performance:
 - a. Each temperature sensor node shall sense changes using integral bandgap voltage reference circuitry and perfectly proportional to absolute temperature (PTAT) ΔV technology.
 - b. Temperature measurement accuracy shall be equal to or greater than ±1.08° F at 77° F (±0.6° C at 25° C).

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- c. The operating temperature range shall be at least -58° F to 302° F (-50° C to 150° C).
 - d. Output resolution shall be at least 0.36° F (0.2° C).
- 7. Power, Connectivity and Communications:
 - a. The BACnet combination sensor shall be capable of communicating with other devices using an RS-485 standard interface and BACnet-MS/TP protocol, implemented as a Master.
 - 1) Communication speed shall be field-selectable between 9.6, 19.2, 38.4 and 76.8 kBaud.
 - b. BACnet devices shall implement the open protocol in compliance of the requirements of ASHRAE Standard 135-2008 and all BACnet products shall be BTL Listed.
 - c. The BACnet combination sensor shall be capable of field set-up and configuration using a simple dip-switch interface.
 - d. The BACnet combination sensor shall operate on 24 VAC (22.8 to 26.4 VAC), 50/60Hz.
 - 1) The combination sensor design shall include protection from over voltage, over current transients and power surges.
 - 2) The combination sensor shall use "watch-dog" circuitry to assure automatic processor reset after power disruption, transients and brown-outs.
 - e. The BACnet combination sensor design shall be capable of communicating to the network if one of the sensor functions becomes faulty, and will continue to operate the remaining CO₂ or RH/Temp sensor nodes.
- 8. The BACnet combination sensor enclosure shall be a low profile wall mount type, compatible in size for mounting with a standard single-gang electrical box or for surface mount applications.
 - a. The sensors shall be installed at locations that are protected from weather and/or water.
- 9. The manufacturer's authorized representative shall review and approve wall-position placement for each measurement location indicated on the plans.

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- a. A written report shall be submitted to the consulting mechanical engineer if any measurement locations do not meet the manufacturer's recommendations or requirements.
- 10. Acceptable manufacturer shall be Ebtron Model IAQ-300-N.
- K. Airflow Stations (DP Type):
 - 1. Duct Mounted Air Flow Stations:
 - a. Rectangular: 16 gauge galvanized casing, 8 in. deep, with formed 1-1/2 in. integral 90° connecting flanges.
 - b. Oval: 18 gauge galvanized casing, 8 in. long between beads with 1 in. connecting sleeve on each end (10 in. overall length). Actual O.D. dimensions are 1/4 in. less than specified duct I.D. dimensions.
 - c. Accuracy: Within 2% throughout the velocity range of 600 FPM and over, when installed in accordance with published recommendations.
 - d. Temperature: 350°F continuous operation, 400°F intermittent operation.
 - e. Humidity: 0-100% continuous operation.
 - f. Corrosion Resistance: Good salt air, excellent solvent and aromatic hydrocarbon resistance.
 - g. Element Material: 6063-T5 anodized aluminum.
 - h. Connection Fittings: 1/4 in. compression, suitable for use with thermoplastic or copper tube.
 - i. Design Equipment: Paragon Controls FE-1500.
 - j. Make: Paragon, Cambridge, Air Monitor.
 - 2. Fan Inlet Air Flow Stations:
 - a. Material: 6063-T5 anodized aluminum, galvanized mounting brackets.
 - b. Accuracy: Within 2% throughout the velocity range of 600 FPM and over, when installed in accordance with published recommendations.

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- c. Temperature: 350°F continuous operation; 400°F intermittent operation.
 - d. Humidity: 0-100% continuous operation.
 - e. Connection Fittings: 1/4 in. compression, suitable for use with thermoplastic or copper tube.
 - f. Corrosion Resistance: Good salt air and mild acid resistance, excellent solvent and aromatic hydrocarbon resistance.
 - g. Design Equipment: Paragon Controls FE-1050.
 - h. Make: Paragon, Cambridge, Air Monitor.
- 3. Outside Air Flow Station:
 - a. Material: Element 6063-T5 anodized aluminum and casing 16 gauge G90 galvanized steel.
 - b. Accuracy: Within $\pm 0.5\%$ of actual flow through the velocity range of 200 to 12,00 fpm when installed in accordance with published recommendation and within $\pm 5\%$ at a velocity of 100 fpm. Operating velocity range 100 to 2,800 fpm.
 - c. Temperature: 350°F continuous operation and 400° intermittent operation.
 - d. Humidity: 0 to 100%.
 - e. Design Equipment: Paragon Controls mode OAFE-1500.
 - f. Make: Paragon, Ruskin.
- 4. Air Volume/Velocity Transducers for Duct Outside Air and Fan Inlet Airflow Stations:
 - a. The transducer shall be a combination differential pressure transmitter, square root extractor, scaling multiplier, and output filter with process indication, complete in a single package.
 - b. The measured air volume shall be locally indicated on a door mounted LED display meter scaled in CFM.
 - c. The transducer package shall be a factory calibrated for the flow-measuring element being served.

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- d. A transducer shall be provided for each individual airflow station.
 - e. Accuracy shall be plus or minus 0.25%.
 - f. An output signal of 0-10 VDC or 4-20 mA shall be generated for monitoring by the DDC system.
 - g. Design Equipment: Paragon Controls Microtrans.
 - h. Make: Paragon, Cambridge, Air Monitor.
- L. Liquid Flow Measurement:
 - 1. Hi Liquid flow measurement devices shall be accurate to $\pm 0.75\%$ over a turn down ratio of 10:1. Insertion probe sensing element shall be made of 316l stainless steel. The sensing element shall have an elliptical shape that eliminates the separation point at a fixed or variable location ahead of the static pressure pick up point. Device shall only require one welded insert to mount to piping system. Acceptable manufacturer shall be Preso, model BAR.
- M. Safety/Status Devices:
 - 1. Low Limit Detector: Electric type, with 20 ft. long serpentine element, with manual reset and auxiliary contacts to the DDC, set for 37°F for "freeze" protection and 55°F for fan discharge application. Provide a 20 ft. long element for every 25 sq. ft. of coil face area.
 - 2. High Limit Detector: High limit thermostats shall be located as directed, and shall be manual reset type set at 120°F in the return and 180°F in the discharge. Thermostats shall be double pole so as to provide input capability for alarm at the temperature control system.
 - 3. Pump status shall be provided through adjustable range current sensing element on pump motor.
 - 4. Fan status shall be provided through adjustable range current sensing element on the fan motor.
- N. Miscellaneous Devices:
 - 1. Provide necessary, relays, transformers, required for a complete and operable system.

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2.2 CONTROL CABINETS

- A. BMS control panels shall be fully enclosed cabinet, baked enamel, steel, aluminum or composite material construction and shall meet the requirements of NEMA 1 enclosures. Panels shall have hinged door with a locking latch. Cover exposed electrical connections. Each component on front panel shall have an appropriate engraved label describing its function. Components inside the panel shall be appropriately labeled for ease of identification. Stick-on labels are not acceptable. Panels shall be either free-standing or wall-mounted. Provide support steel framing.

2.3 BUILDING MANAGEMENT SYSTEM

- A. The BMS system shall consist of Network Controllers, standalone or application specific controllers, input/output unit modules, operator workstations, and file servers to support system configurations. The BMS system shall provide control, alarm detection, scheduling, reporting and information management for the entire facility.
- B. The BMS shall be capable of being segmented, through software, into multiple local area networks per floor of building, distributed over a wide area network or sharing a single file server. This enables workstations to manage wide area network, and/or the entire system with all devices being updated and sharing the most current database. In the case of a single workstation system, the workstation shall contain the entire database - with no need for a separate file server.
- C. For multi-workstation systems, a file server shall be utilized capable of residing directly on the Owner's Ethernet TCP/IP preferred network with no required gateways. This network may be dedicated for temperature control systems only so it does not interfere with other networks.
- D. In addition to the above local area network and wide area network, the workstation software shall be capable of managing remote systems via remote high speed network as a standard component of the software.
- E. The BMS system shall be scalable and expandable at all levels of the system using the same software interface and controllers.
 - 1. The system shall use the same application programming language for all equipment: Operator Workstation, Network Controllers, Remote Site Controllers and Standalone, or application specific, Digital Controllers.
- F. The BMS system design shall include solutions for the integration of the following "open systems" protocols: BACnet, LonTalk and digital data communication to third party microprocessors such as chiller controllers, fire panels and variable frequency drives (VFD's).

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1. The system shall also provide the ability to program custom ASCII communication drivers, which shall reside in the network control unit, for communication to third party systems and devices. These drivers shall provide real time monitoring and control of the third party systems.

2.4 SURGE SUPPRESSION (SP) RECEPTACLE

- A. Provide at each DDC panel and operator workstation locations, a surge suppression receptacle with metal oxide varister to dissipate the electrical energy of voltage spikes. 20 ampere, duplex, NEMA 5-20R configuration. Back and side wiring, high impact nylon body.
- B. Acceptable Make: Hubbell 5352-S.

PART 3 - EXECUTION

3.1 GENERAL SYSTEM REQUIREMENTS

- A. The control of each system shall be guaranteed to perform as described in the Sequence of Operation on the drawings. Equipment, remote switches, in finished rooms shall be flush-mounted, if possible. Interlock supply and return fans, humidifiers with fans, condensers or cooling towers with air conditioning equipment and similar situations demanding coordinated operation.

3.2 SYSTEM COMPONENTS

- A. Valves: Union or flanged connected. Locate close to apparatus controlled with pipe reducers and increasers located closest to valve. Locate, arrange, and pipe per installation diagram.
- B. Thermostats/Sensors: Room thermostats or sensors shall be mounted symmetrical with adjacent items such as light switches (nominally 44 inch to the center of the device and in accordance with ADA requirements). Verify exact room location to avoid doors, fixed and portable equipment. Install to minimize damage. Do not install adjacent to lighting dimmers or other heat generating equipment.
- C. Dampers and Damper Operators: Tag dampers for proper location. Install per manufacturer's printed instruction as to motor size and quantity, linkage arrangement, drive connection point. Adjust to close tightly. Allow for conduit sleeve or blank space for roof fan dampers. Where ducts are insulated, set damper operators at least 2 in. away from side of duct to allow for insulation.

3.3 SMOKE DAMPERS AND FIRE/FAN SHUT DOWN

- A. Provide control for smoke dampers as required. Division 26 "Electric" to provide signal wiring to close all smoke partition smoke dampers associated with a

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particular air handling unit upon alarm at any duct smoke detector in that particular system.

- B. Division 26 "Electric" to provide a signal to stop air handling unit fans and close air handling unit smoke dampers upon activation of the fire alarm system. Wiring to be directly to the motor starter.
- C. Division 26 "Electric" shall also provide a signal to the DDC control system that the fire alarm system is activated.

3.4 LOW AND HIGH LIMIT SAFETY FUNCTIONS

- A. Provide for all supply fan units. Wiring to be directly to the motor starter. High limit controller (firestat) shall be located in the unit discharge, set at 180°F and prevent the fan from operating until reset. High limit shall alarm DDC system. Low limit shall be strung on the discharge face of preheat coils OR upstream face of cooling coils set at 37°F. Low limit shall: prevent fan from operating, fully close the outside air damper, fully close the relief air dampers, open return air damper, and alarm DDC system until reset.

3.5 SYSTEM TESTING AND COMMISSIONING

- A. At the time of installation, systems shall be tested for control device operation prior to the systems acceptance. A report of each systems performance shall be submitted to the Owner's Representative. The report shall include:
 - 1. Field verification and demonstration checklist of analog input calibration, analog output operation, digital input function, and digital output operation.
 - 2. Trend log of inputs and output, printed every two (2) hours, for one (1) week.
 - 3. Refer to "Instructions and Adjustments".

3.6 SYSTEM DESCRIPTION - GENERAL

- A. All systems shall maintain the scheduled or otherwise noted minimum outside air ventilation rate during building occupied hours.
- B. Provide normally open hot water and normally closed cooling coil valves.
- C. Provide normally open return air damper, normally closed relief air and normally closed outside air dampers and operators.

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- D. Mode of operation (occupied/unoccupied) including building warm-up and pull-down cycles, as well as all system functions shall be programmable and controlled by the BMS system.
- E. Shutdown of air handling units and fans due to a fire alarm shall be by the Electrical Contractor. The fire alarm system will send a signal to the BMS system for monitoring purposes only of each air handling unit and exhaust system. The BMS system will provide a staggered restart of the units once the alarm is cleared.
- F. All setpoints shall be adjustable.
- G. Two (2) outside air temperature sensors and two (2) outside air humidity sensors are to be provided as general inputs to the BMS system. The pair of readings shall be averaged for use by the system. If an individual reading is found to be out of range by comparison, then the other reading shall be used, and an alarm shall be generated.
- H. Where the normal sequence position or status of a device is allowed to be manually over-ridden by the building Owner/operator, the device shall be returned to its normal "system off" position, if the system is shut down by the BMS system or building fire alarm system. This includes overriding manually set and locked setpoints. Upon system restart, the device shall return to its manually over-ridden status. Returning devices to their normal "systems off" position shall be done to reduce the potential of damage to the systems.

3.7 CONTROL SEQUENCE

- A. Refer to plans for control diagrams, sequences and points lists.

END OF SECTION

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SECTION 23 20 10 - PIPING SYSTEMS AND ACCESSORIES

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Provide labor, materials, equipment and services as required for the complete installation designed in Contract Documents.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 078413 - Penetration Firestop Systems.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Pipe and fittings shall be new, marked with manufacturer's name and comply with applicable ASTM and ANSI Standards.
- B. All adhesives, sealants, primers and paint used for piping in the interior of the building shall comply with the maximum Volatile Organic Compound (VOC) limits called for in the current version of U.S. Green Building Council LEED Credits EQ 4.1 and EQ 4.2.

2.2 STEEL PIPING AND FITTINGS

- A. Pipe: ASTM A53, Schedule 40 weight; black or galvanized finish as called for; ends chamfered for welding or roll grooved for grooved mechanical connections.
- B. Fittings: Same material and pressure class as adjoining pipe.
 - 1. Welded Fittings: Factory forged, seamless construction, butt weld type, chamfered ends. Where branch connections are two or more sizes smaller than main size, use of "Weldolets", "Thredolets", or "Sockolets" are acceptable. Socket weld type, 2000 psi wp, where required.
 - 2. Threaded Fittings: Cast or malleable iron, black or galvanized, as required; drainage type where called for.
 - 3. Shop Fabricated Connections and Fittings:
 - a. Shop Fabricated Branch Connections: Fabricated branch connections constructed in strict conformance to the appropriate ASME B 31 Code of Construction may be acceptable as reviewed by the Engineer. All fabricated connections shall be constructed under controlled shop conditions using automated equipment.

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Calculations for all fabricated connections demonstrating conformance to ASME code and project design criteria shall be prepared and submitted for acceptance prior to fabrication. Certified welding procedures, shop quality control procedures and certifications of welders and inspectors shall be submitted to the Engineer prior to fabrication.

- C. Flanges, Unions and Couplings:
1. Threaded Connections:
 - a. Flanges: Cast iron companion type; for sizes 2-1/2 in. and larger.
 - b. Unions: Malleable iron, bronze to iron seat, 300 lb. wwp; for sizes 2 in. and smaller.
 - c. Couplings: Malleable iron, 150 or 300 lb. wwp, based on system pressure. Steel thread protectors are not acceptable as couplings.
 2. Welded Connections:
 - a. Flanges: Welding neck type.
 - b. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents and working temperatures and pressures.
 - c. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.
 3. Grooved Mechanical Connections: Standard Mechanical Couplings: Manufactured in two segments of cast ductile iron, conforming to ASTM A-536, Grade 65-45-12. Gaskets shall be pressure-responsive synthetic rubber, grade to suit the intended service, conforming to ASTM D-2000. Mechanical Coupling bolts shall be zinc plated heat-treated carbon steel track head conforming to ASTM A-449 and, minimum tensile strength 110,000 psi.
 - a. Rigid Type: Coupling housings with offsetting, angle-pattern bolt pads shall be used to provide system rigidity and support and hanging in accordance with ANSI B31.1 Installation ready rigid coupling for direct stab installation without field disassembly. Gasket shall be Grade "EHP" EPDM compound with red and

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green color code designed for operating temperatures from -30° F to +250° F. Basis of design: Victaulic S/107N, S/W07

- b. Flexible Type: Use in locations where vibration attenuation and thermal expansion compensation (including risers) are required. Installation ready flexible coupling for direct stab installation without field disassembly. Gasket shall be Grade "EHP" EPDM compound with red and green color code designed for operating temperatures from -30° F to +250° F. Basis of Design: Victaulic S/177N S/W77
 - c. Fittings: Cast of ductile iron conforming to ASTM A-536, Grade 65-45-12, provided with an alkyd enamel finish.
 - d. Victaulic Floor-Mounted Riser Anchor: Engineered pipe anchor, sizes 2" through 12"; to assist in directing pipe movement in piping system risers that are designed and installed with approved Victaulic products. Standard weight carbon steel to ASTM A53 with orange enamel coating, with carbon steel brackets. Victaulic Original-Groove System grooved ends. Anchors suitable for system operating pressure to 500-psi. Basis of Design: Victaulic No. A10.
 - e. Plain-End Carbon Steel Connections: ½" – 2" Plain End Joints: Installation-Ready fittings for Schedule 40 carbon steel piping in HVAC and mechanical applications. System rated for a working pressure of 300 psi. Fittings shall consist of a ductile iron housing conforming to ASTM A536, Grade 65-45-12, with Installation-Ready ends orange enamel coated. Fittings complete with gasket liner, zinc-electroplated steel bolts and nuts as per the mechanical properties of ASTM A449, and 300 series stainless steel retainer.
- D. Gauge and Instrument Connections: Nipples and plugs for adapting gauges and instruments to piping system shall be IPS brass.
- E. Base Elbows:
- 1. Cast iron or steel type, flange connections; Crane 500 or equivalent. Made from welding elbows, with welded pipe support and steel base. Reducing elbows where necessary.

ELBOW SIZE	SUPPORT SIZE	BASE PLATE
2 in. to 3 in.	1-1/4 in.	6 in. x 6 in. x 1/4 in.
4 in. to 6 in.	2-1/2 in.	8 in. x 8 in. x 1/4 in.
8 in. and larger	6 in.	14 in. x 14 in. x 5/16 in.

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2. Anchor bolt holes in each corner of base for securely bolting to floor or concrete base; minimum 3/4 in. bolts.

2.3 COPPER TUBE AND FITTINGS - SOLDER JOINT

- A. Pipe: ASTM B88; Type K, L or M, hard temper. Soft temper only where specified. Plans show copper tube sizes.
- B. Tees, Elbows, Reducers: Wrought copper, ANSI B16.22 or cast bronze; ANSI B16.8 solder end connections.
- C. Unions and Flanges: 2 in. and smaller use unions, solder type, cast bronze, ground joint, 150 lb. swp: 2-1/2 in. and over use flanges, cast bronze, companion type, ASME drilled, solder connection, 150 lb. swp.
- D. Solder Materials: No-lead solder, using alloys made from tin, copper, silver and nickel.
- E. Make: Harris "Stay-Safe 50" and "Bright", Engelhard "Silverbright 100", Willard Industries "Solder Safe (silver bearing)", Canfield "Watersafe" or approved equal.

2.4 STAINLESS STEEL PIPE AND FITTINGS - PRESSURE-SEALED JOINTS

- A. Pipe: Type 304/304L, Schedule 10S, stainless steel conforming to ASTM A312 with plain ends.
- B. Couplings and fittings shall be formed of precision cold drawn stainless steel pipe with synthetic rubber O-ring seals.
- C. O-ring seals shall be molded of synthetic rubber, Grade HNBR suitable for potable water up to 210°F or Grade EPDM suitable for water up to 250°F.
- D. Fitting ends shall be pressed onto pipe using only a tool specifically designed for this purpose. Pipe ends must be fully inserted into the coupling and fitting housing up to the pipe stop. 500 psig maximum CWP rating.
- E. Fittings: Elbows, tees, laterals, reducers, adapters as required. Same construction as couplings.
- F. Design Basis: Victaulic Vic Press 316, Shurjoint, Viega Pro Press Stainless.

2.5 COPPER TUBE AND FITTINGS - PRESS FITTINGS

- A. Tubing Standard: Copper tubing shall conform to ASTM B75 or ASTM B88.
- B. Fitting Standard: Copper fittings shall conform to ASME B16.18, ASME B16.22, or ASME B16.26.

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- C. Press Fitting: Copper press fittings shall conform to the material and sizing requirements of ASME B16.18 or ASME B16.22. O-rings for copper press fittings shall be EPDM.
- D. Make: Viega Pro-Press, Nibco, Tyco Grinnell, Elkhart Apolloxpress, Mueller.

2.6 COPPER DRAINAGE TUBE AND FITTINGS - SOLDER JOINT

- A. Pipe: ASTM B306, Type DWV, hard temper.
- B. Fittings: Wrought copper, ANSI B16.29 or cast bronze, ANSI B16.23; solder end connections.
- C. Solder Materials: No lead solder, using alloys made from tin, copper, silver and nickel.
- D. Make: Harris "Stay-Safe 50" and "Bright", Engelhard "Silverbright 100", Canfield "Watersafe" or approved equal.

2.7 COPPER TUBE AND FITTINGS - GROOVED MECHANICAL CONNECTIONS

- A. Pipe: ASTM B88, Type K or L, hard temper.
- B. Fittings: Wrought copper, roll grooved mechanical connections, ASTM B-75, ANSI B16.22 for sizes 2 in. - 4 in. Cast bronze, rolled grooved mechanical connections, ASTM B-584, ANSI B16.18 for sizes 5 in. - 8 in., with copper tube dimensioned grooved ends designed to accept rolled grooved couplings (flaring of tube and fitting ends to IPS dimensions is not permitted).
- C. Couplings: Mechanical Couplings: 2"-8" for copper tubing consisting of ductile iron cast housings, complete with a synthetic rubber gasket of a pressure-responsive design, with plated nuts and bolts to secure unit together. Couplings shall be manufactured to connect copper tubing sized tube and fittings. Ductile iron housings conforming to ASTM A-536, Grade 65-45-12, coated with copper colored alkyd enamel. Housings cast with offsetting, angle-pattern bolt pads to provide rigidity. Gasket shall be Grade "EHP" EPDM compound with red color code designed for operating temperatures from -30°F to +250°F. Basis of Design: Victaulic 607
- D. Butterfly Valves: 2-1/2" - 6", 300 psi maximum pressure rating, with copper tubing sized grooved ends. Cast brass body to UNS C87850. Aluminum bronze disc to UNS C95500, with pressure responsive elastomer seat. Stem shall be offset from the disc centerline to provide complete 360-degree circumferential seating. Bubble tight, dead-end or bi-directional service, with memory stop for throttling, metering or balancing service. Valve may be automated with electric, pneumatic, or hydraulic operators. Certified to the low lead requirements of NSF-372. Victaulic Series 608N.

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2.8 COPPER TUBE AND FITTINGS - BRAZED JOINT

- A. Pipe: ASTM B88, Type K or L, hard temper.
- B. Tees, Elbows and Reducers: Wrought copper, ANSI B16.22 or cast bronze, ANSI B16.18.
- C. Unions and Flanges: Unions for 2 in. and smaller. Brazed type cast bronze ground joint, 150 lb. swp; flanged for 2-1/2 in. and larger, brazed type, cast bronze, companion type, gasketed and bolted, ASME drilled 150 lb. swp.
- D. Brazing Materials: Class BcuP-2 for brazing copper to brass, bronze or copper. Harris, Inc. Stay-Silv 0 or approved equal.

2.9 REFRIGERATION PIPING

- A. Type L hard temper deoxidized, dehydrated, and sealed copper tubing, refrigerant grade.
- B. Refrigerant grade wrought copper fittings. Long radius elbows.
- C. Factory made suction traps, Melco Type PT.
- D. Piping and system shall meet the requirements of Safety Code for Mechanical Refrigeration, ANSI/ASHRAE 15-1994 and ASME/ANSI B31.5.
- E. Make: Mueller, Howell Metal, Cerro, Cambridge-Lee, Universal Tube.

2.10 HANGERS, INSERTS, AND SUPPORTS

- A. Hangers, Inserts, Clamps: B-Line, Grinnell, Michigan Hanger, PHD Manufacturing, Anvil, Hilti.
- B. Hangers:
 - 1. Adjustable, wrought malleable iron or steel with electroplated zinc or cadmium finish. Copper plated or PVC coated where in contact with copper piping. Hot-dipped galvanized finish for exterior locations.
 - 2. Adjustable ring type where piping is installed directly on hanger for piping 3 in. and smaller.
 - 3. Adjustable steel clevis type for 4 in. and larger, and where insulation passes through hanger.
 - 4. Hangers sized to permit passage of insulation through the hanger for all piping.

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5. Nuts, washers and rods with electroplated zinc or cadmium finish. Hot-dipped galvanized finish for exterior locations.
- C. Hanger Shields:
1. Pre-Insulated Type:
- a. Insulated pipes shall be protected at point of support by a 360° insert of high density, 100 psi waterproof calcium silicate, encased in a 180° sheet metal shield. Insulation insert to be same thickness as adjoining pipe insulation and extend 1 in. beyond sheet metal shield. Insulation shall be provided with a factory installed ASJ.
2. Field-Insulated Type:
- a. #18 USSG, galvanized steel shields, minimum 120° arc. Provide ICA-HAMFAB-BLOCK, 18# density molded fiberglass inserts, between pipe and hanger shield to maintain proper spacing for insulation. Insulation inserts shall extend 1 in. beyond the sheet metal shields. Material shall comply with ASTM E84 25/50, have a thermal conductivity of K=.30 (stable) and have a service temperature of -120°F to +650°F. Install in accordance with manufacturer's printed instructions.
3. Shield Sizing:
- | PIPE SIZE | SHIELD LENGTH | MINIMUM GAUGE |
|----------------------|---------------|---------------|
| 1/2 in. to 3-1/2 in. | 9 in. | 20 |
| 4 in. | 9 in. | 20 |
| 5 in. and 6 in. | 9 in. | 20 |
| 8 in. to 12 in. | 12 in. | 18 |
| 14 in. to 24 in. | 18 in. | 16 |
4. Hanger shield gauges listed are for use with band type hangers only. For point loading (roller support), increase shield thickness by one gauge, and length by 50%.
- D. Hanger Spacing Schedules: (Based upon most stringent requirement of MCNYS and ASME B31.9)

COPPER OR PLASTIC PIPE SIZE	COPPER PIPE HANGER SPACING	PLASTIC PIPE HANGER SPACING	HANGER ROD SIZE
3/4 to 1 in.	6 ft.	3 ft.	3/8 in.

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COPPER OR PLASTIC PIPE SIZE	COPPER PIPE HANGER SPACING	PLASTIC PIPE HANGER SPACING	HANGER ROD SIZE
1-1/4 in.	6 ft.	4 ft.	3/8 in.
1-1/2 to 2 in.	8 ft.	4 ft.	3/8 in.
2-1/2 to 4 in.	10 ft.	4 ft.	1/2 in.
5 in. and larger	10 ft.	4 ft.	3/4 in.

STEEL PIPE SIZE	STEEL PIPE HANGER SPACING	HANGER ROD SIZE
3/4 to 1 in.	8 ft.	3/8 in.
1-1/4 in.	10 ft.	3/8 in.
1-1/2 to 2-1/2 in.	12 ft.	3/8 in.
3 to 4 in.	12 ft.	1/2 in.
5 in. and larger	12 ft.	3/4 in.

- E. Inserts: Carbon steel body and square insert nut, galvanized finish, maximum loading 1,300 lbs., for 3/8 in. to 3/4 in. rod sizes. Drill through decking for hanger rods and secure devices with integral support plate strap with sheet metal screws. Devices shall have a safety factor of four.
- F. Beam Attachments:
1. C-Clamp, locknut, electroplated finish, UL listed, FM approved, for pipe sizes 2 in. and smaller.
 2. Center load style with clamp attachments that engage both edges of beam, electroplated finish, UL listed, FM approved, for pipe sizes larger than 2 in., refer to "Supports" for additional requirements.
 3. Welded beam attachments may be considered only upon the review and acceptance of the structural engineer of record with written confirmation of weld meet configuration, location and service/pipe size submitted to the Mechanical Engineer for review.
- G. Supports:
1. Provide intermediate structural steel members where required for hanger attachment. Secure member to structure. Select size of members based on a minimum factor of safety of four.
 2. For Weights Under 1000 lbs.: Insert, "U" shaped channel, beam clamps or other structurally reviewed support. The factor of safety shall be at least four. Follow manufacturer's recommendations.

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3. For Weights Above 1000 lbs.: Drill through floor slabs and provide flush plate welded to top of rod or provide additional inserts and hangers to reduce load per hanger below 1000 lbs.
 4. Make: Hilti, ITW Ramset, Phillips "Red Head", or approved equal.
- H. Trapeze Hangers:
1. For use on 1-1/2 in. and smaller piping only.
 2. Hangers shall be supported with rod sized with a safety factor of four.
 3. May be manufactured type "U" shaped channel, or suitable angle iron or channel. Round off all sharp edges.
 4. Securely fasten piping to trapeze with "U" bolt or straps, dissimilar metals shall not touch, use isolation gaskets.
 5. Make: B-Line, Kindorf, Unistrut, or approved equal.

2.11 PIPING ACCESSORIES

- A. Escutcheon Plates: Provide escutcheon plates on uninsulated piping in exposed and finished areas. Steel or cast brass polished chrome, split hinge type with setscrew, high plates where required for extended sleeves.
- B. Pipe Guides: Cylindrical steel guide sleeve, proper length for travel, integral bottom base anchor, top half removable. Split steel spider to bolt to pipe, copper plated spider for copper pipe. Insulated style where pipe is required to be insulated. Make: Tri-State Industries, or equal.
- C. Anchors:
1. Pipe support; same material as pipe; as manufactured by Pipe Shields Model C1000 or C2000, Keflex, Metraflex, Flexonics or Advanced Thermal Systems.
 2. Pipe Anchors:
 - a. Anchors shall be designed and located as to prevent stress to piping or building structural components from exceeding those permitted by ASME B31.9 and to prevent transfer of loading and stressing to connected equipment.
- D. Pipe Roll Stand: Cast iron roll stand. Make: Advanced Thermal Systems, Carpenter and Patterson, ITT Grinnell, Pipe Shields.

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2.12 SLEEVES

A. Standard Type:

1. Schedule 40 black steel pipe sleeves shall be used for sleeves in horizontal and vertical applications through structural surfaces. Sleeves shall extend a minimum of 1 in. beyond both sides of the structure surface being penetrated. The sleeve shall be sized to account for the total diameter of the service, inclusive of insulation and the appropriate annular space for firestopping installation or requirements of the sealing element manufacturer.
2. Full circle water stop collar for sleeves located in below grade walls, wet wells and waterproofed surfaces. The collar shall be fabricated from steel plate and welded to the sleeve around its entire circumference.
3. Schedule 40, PVC sleeves or sheet metal sleeves for nonstructural surfaces and existing construction. Sheet metal sleeves shall be 18 gauge minimum and braced to prevent collapsing. Sleeves shall extend a minimum of 1/2 in. beyond both sides of the non-structural vertical surface being penetrated. The sleeve shall be sized to account for the total diameter of the service, inclusive of insulation and the appropriate annular space for firestopping.

B. Pre-Insulated Type:

1. Adjustable or fixed length metal cans, 24 gauge minimum sized for 1 in. spacing between insulation and can. Insulation shall consist of a 360° waterproofed calcium silicate insert sized to extend 1 in. beyond wall or floor penetration. Calcium silicate insert shall be the same thickness as adjoining pipe insulation. Spacing between shield and can packed at each end with double neoprene rope positively fastened.

2.13 SEALING ELEMENTS

A. Expanding neoprene link type, watertight seal consisting of interlocking links with zinc plated bolts.

1. Make: Thunderline "Link-Seal" Series 200, 300 or 400, Pyropac, Calipco.

B. Waterproof Type:

1. Exterior Walls, Below Grade, Above Floor: Synthetic rubber material with zinc plated bolts. Make: "Link-Seal" Series 200, 300 or 400, Pyropac, Calipco.

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2.14 FIRESTOP SYSTEM FOR OPENINGS THROUGH FIRE RATED WALL FLOOR ASSEMBLIES

- A. Materials for firestopping seals shall be listed by an approved independent testing laboratory for "Penetration Firestop Systems". The system shall meet the standard fire test for Penetration Firestop Systems designated ASTM E814. Firestop system shall be provided at locations where piping passes through fire rated wall, floor/ceiling, or ceiling/roof assembly. Minimum required fire resistant ratings of the assembly shall be maintained by the Firestop System. Installation shall conform with the manufacturer's recommendations and other requirements necessary to meet the testing laboratory's listing for the specific installation.

2.15 PIPING MATERIALS AND SCHEDULE

- A. See Exhibit "A", "Schedule of Piping Materials" at end of this Section for (HVAC) piping.

PART 3 - EXECUTION

3.1 EQUIPMENT AND SYSTEMS

- A. Provide equipment and systems in accordance with laws, codes, and provisions of each applicable section of these specifications. Accurately establish grade and elevation of piping before setting sleeves. Install piping without springing or forcing (except where specifically called for), making proper allowance for expansion and anchoring. Arrange piping at equipment with necessary offsets, union, flanges, and valves, to allow for easy part removal and maintenance. Offset piping and change elevation as required to coordinate with other work. Avoid contact with other mechanical or electrical systems. Provide adequate means of draining and venting units, risers, circuits and systems. Install drains consisting of a tee fitting with a 3/4 in. ball valve with hose end cap and chain, at low points in hydronic piping system mains, and elsewhere as required for system drainage.
- B. Conceal piping unless otherwise called for. Copper tubing shall be cut with a wheeled tubing cutter or other approved copper tubing cutter tool. The tubing must be cut square to permit proper joining with the fittings. Ream pipes after cutting and clean before installing. Cap or plug equipment and pipe openings during construction. Install piping parallel with lines of building, properly spaced to provide clearance for insulation. Make changes in direction and branch connections with fittings unless submitted and accepted per Part 2. Do not install valves, union and flanges in inaccessible locations. Provide trap seal of adequate depth on drain pans.

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- C. Provide reducers at all control valves, where control valve is smaller than pipeline size. Reducers for steam control valves shall be eccentric type. Provide unions at each side of every control valve and reducers directly adjacent to the unions.
- D. Provide reducers at all balance valves, where balance valve is smaller than pipeline size.

3.2 PIPING OVER ELECTRICAL EQUIPMENT

- A. Contractor shall route piping to avoid installation directly over electric equipment, including, but not limited to panels, transformers, disconnects, starters, motor control center, adjustable speed drives and fused switches.
- B. Piping shall not be installed in the dedicated electric and working space as defined by NEC 110. Dedicated electrical space is generally equal to the depth and width of electrical equipment, and extends 6 ft. above the electrical equipment, or to a structural ceiling. Dedicated working space is a minimum of 30 in. wide or the width of equipment (whichever is larger) a minimum of 6 ft.-6 in. tall, with a depth of 3 ft. to 9 ft. depending on the voltage.

3.3 WATER AND GLYCOL SYSTEMS

- A. Top connection for upfeed, bottom or side connection for downfeed. Grade off level; up in direction of flow and down toward drain.

3.4 REFRIGERATION PIPING

- A. Fittings brazed with silver brazing alloy. Guarantee refrigerant charge for one year from date of final acceptance. Provide for flexibility at compressor connections. Piping and system shall meet the requirements of Mechanical Refrigeration Safety Code, ANSI B9.1. Clean piping, then pump-down and evacuate system to 0.1 in. VAC break vacuum with dry nitrogen and re-evacuate to 0.1 in. VAC and hold for four (4) hours; then charge system. Charge with refrigerant as recommended by manufacturer.

3.5 HANGERS, INSERTS AND SUPPORTS

- A. Piping shall not be supported by wires, band iron, chains, or from other piping. Support each pipe with individual hangers from concrete inserts, welded supports, or beam clamps of proper configuration and point loading design requirements for each location including the designated safety factor. Trapeze hangers are acceptable for racking of multiple pipes of 1-1/2 in. or less in size. Follow manufacturer's safe loading recommendations. Suspend with rods of sufficient length for swing and of size as called for, using four nuts per rod. Provide additional rustproofed structural steel members, where required for proper support. Provide oversized hangers where insulation/supports must pass

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between pipe and hanger. Only concentric type hangers are permissible on piping larger than 2-1/2 in., "C" types are permitted for piping 2-1/2 in. and smaller. Provide riser clamps for each riser at each floor.

- B. Provide a pipe hanger within 12 in. of pipe unions and piping connections to equipment, in order to facilitate disconnections of piping without pipe sagging.

3.6 HANGERS ATTACHED TO JOISTS

- A. Individual hangers may be suspended directly from the bottom chord panel point provided that the sum of the concentrated loads within the chord panel does not exceed 100 pounds and the attachments are concentric to the chord. (Eccentrically loaded joists using beam clamps or other attachment methods are not acceptable.)
- B. For nominal concentrated loads between panel chords, which have been accounted for in the specified uniform design load for the joists, this Contractor is to provide struts to transfer the load to a panel point on the opposite chord as reviewed and acceptable by the Structural Engineer of Record.

3.7 PIPE CONNECTIONS

- A. Solder Connections: Nonacid flux and clean off excess flux and solder.
- B. Press Connections: Copper press fittings shall be made in accordance with the manufacturer's installation instructions. The tubing shall be fully inserted into the fitting and the tubing marked at the shoulder of the fitting. The fitting alignment shall be checked against the mark on the tubing to assure the tubing is fully engaged (inserted) in the fitting. The joints shall be pressed using the tool approved by the manufacturer.
- C. Brazed Connections: Make joints with silver brazing alloy in accordance with manufacturer's instructions. Remove working parts of valves before applying heat.
- D. Threaded Connections: Clean out tapering threads, made up with pipe dope; screwed until tight connection. Pipe dope must be specific for each application.
- E. Flanged Joints: Select appropriate gasket material, size, type and thickness for service applications. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.
- F. Dielectric Protection: Provide dielectric protection devices at ALL piping connections and ALL equipment connections, where dissimilar metals meet. Follow all applicable manufacturer's recommendations at equipment connections. Dielectric protection systems are not required for air or gas systems.

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- G. Grooved Joints: Pipe ends shall be clean and free from indentations, projections and roll marks in the area from pipe end to groove for proper gasket sealing. All grooved products must be from the same manufacturer. The gasket style and elastomeric material shall be verified as suitable for the intended service as specified. Flexible couplings only to be used for expansion loops, pump trim and where approved by the engineer. A factory trained representative shall provide on-site training for contractor's field personnel in the use of grooving tools, application of groove, and product installation. A Victaulic representative shall periodically visit the job site and review installation. HDPE Pipe Connections: Shall be joined by heat fusion. All procedures shall meet the requirements of Title 49 of the Code of Federal Regulations 192.285 as it applies to heat fusion.

3.8 WELDING USE THIS ARTICLE FOR MOST PROJECTS

- A. Welding shall be performed in compliance with the welding procedure specifications prepared by the National Certified Pipe Welding Bureau. Welded pipe fabricated by certified welder. Contractor shall submit proof of current certification of each welder if requested by Owner. Use full-length pipe where possible; minimum distance between welds, 18 in. on straight runs. Welds must be at least full thickness of pipe inside smooth and remove cutting beads, slag and excess material at joints; chamfer ends. Minimum gap 1/8 in., maximum 1/4 in., for butt welds. One internal pass and one external pass minimum required on slip-on flanges. Do not apply heat to rectify distorted pipe due to concentrated welding; replace distorted pipe. When welding galvanized pipe, apply cold galvanizing on joint after welding.

3.9 HANGER SHIELDS

- A. Provide at hangers for all piping. Pre-insulated type or field-insulated type at Contractor's option.

3.10 SLEEVES

- A. Provide for pipes passing through floors, walls or ceilings.
- B. Pre-Insulated Type: Required for chilled water, and refrigerant piping.
- C. Standard Type: Provide for piping, except as called for.
- D. Extend 1/8 in. above finished areas. In above grade mechanical and other areas with floor drains; use steel pipe sleeves 2 in. above floor. Use pipe sleeves in bearing walls, structural slabs, beams and other structural surfaces, and where called for. Sleeves shall be as small as practical, consistent with insulation, so as to preserve fire rating. Fill abandoned sleeves with concrete. Provide rubber grommet seals for pipes passing through ducts or air chambers or built-up housings.

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3.11 ANCHORS

- A. Provide piping system anchors where shown on the plans, and as recommended by the expansion joint/loop manufacturer. Where an anchor is shown at a change in piping direction, it shall fully control movement in both directions. In lieu of a single anchor fabricated for two directional control, two (2) individual anchors may be provided. Provide detailed fabrication drawings for all field-fabricated anchors.
- B. Design anchors and equipment and piping supports including comprehensive structural engineering analysis by a qualified professional engineer, licensed to practice in the State of New York using the performance and design criteria specific to this project.

3.12 SLEEVE PACKING

- A. Seal void space at sleeves as follows:
 - 1. Interior Locations: Firmly pack with fiberglass and caulk.
 - 2. Exterior Walls and Below Grade Cored Holes: Use sealing element.
 - 3. Fire Rated, Partitions and Floor Slabs: Use fire rated sealing elements, materials and methods. Provide per manufacturer's instructions to maintain firestop.
 - 4. Waterproofed Walls and Floors: Use waterproof sealing element, device, or compound.

3.13 ESCUTCHEON PLATES

- A. Provide polished chrome escutcheon plates for uninsulated exposed piping passing through floors, walls or ceilings in finished areas.

3.14 PROTECTION AGAINST PHYSICAL DAMAGE

- A. In concealed locations where piping, other than cast-iron or steel, is installed through holes or notches in studs, joists, rafters or similar members less than 1-1/2 in. from the nearest edge of the member, the pipe shall be protected by shield plates. Protective steel shield plates having a minimum thickness of 0.0575 in. (No. 16 gage) shall cover the area of the pipe where the member is notched or bored, and shall extend not less than 2 in. above sole plates and below top plates.

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3.15 PIPE LINE SIZING

- A. Pipe sizes called for are to be maintained. Pipe sizing changes made only as reviewed by Owner's Representative. Where discrepancy in size occurs, the larger size shall be provided.

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EXHIBIT "A" - PIPING MATERIALS (HVAC)

(Notes are at end of Exhibit "A")

<u>SERVICE</u>	<u>PIPE MATERIALS</u>	<u>FITTINGS</u>	<u>CONNECTIONS</u>
Hot water heating	Schedule 40, black steel	Malleable iron and butt weld	Screwed 2 in. and smaller; Welded 2-1/2 in. and larger; (SEE NOTE 1)
Hot water heating (optional)	Schedule 40, black steel	Grooved, rigid couplings	Mechanical with gasket, 1-1/2 in. and larger (SEE NOTE 2)
Hot water heating (optional)	Type L copper	Wrought copper or cast bronze, solder end	No-lead solder for 2 in. and smaller; 95/5 for 2-1/2 in. and larger
Hot water heating (optional)	Type L copper	Wrought copper or cast bronze	Viega Pro-Press, Nibco Press, Elkhart Apolloxpress
Hot water heating (optional)	Type L copper	Wrought copper or cast bronze	Mechanical with gasket, 1-1/2 in. and larger (SEE NOTE 2)
Vent, overflow, drain	Type DWV or Type M copper	Wrought copper	Threaded or solder
Vent, overflow, drain (optional)	Type K or L copper	Grooved, rigid couplings	Victaulic mechanical coupling with gasket
Steam up to 50 psi, including steam relief vent piping	Schedule 40, black steel	2000# forged steel or cast iron for screwed; butt weld fittings for welded or flanged	2-1/2 in. and larger butt welded or flanged; 2 in. and smaller screwed or socket welded (SEE NOTE 1)

NOTES FOR EXHIBIT "A":

NOTE 1: Screwed piping permitted in Crawl Spaces, Mechanical Rooms and Boiler Rooms.

NOTE 2: Grooved piping shall not be installed in shafts.

END OF SECTION

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SECTION 23 21 10 - WATER SYSTEMS SPECIALTIES

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Provide labor, materials, equipment and services as required for the complete installation designed in Contract Documents.

1.2 SUBMITTALS

- A. Submit product data on water system specialties.

1.3 GENERAL REQUIREMENTS

- A. Equipment and accessories shall be rated for a minimum of 125 psi wwp, and 250°F temperatures, unless otherwise stated.
- B. All equipment shall be installed in accordance with manufacturer's written installation instructions and schematics.

PART 2 - PRODUCTS

2.1 AIR ELIMINATING SUPPLY FITTING

- A. Designed to eliminate air from supply water; located in supply header from heat generating devices; flanged or screwed.
- B. Design Equipment: Bell & Gossett "Airtrol".
- C. Manufacturers: Armstrong, Bell & Gossett, Patterson, Taco, Spirotherm.

2.2 RELIEF VALVES

- A. To relieve full heating capacity.
- B. Provide an ASME labeled safety relief valve as called for on the plans/details.
- C. Manufacturer: ITT, Bell & Gossett, Watts, Kunkle, Spence, Keckley.

2.3 FLOW BALANCERS

- A. Balancing and flow meter stations suitable for use on heating and cooling systems. Constructed for 125 psi and 250°F.

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- B. 6 in. and Smaller: Calibrated balance valve with provisions for connecting a portable differential pressure meter. Flow balancer is to be suitable as a service valve. Meter connections to have built-in check valves. An integral pointer shall register degree of valve openings. Valve shall have internal seals.

1. Balance valve sizes shall be based upon gpm range rather than pipe size.

Balance Valve Size	GPM Range
1/2 in.	Up to 2.5
3/4 in.	2.5 - 4.5
1 in.	4.5 - 10
1-1/4 in.	10 - 15
1-1/2 in.	15 - 30
2 in.	30 - 60
2-1/2 in.	60 - 100
3 in.	100 - 180
4 in.	180 - 300
5 in.	300 - 450
6 in.	450 - 600

2. Design Equipment: Bell & Gossett "Circuit Setter"

3. Manufacturers: Bell & Gossett, Armstrong, Patterson, Taco, Tour & Anderson, Oventrop Hydrocontrol, Watts.

- C. 5 in. and Larger: Nickel-plated flow meter with provisions for connecting a portable differential pressure meter. Shall be individually calibrated. Provide with a butterfly valve with memory stop balancing cock at each location.

1. Flow meter size shall be based upon manufacturer's recommended gpm range rather than pipe size.

Flow Meter Size	GPM Range
5 in.	300 - 500
6 in.	500 - 850
8 in.	850 - 1500
10 in.	1500 - 2500
12 in.	2500 - 3500

2. Design Equipment: Bell & Gossett "Circuit Sensor".

3. Manufacturers: Bell & Gossett, Patterson, Taco, Oventrop Hydrocontrol, Watts.

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2.4 SUCTION DIFFUSER

- A. Provide as shown on plans, an angle pattern flow straightening fitting equipped with a combination diffuser-strainer-orifice cylinder, flow straightening vanes, start-up strainer and adjustable support foot. The combination diffuser-strainer-orifice cylinder shall be designed to withstand pressure differential equal to the system pump shutoff head (maximum 175 PSIG) and shall have a free area equal to five times the cross section area of the pump suction opening. The length of the flow straightening vanes shall be no less than 2-1/2 times the diameter of the system pump suction connection.
- B. The Flow Straightening Fitting shall have NPT, flanged or (grooved) mechanical system connections as applicable. The fitting shall have a stainless steel combination diffuser-strainer-orifice cylinder with 3/16 in. diameter perforations to protect the system pump, and full length flow straightening vanes shall provide nonturbulent flow to the suction side of the system pump. The start-up strainer shall be of 16 mesh bronze, and the support foot shall eliminate pipe strain at the flow fitting/pump connection. All internal components shall be replaceable.
- C. Construction Materials:
- | | | | |
|----|-------------------------------------|---|---------------------------|
| 1. | Body and Cover: | NPT and Flanged Models
Grooved Models | Cast Iron
Ductile Iron |
| 2. | Straightening Vanes: | X Models
Z and Grooved Models
Steel | Steel
Stainless |
| 3. | Orifice Cylinder: | Z and Grooved Models
Steel | Stainless |
| 4. | Start-Up Strainer: | X, Z and Grooved Models | 16 Mesh Bronze |
| 5. | O-Ring Seal: | All models | EPDM |
| 6. | Type X Models (for closed systems). | | |
| 7. | Type Z for (open systems). | | |
- D. Design Equipment: Bell & Gossett.
- E. Acceptable Manufacturer: Bell & Gossett, Armstrong, Taco, Paco, Grundfos, Thrush, Patterson, Victaulic.

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2.5 STRAINERS

- A. Cast semi-steel body or cast iron construction for steel piping and bronze body construction for copper piping; equipped with removable, monel or stainless steel water screen; maximum pressure drop 2 psi with free area at least four times area of pipe. Provided with blow-off outlet.
- B. Sizes 5 in. and Smaller, Y-Pattern Strainer: 125 psig working pressure; flanged ends for NPS 2-1/2 in. and larger, threaded connections for NPS 2 in. and smaller, bolted cover, perforated stainless steel basket and bottom drain connection.
- C. Sizes 6 in. and Larger, Basket Strainer: 125 psig working pressure; flanged end connections, bolted cover, perforated stainless steel basket and bottom drain connection.
- D. Design Equipment: Mueller.
- E. Manufacturers: Elliott, Keckley, Mueller, Webster, Victaulic, Watts, Spirax-Sarco.

2.6 TRIPLE DUTY VALVE

- A. Provide as shown on plans, a straight, angle or straight-angle pattern valve designed to perform the functions of a center guided nonslam check valve, shutoff valve and calibrated balancing valve.
- B. 2 in. and Smaller: The valve shall be of brass construction with connections per ANSI B1.20.1-83 suitable for 200 psi working pressure for operation temperatures up to 250°F. The valve shall be fitted with a chrome plated brass ball, glass and carbon filled PTFE seating rings, EPDM seals and brass stem. Check valve to have chatter preventing stainless steel spring and EPDM seals.
- C. 2 in. and Larger: The valve shall be of heavy-duty cast iron (NPT and flanged models only) or ductile iron (grooved models only) construction with connections per ANSI B1.20.1-83 suitable for 175 psi working pressure for operating temperatures up to 250°F. The valve shall be fitted with a bronze seat, replaceable bronze disc with EPDM seat insert or stainless steel stem, and chatter preventing stainless steel spring. The valve design shall permit repacking under full system pressure.
- D. Cv rating shall be provided at every 10% increment opening for the straight and angle valve. Manufacturer shall supply the Cv rating for read-out of flow determination and system pressure drop.

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- E. The valve shall be equipped with brass readout valves (with integral check valve) to facilitate taking differential pressure readings across the orifice for accurate system balance. The valve shall be produced at an ISO 9001 approved facility.
- F. Triple duty valve sizes shall be based upon gpm range rather than pipe size. The valve shall be capable of system flow at the lowest open flow pressure drop. Submit performance chart for system balancing for each valve indicating design flow and minimum and maximum turn-down pressure drops.
- G. Design Equipment: Bell & Gossett 3DV (2 in. and smaller) or 3DS (2 in. and larger).
- H. Manufacturers: Armstrong Flo-Trex, Bell & Gossett, Taco Plus Two, Grundfos, Thrush, Patterson, Victaulic.

2.7 AIR VENTS

- A. Manual air vents shall be a 3/4 in. ball valve with bronze body, nickel plated bronze ball, hose end, cap and chain, Watts B6000CC.
- B. Automatic air vents shall be float type, 35 psig rated, Armstrong No. 502CV OR float type, 150 psig rated, Armstrong No. 75 or Spirotop. Provide unit with an appropriate rating, as necessary for location.
- C. High Capacity Automatic Air Vent:
 - 1. Cast iron body. 150 psig rated. Stainless steel float.

2.8 FLEXIBLE PIPE AND PUMP CONNECTIONS (BRAIDED STAINLESS STEEL)

- A. Braided stainless steel pump and pipe connector(s) shall be constructed of annular corrugated stainless steel close-pitch hose with stainless steel overbraid. The corrugated metal hose, braid(s) and a stainless steel ring-ferrule/band (material gauge not less than .048 in.) shall be integrally seal-welded using a 100% circumferential, full-penetration TIG weld. Fittings shall be attached using a 100% circumferential TIG weld.
- B. Braided stainless steel pump and pipe connector(s) must be suitable for operating temperatures up to 850°F. The rated working pressure of the braided metal hose must have a minimum 4:1 safety factor.
- C. Each braided stainless steel connector shall be individually leak tested by the manufacturer using air-under-water or hydrostatic pressure.

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- D. Braided stainless steel connectors shall carry a three (3) year warranty when installed in accordance with all specifications and installation instructions as described by the manufacturer.
- E. End fittings shall be flat-faceplate steel flanges with 150# ANSI drilling, and outside diameter, carbon steel MPT ends, flanged by Schedule 40 grooved ends or increasing ends.
- F. Acceptable Manufacturers: Flexhose Pumpsaver or equivalent Keflex, Metraflex, Mason-Mercer.

2.9 VICTAULIC PUMP DROPS

- A. Vibration Isolation Pump Drop Factory assembled grooved end vibration isolation pump drop for pipe sizes 3" through 12". Orange enamel coated assembly, consisting of a Class 150 flange for pump connection
 - 1. Suction Pump Drop: consisting of a suction diffuser with stainless steel basket, butterfly valve with offset stem for 360-degree circumferential seating, and pipe spool with thermometer and pressure ports. Assembly is installation-ready, with flexible couplings to accommodate vibration attenuation and stress relief. Assembly rated for working pressure to 300-psig. Basis of Design: Victaulic Series 381.
 - 2. Discharge Pump Drop: Tri-service valve assembly consisting of a spring-actuated Venturi-Check valve and butterfly valve with offset stem for 360-degree circumferential seating, and pipe spool with thermometer and pressure ports. Assembly is installation-ready, with flexible couplings to accommodate vibration attenuation and stress relief. Assembly rated for working pressure to 300-psig. Basis of design: Victaulic Series 380.
 - 3. Series 385 Vibration Isolation Air Handling Unit Drop Manufactured grooved end vibration isolation drop for air handling unit coil supply and return connections in sizes 2" - 6" to accommodate isolation, straining balancing, and drainage. Orange enamel coated drop, consisting of ASTM A53 carbon steel pipe spools, Style 920/920N Mechanical-T fittings with base end cap with drain outlet and DZR brass drain valve. Supply connections include a Vic 300 MasterSeal butterfly valve and Style 732 Y-pattern strainer with PT ports, and the return connection includes a Series 787 or 789 circuit balancing valve. Installation-ready, with flexible couplings to accommodate vibration attenuation and stress relief, rated for working pressure to 300-psig. Standard of Acceptance: Victaulic Series 385.

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PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

- A. Obtain detailed instructions from each manufacturer for proper method of installation.

3.2 AIR VENTING

- A. Provide where specifically called for in piping details and at all points in piping systems where air may collect due to changes in piping elevation.
 - 1. Manual air vent assembly consisting of 1-1/4 in. x 4 in. air collection chamber with 3/4 in. hose end ball valve with cap and chain.
 - 2. Automatic air vent with a ball valve for the purpose of isolation and service or replacement.
 - 3. Unless otherwise indicated, automatic air vents shall only be installed in Mechanical Rooms. Pipe high capacity air vent discharge down to floor.
- B. Equipment Vents:
 - 1. When equipment is above mains: Connect run-outs or risers to upper quadrant or top of mains. Install vent assembly concealed within enclosure, consisting of 1 in. diameter by 4 in. to 6 in. long air collection chamber with 1/4 in. soft copper tube to manual valve. Mount securely near bottom of enclosure, but not fastened to enclosure. For individual units, radiators, fan convectors and units with return grilled: Provide screwdriver operated manual valve, operated from discharge grille or access door. Drill enclosure and position valve for operating without removing enclosure.
 - 2. When equipment is below mains: Connect piping run-outs or risers to bottom or lower quadrant of mains. Vent assembly not required in unit. Provide means of purging and draining each unit if required. Use tees instead of ells at low point of run-outs.

3.3 RELIEF VALVES

- A. Hot Water System: Pipe discharge to floor drain and place hanger at elbow. Install piping so as not to introduce stress of PRV body.

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3.4 FLOW BALANCERS

- A. Where flow balancers are smaller than pipe line size, provide reducers directly adjacent to flow balancers.
- B. Provide on zone or riser returns, on each hydronic unit and where called for. Meter connection points shall not point downward.
- C. On terminal heating and cooling unit details where a shut-off valve is shown in conjunction with the flow balancer (3 in. and smaller), if the Armstrong "CBV" or Tour & Anderson "ST" is used, the shut-off valve may be deleted.

3.5 SUCTION DIFFUSERS

- A. Provide at inlet to base mounted pump.
- B. Pipe suction diffuser blow-off connection (full size with ball valve) to nearest floor drain.

3.6 TRIPLE DUTY VALVES

- A. Provide an increaser on discharge side of triple duty valve to match full flow pipe size, if triple duty valve is smaller than line size.

END OF SECTION

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SECTION 23 21 23 - PUMPS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Provide labor, materials, equipment and services as required, for the complete installation designed in Contract Documents.

1.2 SUBMITTALS

- A. Shop drawings and performance curves, on pumps and pump accessories clearly indicate which equipment is being submitted.
- B. Provide catalog information on motors as specified in Section 230513.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

- A. Pumps shall be non-overloading over their entire performance range with motors capable of running continuously without undue noise, heating, or sparking. Impellers shall be statically and dynamically balanced. Provide mechanical seals for closed systems, constructed of carbon rings with ceramic mating seat up to 220°F. Provide packing type seals for open systems only. Provide materials suitable for water pressures, temperature and conditions for each application. Provide tapped discharges and suction connections for gauges, vent and drain. Provide factory trimmed impeller if required, to meet initial delivery requirements.
- B. Provide the services of a factory service engineer or machinist to check each pump alignment before pump is started, using laser equipment.

2.2 SELECTION CRITERIA

- A. Pumps shall be non-overloading over their entire performance ranges, with trimmed impeller as required to meet initial delivery requirements. Pump selection shall not take into account, or infringe on the service factor of the motor.
- B. Select pumps at a point within the maximum efficiency for a given impeller casing construction. Deviations within 3 percent of maximum efficiency are permissible, provided that the lesser efficiency is not less than the scheduled efficiency.
- C. Pumps may not be selected such that the impeller diameter is larger than 90 percent of the published maximum diameter for the casing using smaller equipment than the scheduled equipment.

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2.3 CIRCULATOR PUMPS

- A. The pump shall be a maintenance-free, in-line, single stage, wet rotor type with the motor mounted directly to the pump volute. The pump valve shall be constructed of cast iron and rated at 175 psi working pressure. The pump body is cast iron or stainless steel. The impeller shall be secured directly to the motor shaft by means of a stainless steel split cone. The motor shaft shall be constructed of aluminum oxide ceramic and shall be supported by two radial bearings mounted in a bearing plate and rotor can. The pump shall not have a coupling or mechanical seal. Three speed motor and switch.
- B. Design Equipment: Bell & Gossett
- C. Make: Taco, Armstrong, Bell & Gossett, Grundfos, Wilo.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install pumps to provide access for periodic maintenance including removing motors, impellers, couplings and accessories.
- B. Independently support pumps and piping so weight of piping is not supported by pumps and weight of pumps is not supported by piping.
- C. Provide 6 in. concrete pad for each base mounted pump. Level base so that pump and pump casing are not strained. Align pumps as directed by manufacturer. After pumps have been aligned, install dowels to prevent shifting. Fill base with non-shrink grout through grouting holes provided in baseplate. Contractor responsible for accurate size of base and exact location of mounting bolts. Contractor responsible for trouble resulting from poor pump alignment.
- D. Base mounted end suction pumps shall be provided with inlet suction diffusers where shown on drawings. Pipe suction diffuser blow-off (full line size with ball valve) to nearest floor drain. Provide start-up strainers for first 48 hours of operation. Replace after completion of start-up period.
- E. In-line pumps shall be installed using continuous-thread, hanger rods and elastomeric hangers of size required to support weight of in-line pumps.

3.2 ALIGNMENT

- A. Engage a factory-authorized service representative to perform alignment services for all pumps that use a coupler attached to the device train, whether base mounted or inline mounted. Alignment shall be accomplished with a laser shaft alignment system.

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- B. Comply with requirements in Hydronics Institute standards for alignment of pump and motor shaft. Add shims to the motor feet and bolt motor to base frame. Do not use grout between motor feet and base frame.
- C. Comply with pump and coupling manufacturers' written instructions.
- D. After alignment is correct, tighten foundation bolts evenly but not too firmly. Completely fill baseplate with nonshrink, nonmetallic grout while metal blocks and shims or wedges are in place. After grout has cured, fully tighten foundation bolts.
- E. Provide an alignment report indicating alignment setup data, tolerances and final results.

3.3 STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform startup service.
 - 1. Complete installation and startup checks according to manufacturer's written instructions.
 - 2. Check piping connections for tightness.
 - 3. Clean strainers on suction piping.
 - 4. Perform the following startup checks for each pump before starting:
 - a. Verify bearing lubrication.
 - b. Verify that pump is free to rotate by hand and that pump for handling hot liquid is free to rotate with pump hot and cold. If pump is bound or drags, do not operate until cause of trouble is determined and corrected.
 - c. Verify that pump is rotating in the correct direction.
 - 5. Prime pump by opening suction valves and closing drains, and prepare pump for operation.
 - 6. Start motor.
 - 7. Open discharge valve slowly.

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3.4 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain hydronic pumps.

END OF SECTION

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SECTION 23 22 10 - STEAM SPECIALTIES AND ACCESSORIES

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Provide labor, materials, equipment and services as required for the complete installation design in Contract Documents.

1.2 GENERAL REQUIREMENTS

- A. Steam specialties shall be of one manufacture, insofar as possible. Straight through, angle or offset body to suit job conditions. Steam specialties designed to withstand 125 psi steam pressure without damage, but with openings sized for operating steam pressure.

1.3 SUBMITTAL

- A. Submit shop drawings on steam specialties and accessories. Schedule of equipment, capacities, and pressure drops.

1.4 ACCEPTABLE MANUFACTURERS

- A. Basis-of-Design: Subject to compliance with the requirements of this Section, provide product by one of the following:
 - 1. Armstrong, Mepco, Hoffman, Watts, Tunstall, Watson McDaniel.

PART 2 - PRODUCTS

2.1 STEAM TRAPS

- A. Determine maximum condensing rate by multiplying operating condensing rate by the following multipliers:
 - 1. Heat exchangers and coils that do not handle outside air x 2.0.
- B. Select each trap in accordance with manufacturer's published recommendations for maximum efficiency, handling air, non-condensable gases, and maximum condensate loads:
 - 1. Steam traps draining equipment without a control valve or similar modulating device should be sized based on the condensate load multiplier at the design maximum supply steam pressure.
 - 2. Steam traps draining equipment with a modulating steam supply control valve should be sized based on the maximum condensate loads given at

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minimum available pressure (0.25 psig differential pressure), provided the trap inlet is able to be installed a minimum of 6" below the condensate outlet of the source being drained.

C. Steam Trap Selection by Application

1. For Drip Applications:
 - a. For pressure 30 psig and above: Thermodynamic Disc
 - b. For pressures below 30 psig: Float & Thermostatic (with 30 psi orifice)
 - c. Alternative for pressures below 30 psig: Inverted Bucket (with orifice selected to equal or exceed highest possible system operating pressure)

D. Steam Trap Selection by Type

1. Thermodynamic Disc (drip applications 30 psig to 600 psig): The steam trap shall be all stainless steel thermodynamic disc type with threaded NPT connections on a common center line. The steam trap shall have an integral seat design with a hardened disc and seating surface, with balanced 3-port discharge for extended service life. Trap will operate with up to 80% back pressure and in any position up to 600 psig @ 800°F.
2. Float & Thermostatic (drip and process applications of various pressures up to 250 psig): Steam trap shall be a cast iron body design with parallel pipe inlet and outlet connections threaded NPT mounted on side or cover plate of trap body. All internals shall be stainless steel with hardened seat area. Float shall actuate the valve via a hinged lever and linkage. Air vent shall be located at the high point of the trap body and of a filled thermal element design with stainless steel, welded, encapsulated bellows capable of discharging air and non-condensable gases continuously within 15°F of saturated temperature. All internal trap components shall have the ability to be replaced with the trap cover (body on smaller sizes) remaining in-line. Trap shall be suitable for a maximum saturated steam operating pressure of 250 Psig.

2.2 STRAINERS

- A. Y-Pattern Strainers; NPS 2 in. and Smaller: 250 psig working steam pressure; cast iron body, threaded connections, tapped blowoff connection and plug.
 1. No. 20 (standard) stainless steel mesh for steam and condensate services.

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2. Design Equipment: Spirax-Sarco IT.
- B. Basket Strainers; NPS 2 in. and Larger: 125 psig working steam pressure; ASTM A 126; Class B cast iron body; flanged connections, bolted cover, tapped blowoff connection and plug.
 1. NPS 2 in. to NPS 3 in.: 1/16 in. stainless steel mesh for condensate service.
 2. NPS 4 in. and Larger: 1/8 in. stainless steel mesh for condensate service.
 3. Design Equipment: Spirax-Sarco 733.

2.3 VACUUM BREAKERS

- A. Adjustable from 1/4 in. - 20 in. Hg vacuum, 3/4 in. straight shank, suitable for 150 psi and 366°F.
 1. Design Equipment: Hoffman No. 62.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install traps with unions. All traps, other than radiation traps, installed with maximum drip leg to maintain "dry" conditions in equipment and piping. Minimum drip leg length to be 14 in. unless restricted by installation conditions. If restricted, resize trap accordingly. Provide thermostatic traps (0 to 15 psi) on return connection to each steam unit less than 25 MBH, and where called for. Provide float and thermostatic traps (15 psi to 20 in. vacuum), on return end of each steam unit larger than 25 MBH and where called for. When required to raise low pressure steam mains to clear obstructions, provide drip trap at low point and connect to condensate piping.
- B. Provide drip traps at all system low points including upward changes of elevations, end of steam mains and intermediate drop points.
- C. Provide drip trap where condensate is required to be lifted (15 psig or greater pressure only). Provide external thermostatic vent trap connected to tapping on cover, and installed above high point of return piping lift.
- D. Strainers: Full size of pipe to control valve and/or trap.
 1. Install strainer housing in "horizontal" position to prevent the accumulation of condensate.

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2. Provide strainers on supply side of control valves, pressure reducing valves, traps and elsewhere as indicated. Install NPS 3/4 in. nipple and full port ball valve in blowdown connection of strainers NPS 2 in. and larger. Match size of strainer blowoff connection for strainers smaller than NPS 2 in. No strainer required ahead of trap if one is provided ahead of upstream control valve.
- E. Vacuum Breaker: Provide on discharge side of each control valve supplying steam to heating equipment.
- F. Air Vents:
1. Provide in conjunction with any Vacuum Breaker or when Pump-Traps are specified on heat transfer applications.
 2. Provide on steam piping at end of steam mains.
 3. Install 6" minimum above steam piping.

END OF SECTION

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SECTION 23 31 00 - SHEET METAL AND DUCTWORK ACCESSORIES CONSTRUCTION

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Provide labor, materials, equipment and services required for the complete installation designed in Contract Documents.

1.2 QUALITY ASSURANCE

- A. Ductwork shall be fabricated and installed in compliance with latest edition of the following standards.
 - 1. SMACNA Duct Construction Standards - Metal and Flexible Ductwork.
 - 2. SMACNA Duct Liner Application Standard.
 - 3. SMACNA HVAC Air Duct Leakage Test Manual.
 - 4. 2015 Energy Conservation Construction Code of New York State.
 - 5. Plans and Specifications which exceed the requirements in any of the referenced standards.
 - 6. 2015 Mechanical Code of New York State.
- B. All sheet metal shall be fabricated and installed by an experienced Contractor specializing in this type of work.
- C. All ductwork and fittings shall have a computer generated label affixed to the exterior surface of each section, detailing all applicable information including the duct dimensions, gauge, reinforcement type/class and connection type by systems manufacturer. Galvanizing thickness shall be clearly stenciled on each duct section.
- D. All ductwork on the project shall meet the SMACNA Duct Cleanliness For New Construction Guidelines, "Advanced Level" of duct cleanliness for production, delivery, storage and installation of ductwork.

1.3 SUBMITTALS

- A. Ductwork Shop Drawings.
- B. Duct Access Doors.
- C. Flexible Duct.

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- D. Submit a complete shop standard manual including miscellaneous materials, and construction details for all shop fabricated materials including, but not limited to, volume dampers, turning vanes, duct sealant, equipment flexible connections, access doors, flexible duct, acoustical duct lining, etc.

1.4 GENERAL

- A. All adhesives, sealants, primers and paint used for ductwork in the interior of the building shall comply with the maximum Volatile Organic Compound (VOC) limits called for in the current version of U.S. Green Building Council LEED Credits EQ 4.1 and EQ 4.2.

1.5 DUCTWORK CLASSIFICATION

- A. Duct systems are to be classified and constructed per the SMACNA Velocity-Pressure classification system as follows:
 - 1. All ductwork shall be constructed for a minimum pressure class of 2 in. w.g. (unless stated otherwise) for the following systems, as applicable:
 - a. Supply duct downstream of terminal units.
 - b. Typical low pressure supply ductwork.
 - c. Typical return ductwork.
 - d. Typical low pressure exhaust ductwork.
 - 2. Supply duct upstream of terminal units shall be constructed for a minimum pressure class of 3 in. w.g. unless otherwise stated or required as per below.
 - 3. Pressure classes above 3 in. w.g. shall be provided as follows, based upon the external static pressure as scheduled for each specific fan.

<u>Scheduled External Static Pressure</u>	<u>Pressure Class</u>
Over 3 in. up to 4 in. w.g.	4 in. w.g.
Over 4 in. up to 6 in. w.g.	6 in. w.g.
Over 6 in. up to 10 in. w.g.	10 in. w.g.

1.6 DUCTWORK SHOP DRAWINGS

- A. Prepare minimum 1/4 in. scale drawings:
 - 1. Detailed ductwork shop drawings shall include size, layouts and pressure classifications. Any ductwork installed without benefit of review by the

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Engineer of Record may be subject to replacement at the expense of the Contractor.

2. Constructed from actual field inspections and measurements so as to assure a complete job.
 3. Incorporate dimensions of actual equipment proposed for use on the project.
 4. Showing adequate sections, elevations, and plan views and indicating the bottom of ductwork elevations from the finished floor.
 5. Indicating all volume dampers, fire dampers, smoke dampers, damper access doors and other accessories required for a completed project.
- B. Call to the attention of the Engineers immediately, any major deviations from the Contract Drawings, which must be made. All deviations shall be documented in writing.
- C. Indicate roof, wall and floor opening dimensions and locations shown on shop drawings.
- D. Submit prints to each Contractor of the other trades for review for interference's and coordination with their work.

PART 2 - PRODUCTS

2.1 DUCTWORK MATERIALS

- A. Unless otherwise called for, provide materials in accordance with Exhibit I at the end of this section.

2.2 SQUARE AND RECTANGULAR DUCTWORK

- A. Materials:
1. Galvanized Sheetmetal: Comply with ASTM A653 and A924, with G90/Z275 coating.
 2. Stainless-steel Sheets: Comply with ASTM A 480/A 480M, Type 304 or 316, as indicated in Exhibit "I"; cold rolled, annealed, sheet. Exposed surface finish shall be No. 2B, No. 2D or No. 3 as indicated in Exhibit "I".
 3. Aluminum sheets: Comply with ASTM B 209 (ASTM B 209M) Alloy 3003, H14 temper; with mill finish for concealed ducts, and standard, one-side bright finish for duct surfaces exposed to view.

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4. Gauges per SMACNA HVAC Duct Construction Standards, Metal and Flexible.
- B. Transverse and longitudinal duct seams reinforcement shall conform to appropriate tables and figures per SMACNA Velocity-Pressure Classification for duct construction.
 1. Transverse joints shall be sealed with duct joint sealant. "Ductmate" or "Nexus" 4-bolt connection systems may be used in lieu of standard construction.
 2. Field assembled longitudinal seams shall be sealed with duct sealant. Factory or shop fabricated rolled or machine pressed longitudinal seams does not require sealant.
- C. Corner closures shall be required as described and illustrated by SMACNA Duct Construction Standards.
- D. Throat radius on all elbows shall not be less than the dimension of the duct plane of radius. Where this cannot be maintained, use shorter radius with internal guide vanes, or square elbow with turning vanes.
- E. Bracing and hanging of ductwork shall be per SMACNA Standards for size and system class of ductwork being used.
- F. Any transformations shall not reduce the ductwork cross-sectional area. Maximum angle in straight duct, 20° for diverging flow and 30° for contraction flow. Transformation from square to round or flat to oval seams welded or brazed.

2.3 ROUND DUCTWORK

- A. Standard Round Ductwork:
 1. Materials:
 - a. Galvanized Sheetmetal: Comply with ASTM A653 and A924, with G90/Z275 coating.
 - b. Stainless-steel Sheets: Comply with ASTM A 480/A 480M, Type 304 or 316, as indicated in Exhibit "I"; cold rolled, annealed, sheet. Exposed surface finish shall be No. 2B, No. 2D or No. 3 as indicated in Exhibit "I".
 - c. Aluminum sheets: Comply with ASTM B 209 (ASTM B 209M) Alloy 3003, H14 temper; with mill finish for concealed ducts, and standard, one-side bright finish for duct surfaces exposed to view.

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- d. Gauges per SMACNA Duct Construction Standards. Spiral lock-seam or longitudinal fusion-welded.
- 2. All spiral ducts shall have locked seams so made as to eliminate leakage under pressure for which this system has been designed. Longitudinal seams duct shall have fusion-welded butt seams.
- 3. No stovepipe will be allowed.
- 4. Round Ductwork Fittings:
 - a. All fittings fabricated per SMACNA Standards for round and flat-oval ductwork, material to match straight pieces of ductwork.
 - b. Fittings shall have continuous, welded seams.
 - c. 90° tees shall be conical type. 90° tees and 45° laterals up to and including 12 in. diameter tap size shall have a radiused entrance into the tap, produced by machine or press forming. The entrance shall be free of any restrictions.
 - d. Round taps off the bottom of rectangular ducts down to diffusers shall be made with a 45° square to round shoe-tap.
- 5. Elbows:
 - a. Diameters 3 in. through 8 in.: Two-section stamped and continuously welded elbows, material to match straight pieces of ductwork.
 - b. Over 8 in.: Gored construction with standing seam construction and internally sealed or continuously welded. Less than 35° - two gores, 36° to 70° - three gores, over 71° - five gores.
 - c. Fabricated to a centerline radius of 1.5 times the cross-section diameter.
- 6. Joints:
 - a. For duct construction pressure 3 in. w.g. or greater:
 - 1) Round Joints:
 - a) Unexposed Duct 3 in. - 30 in. Diameter: Connect round duct with a one piece interior slip coupling, at least two gauges heavier than duct wall, beaded at

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center and fastener to duct with screws. Seal joint with an approved sealant applied continuously around both end of coupler prior to assembling and after fastening.

- b) All Exposed Duct and Unexposed Duct 30 in. - 72 in. Diameter: Install using a three piece, gasket flanged-joint consisting of two internal flanges, with integral mastic sealant, and one external closure band, which compress the gasket between the internal flanges.

- (1) Acceptable Manufacturer: Ductmate Industries "Spiralmate" system or approved equal.

- c) Above 72 in. Diameter: Install using companion angle flanged joints as defined in Figure 3-1 of the 2005 SMACNA Manual, "HVAC Duct Construction Standards, Metal and Flexible" Third Edition. Refer to manual for proper sizing and construction details.

- d) Dust collection systems and exposed duct 3 in. - 14 in. use a one piece, polyethylene lined gasket connector with integrated bolt for the closure system.

- (1) Acceptable Manufacturer: Ductmate Industries "Quicksleeve" or approved equal.

- b. Pipe-to-pipe joints in diameters up to 60 in. shall be by the use of sleeve couplings, reinforced by rolled beads.
- c. Pipe-to-fitting joints in diameters up to 60 in. shall be by slip-fit of projecting collar of the fitting into the pipe.
- d. Insertion length of sleeve coupling and fitting collar shall be 2 in. up to 36 in. diameter and 4 in. above 36 in. diameter.
- e. Pipe-to-pipe and pipe-to-fitting connections in ductwork above 60 in. in diameter shall be made by angle ring flanges. The flange on the pipe shall be a 2 in. x 2 in. x 3/16 in. angle attached to the pipe with a continuous weld. The fittings shall have a loose ring "Van Stone" flange. A 5/8 in. flange shall be provided to act as a gasketing surface for sealing with the angle ring being a rolled,

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welded ring 2 in. x 2 in. x 3/16 in. Bolt hole spacing for angle rings shall be 6 in. centers.

- f. If longitudinal seam duct greater than 60 in. in diameter is supplied in lengths greater than 4 ft., one angle ring must be welded to the duct on 4 ft. centers for support.

2.4 DUCTWORK SEALING

- A. SMACNA Duct Sealing Classification shall be used for duct systems using the following criteria:
 - 1. Ductwork and all plenums with pressure class ratings shall be constructed to Seal Class A, as required to meet the requirements of SMACNA Duct Construction Standards and with standard industry practice, including transverse joints, longitudinal seams, fitting connections, and all penetrations of the duct wall.
 - 2. Openings for rotating shafts shall be sealed with bushings or other devices that seal off air leakage. Pressure sensitive tape shall not be used.
 - 3. All connections shall be sealed, including but not limited to spin-ins, taps, other branch connections, access doors, access panels and duct connections to equipment.
 - 4. Sealing that would void product listings is not required.
 - 5. Spiral lock seams need not be sealed.
- B. Duct sealant for indoor applications shall be non-fibrated, water based, Hardcast Iron-Grip IG-601, Ductmate PRO Seal, Foster 32-17 or Childers CP146.
- C. Duct sealant for outdoor applications shall be fibrated, water based, Hardcast Versa-Grip VG-102, Ductmate Fiberseal, Foster 32-17 or Childers CP148.
- D. Sealants and tapes shall be listed and labeled in accordance with UL 181A or UL181B and marked according to type.

2.5 TURNING VANES

- A. Provide in mitered elbows as shown on contract drawings. Vanes 36 in. or longer shall be double wall air foil type. All turning vanes shall be installed as per the latest SMACNA Standards. Turning vane size and spacing shall be as per SMACNA. Turning vane spacing greater than SMACNA Standards is not acceptable.

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- B. Turning vanes shall be Harper or equivalent double wall turning vanes fabricated from the same material as the duct.
- C. Turning vane front and back panels shall be securely locked together with adequate crimping to prevent twisting of vane. Vane shall be capable of withstanding 250 pounds of tensile load when secured according to the manufacturer's instructions.
- D. Rails for mounting turning vanes shall have self locking, friction fit tabs designed to facilitate proper alignment of vanes. Tab spacing shall be as specified in Figure 4-3 of the 2005 SMACNA Manual, "HVAC Duct Construction Standards, Metal and Flexible". Rail systems with non-compliant tab spacing shall not be accepted.
- E. Acoustical Turning Vane: Shall be used in applications that require quiet operating systems. Mounting rails shall have friction insert tabs that align the vanes automatically.
- F. Acceptable Manufacturer: Ductmate Industries PRO-Rail Turning Vane or approved equal.

2.6 DAMPERS IN DUCTWORK

- A. Blade Type Volume Dampers: Constructed per SMACNA, one gauge heavier than duct material, securely fastened to 3/8 in. sq., cold rolled steel operator rod. Provide Ventlock 639 elevated dial regulator for 2 in. insulated ductwork.
- B. Multiple Blade Type Volume Dampers: Provide multiple blade volume dampers in ductwork above 12 in. in height.
 - 1. Heavy duty, manual balancing dampers suitable for application in HVAC systems with velocities to 1,500 ft. per minute, open position and max. pressure of 3 in. w.g. close position. Ruskin MD 35 or equivalent.
 - 2. Fabrication:
 - a. Frame: 5 in. x minimum 16 gauge roll formed, galvanized steel hat-shaped channel, reinforced at corners. Structurally equivalent to 13 gauge U-channel.
 - 3. Blades:
 - a. Style: Single skin with 3 longitudinal grooves.
 - b. Action: Parallel
 - c. Orientation: Horizontal

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- d. Material: Minimum 16 gauge equivalent thickness, galvanized steel.
 - e. Width: Nominal 6 in.
 - 4. Bearings: Molded synthetic sleeve, turning in extruded hole in frame.
 - 5. Linkage: Concealed in frame.
 - 6. Axles: Minimum 1/2 in. diameter, plated steel, hex-shaped, mechanically attached to blade.
 - 7. Control Shaft: 3/8 in. square plated steel.
 - 8. Finish: Mill galvanized.
 - a. Actuator: Hand quadrant for 3/8 in. square extended shaft.
 - b. Hand Quadrant Standoff Bracket: 2 in. standoff for insulated ductwork.
 - c. Oillite bearings.
 - d. Factory Sleeve: Minimum 20 gauge thickness, minimum 12 in. length.
- C. Automatic Air Dampers: Furnished as part of "Building Management System" Section 230923 and installed by this Contractor.
- D. Blast Gates: Aluminum housing, locking thumbscrew, galvanized slide blade.
- E. Remote Balancing Dampers: For round ducts 4 inches to 24 inches in diameter, Greenheck RBDR-50, or equivalent.
 - 1. Ratings: 1 in. wg. pressure differential, 2000 fpm, 180 deg. F.
 - 2. Construction: Reinforced 20 ga. galvanized steel frame, 20 ga. galvanized steel blade, 3/8 in. sq. plated steel axle, synthetic (acetal) sleeve type bearings, 9 volt actuator.
 - 3. Options: (Edit as required):
 - a. "EZ Balance" remote control device with 9 volt battery and 5 ft. RJ11 cable.
 - b. Diffuser body connectors.

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- c. Single gang wall plates with RJ11 ports (1, 2, 3, 4, or 6 port).
Colors: white, ivory or stainless steel.
- d. Round wall/ceiling mounting plate with one port.
- e. 14, 25 or 50 ft. plenum rated RJ11 cable, as required.
- f. RJ11 cable connectors.

2.7 FLEXIBLE AIR DUCTS AND CONNECTORS

- A. Flexible air ducts and connectors shall be constructed in compliance with NFPA Bulletin 90A, 90B and UL Standard 181 and shall be listed and labeled as Class I Air Duct.
- B. Flexible air ducts and connectors shall be tri-laminate:
 - 1. Consisting of corrosion resistant galvanized steel helix encapsulated by a double lamination of polyethylene or spun bond nylon.
 - 2. Factory applied (R 6.0 fiberglass exterior insulation, sheathed in a seamless, tri-directionally reinforced, metalized polyester, exterior vapor barrier.
 - 3. R-value shall be classified by Underwriters Laboratories, and certified by the Air Diffusion Council, in accordance with ADC Flexible Duct Performance and Installation Standard (1991), using ASTM C-518, at installed wall thickness, on flat insulation only. Comply with ASHRAE/IESNA 90.1.
 - 4. Recommended operating pressure for flexible ductwork shall be three times maximum system press but not less than 6 in. w.g. positive pressure for 4 in. - 20 in. dia., 5 in. wg. negative pressure through 16 in. dia., 1 in. negative pressure for 18 in. and 20 in. dia. Maximum velocity of 5500 fpm.
 - 5. Operating temperature range - 20°F to 250°F, intermittent @1/2 in. pos. w.g. max., -20°F to 140°F, continuous at maximum pressure.
 - 6. Flame Spread: 25 max. smoke developed rating: 50 max.
 - 7. Porous inner core flexible duct shall not be used.
- C. Static pressure and thermal performance shall be tested and certified in accordance with Air Diffusion Council (ADC) Test Code FD-72-R1 under conditions of 140°F for 164 hours and 180°F for 4 hours.

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- D. Acoustical performance shall be certified in accordance with ASTM E 477 and/or Air Diffusion Council Test Code FD-72-R1.

1. Minimum Acoustic Performance:

- a. The insertion loss (dB) of a 6 foot length of duct when tested in accordance with ASTM E477 at a velocity of 1000 feet per minute shall be at least:

	<u>125 Hz</u>	<u>250</u> <u>Hz</u>	<u>500</u> <u>Hz</u>	<u>1000 Hz</u>	<u>2000</u> <u>Hz</u>	<u>4000</u> <u>Hz</u>
8 inch dia.	26	27	27	31	32	27
12 inch dia	22	26	24	31	31	20

- E. Friction loss and leakage for flexible duct only shall be certified in accordance with Air Diffusion Council Test Code FD-72-R1. Leakage for connections shall be accordance with UL 181 requirements.

- F. Basis-of-Design: Flexmaster 6B (R-6.0)

- G. Acceptable Manufacturers:

1. Dundas-Jafine Type SPC R6.0
2. Hart & Cooley Type F216 (R-6.0)
3. Flexible Technologies, Inc. Thermaflex Type M-KE (R-6.0)
4. Atco Rubber Products, Inc. Type 036 (R-6.0)

2.8 FLEXIBLE DUCT ELBOW SUPPORT

- A. Provide flexible duct elbow support for flexible duct connected directly to a diffuser collar.
- B. Elbow support shall be a radius forming brace designed to form flexible duct into a 90° elbow not less than one duct diameter in centerline radius.
- C. Elbow support shall be manufactured from 100% recycled copolymer polypropylene with a universal fit of 4 in. thru 16 in. and be UL listed.
- D. Basis-of-Design: Titus Flexright.

2.9 FLEXIBLE CONNECTIONS TO FANS AND EQUIPMENT

- A. Basis of Deign: Ventfabrics, Inc.

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- B. Acceptable Manufacturers: Ductmate Industries, Inc., Duro Dyne Inc., Elgen Manufacturing, Ward Industries, Inc.; a division of Hart & Cooley, Inc.
- C. Materials: Flame-retardant or noncombustible fabrics, water and mildew resistant UL Standard 214.
- D. Coatings and Adhesives: Comply with UL 181, Class 1.
- E. Metal-Edged Connectors: Factory fabricated with a fabric strip 3-1/2 in. wide attached to two (2) strips of 2-3/4-in. wide, 0.028-in. thick, galvanized sheet steel or 0.032 in. thick aluminum sheets. Provide metal compatible with connected ducts.
- F. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.
 - 1. Minimum Weight: 26 oz./sq. yd.
 - 2. Tensile Strength: 480 lbf/in. in the warp and 360 lbf/in. in the filling.
 - 3. Service Temperature: Minus 40 to plus 200°F.
- G. Outdoor System, Flexible Connector Fabric: Glass fabric double coated with weatherproof, synthetic rubber resistant to UV rays and ozone.
 - 1. Minimum Weight: 24 oz./sq. yd.
 - 2. Tensile Strength: 530 lbf/in. in the warp and 440 lbf/in. in the filling.
 - 3. Service Temperature: Minus 50 to plus 250°F.
- H. High-Corrosive-Environment System, Flexible Connectors: Glass fabric with chemical-resistant coating.
 - 1. Minimum Weight: 14 oz./sq. yd.
 - 2. Tensile Strength: 450 lbf/in. in the warp and 340 lbf/in. in the filling.
 - 3. Service Temperature: Minus 67 to plus 500°F.

2.10 ACCESS DOORS

- A. General:
 - 1. Provide access doors of adequate size to allow easy access to the equipment that will require maintenance. Provide insulated or acoustically lined doors to prevent condensation where applicable.

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2. Manufacturer to provide an installed neoprene gasket around perimeter of access door for airtight seal.
3. Systems 3 in. w.g. or less shall utilize a hinged, cam, or hinged and cam square framed access door.
4. Systems 4 in. w.g. and above shall utilize a sandwich type access door. Construct doors in accordance with Figure 7-3 of the 2005 SMACNA Manual, "HVAC Duct Construction Standards, Metal & Flexible" Third Edition.
5. Approved Manufacturer: Ductmate Industries "Sandwich" style door or approved equal.
6. All access doors shall be continuous piano hinged type, unless noted otherwise.
7. Non-hinged only allowed where clearance to ceiling does not allow a full 90° swing.
8. Double panel insulated type when used in insulated duct.
9. Single panel uninsulated type allowed in un-insulated duct.
10. Pressure rated according to system in which being installed. Door-to-frame and frame-to-duct gasketing.
11. Provide specified Seal Class A or B ductwork sealing around frame, and hand adjust the latch tension for proper seal, on all access doors other than sandwich panel (Ductmate) style.
12. MINIMUM access door size for ducts 12 in. or less in depth is 12 in. x 8 in.
13. MINIMUM access door size for ducts 12 in. to 18 in. in depth is 18 in. x 14 in.
14. MINIMUM access door size for ducts more than 18 in. in depth is 24 in. x 18 in.
15. In ducts which require multiple section fire dampers due to duct size, provide one access door for each fire damper section.
16. Access doors for fire and smoke dampers shall be permanently labeled with 1/2 in. high lettering reading "SMOKE DAMPER" or "FIRE DAMPER".

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B. Door Types:

1. Low Pressure Systems (2 in. w.g. pressure class): National Controlled Air ADH-1, Ruskin ADH22, Vent Products 9701, Air Balance FSA-100, Safe Air SAH, Nailor.
2. Medium and High Pressure Systems (3 in. w.g. pressure class and higher):
 - a. Rectangular Duct: Ductmate Industries "Ultimate" Style Door, or equal.
 - b. Round Duct: Ductmate Industries Round Sandwich type, or equal. 8 in. x 4 in. for ducts 14 in. and less in diameter. Ductmate Industries Round Sandwich type 16 in. x 12 in. for ducts more than 14 in. in diameter.
 - c. Furnish and install factory supplied protector molding on cut medal edge for all Ductmate access doors.

2.11 ACOUSTIC-THERMAL DUCT LINING IN DUCTWORK

- A. General: Comply with NFPA Standard 90 and NAIMA Standard AHC-101.
- B. Materials: ASTM C 1071, Type I. Glass mineral wool insulation coated with an anti-microbial EPA registered coating that seals the airstream surface fibers into a smooth, low-friction surface acoustic ductliner shall be of thickness shown in the table. Density at 1.5 PCF. Maximum "K" value to be 0.24 btu/in. /sq. ft. /degrees F. /hr. when tested in accordance to ASTM C177. Acoustic duct liner to be suitable for use up to 6000 feet per minute air velocity and temperatures up to 250°F. The acoustic duct liner shall not accelerate the corrosion of steel, copper or aluminum. The liner shall not absorb greater than 3% by weight when tested per ASTM C1104. Acoustic duct liner shall provide the minimum sound absorption coefficients shown below when tested per ASTM C423 and ASTM E795, Mounting Type A.

OCTAVE BAND FREQUENCIES HZ							
Thickness	125	250	500	1000	2000	4000	NRC
1-1/2 in.	.23	.50	.87	.92	.93	.93	.80
2 in.	.37	.76	1.02	1.00	.98	.92	.95

- C. Thickness: Unless otherwise noted, all supply air ductwork indicated to be acoustically lined, shall have 1-1/2 in. thick liner with a minimum R value of 6. Return or exhaust ductwork, if acoustically lined, shall be of a thickness specifically noted. Note that per the symbol list (L) equals 1-1/2 in. thick. If called for on the plans, (2L) equals 2 in. thick.

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- D. Fire Hazard Classification: Flame spread rating of not more than 25 and a smoke developed rating of no higher than 50, when tested in accordance with ASTM E84, UL 723, UL/ULC S102-M88 and NFPA 255.
- E. Liner Adhesive: Comply with NFPA Standard 90A, ASTM C919, and maximum VOC requirements of LEED EQ 4.1 and EQ 4.2.
- F. Mechanical Fasteners: Galvanized steel, suitable for adhesive attachment, mechanical attachment, or welding attachment to duct. Provide fasteners that do not damage the liner when applied as recommended by the manufacturer, that do not cause leakage in the duct, and will indefinitely sustain a 50 pound tensile dead load test perpendicular to the duct wall.
 - 1. Fastener Pin Length: As required for thickness of insulation, and without projecting more than 1/8 inch into the airstream.
 - 2. Adhesive for Attachment of Mechanical Fasteners: Comply with the "Fire Hazard Classification" of duct liner system.
- G. Design Equipment: Knauf Atmosphere.
- H. Acceptable Makes: Knauf Atmosphere, Certainteed ToughGard R.,

OCTAVE BAND FREQUENCIES HZ							
Thickness	125	250	500	1000	2000	4000	NRC
1-1/2 in.	.10	.47	.85	1.01	1.02	.99	.85
2 in.	.25	.66	1.00	1.05	1.02	1.01	.95

- I. For duct velocities above 4000 fpm, provide metal "build-outs" of proper height, welded to the ductwork for turning vanes and dampers.

2.12 CABLE SUSPENSION SYSTEM

- A. Ductwork not required to be exterior insulated in exposed installations may be installed using a cable suspension system.
- B. Ductwork shall be installed using load rated, stainless steel cable suspension systems. Cables shall be pre-cut lengths, type 316 stainless steel with fused ends, and pre-made end attachments.
- C. Cable grips shall be of 316 stainless steel and have an internal tamperproof cable release mechanism.
- D. Stress distribution saddles shall be prescribed in addition for the support of rectangular duct on corners as necessary.

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- E. Hangers shall have a manufacturer's published safe working load and have a 5 to 1 safety factor.
- F. Hang and support ductwork as defined in the latest edition of SMACNA Manual, "HVAC Duct Construction Standards, Metal & Flexible".
- G. Adjustable steel cable hanging system consisting of spring loaded, serrated clamping mechanism shall be tested and certified in compliance with all applicable SMACNA standards for upper and lower attachment methods.
 - 1. All approved systems must be installed using matching components including steel cable, clamping mechanism and hardware approved by the manufacturer for its corresponding load rating. No Substitution of manufacturer's components is permitted.
 - 2. Approved systems must be installed per the manufacturer's specific instructions and must not exceed the stated working load rating at any point throughout the system.
- H. Supports, bar/angle reinforcements, and other products that are not part of the duct that are manufactured of uncoated mild steel shall either be painted with two (2) coats of primer or shall be manufactured of a galvanized equivalent material.
- I. Approved Manufacturer: Ductmate Industries "Clutcher" Cable Hanging System or Gripple Inc.

2.13 DUCT ACCESSORY HARDWARE

- A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct-insulation thickness.
- B. Ventlock 699 or 699-2 based upon insulation thickness.
- C. Install duct test holes where required for duct traverse testing and balancing purposes.

PART 3 - EXECUTION

3.1 REQUIREMENTS

- A. Equipment and systems shall be installed in accordance with local and state codes and regulations having jurisdiction. Bracing and hanging of ductwork shall be per SMACNA - HVAC Duct Construction Standard
- B. Install all ductwork concealed and tight to the structure above unless noted otherwise on shop drawings. Fabricate only after the approval of shop drawings,

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and in locations to avoid interferences. Ductwork installed without approved shop drawings, which requires removal/modification and/or reinstallation due to conflicts or improper installation shall be repaired at no cost to the Owner.

- C. Sizes given on contract drawings are inside dimensions.
- D. Keep openings continuously closed and sealed with protective plastic wrapping during construction to prevent entrance of dirt and debris.
- E. Extend access openings, damper rods and levers, to outside of external insulation make systems airtight.
- F. No piping, conduit or other obstruction to airflow is permitted in ductwork.
- G. Provide necessary openings, hanger inserts, framing, chases, and recesses, not provided by other trades.
- H. Exposed exhaust or return registers and grilles shall be flush with face of duct; exposed supply registers and grilles shall be mounted outside airstream with 45° shoe-tap extension collars.
- I. Provide 14 gauge sleeves for ducts passing through Mechanical Room floors. Set sleeves 4 in. above finished floor in Mechanical Rooms, seal watertight to floor.
- J. Where a return or exhaust duct is shown to be left open ended, provide hardware mesh screen at opening.
- K. Do not utilize flexible ductwork or connection in any way to connect variable or constant volume boxes to ductwork.
- L. For duct penetrations of non-rated walls, provide sheet metal angle framing or sheet metal closure panels around the entire perimeter of each duct wall penetration on both sides of the wall, where the gap exceeds 1/4 inch. Where the gap is less than 1/4 inch, the gap may be caulked on both sides of the wall. Non-rated wall penetrations SHALL NOT be fire caulked under any circumstances.
- M. For duct penetrations of rated walls, see Specification Section 230500 - Basic Mechanical and Electrical Requirements.
- N. Ductwork that is called for to be welded shall be fully welded, continuous around the entire perimeter at all joints/seams, and shall be fully airtight and watertight.

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3.2 FLEXIBLE CONNECTIONS

- A. Provide flexible connections for the intake and discharge connections of duct connected to fans and air handling equipment.
- B. Round connections are to be made with adhesive and metal drawbands with ends tightly bolted.
- C. Rectangular connections shall be made with material securely held in grooved seam between flanges. Attach with adhesive and mechanical fasteners on 6 in. centers.
- D. Connections shall be made with a minimum of 2 in. space between duct and equipment collars, installed in line, and with 1 in. excess material folded so as not to interfere with airflow through connection.
- E. Mechanically fastened and sealed, with specified duct sealant, at duct and equipment connections.

3.3 FLEXIBLE AIR DUCTS AND CONNECTORS

- A. "Air duct" applies to conduit or passageway for conveying air to or from heating, cooling, air conditioning or ventilating equipment but not including the plenum as defined in NFPA 90A. "Air connector" applies to conduit for transferring air between an air duct or plenum and an air terminal device or an air inlet or an air outlet as defined by the NFPA 90A.
- B. For round to oval connections, provide round-oval flexible adapter.
- C. Flexible air ducts and connectors shall be provided in fully extended condition, free from kinks.
- D. Flexible air ducts and connectors shall not be used in systems with entering air temperatures in excess of 250°F.
- E. Flexible air ducts and connectors shall use only the minimum length required to make the connection and shall be installed in the horizontal or vertical position. Flexible elbows are not acceptable. Do not exceed a maximum length of 48 in., fully extended.
- F. Flexible air ducts and connectors shall use minimum 1/2 in. wide positive locking, steel worm drive clamp, or nylon plenum rated straps for joints and connections. One clamp or strap for the inside core liner and one clamp or strap for the outer jacketing. When non-metallic (nylon) straps are used, they should be listed and labeled to standard UL 181B. Fastener package should be marked UL 181 B-C.

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- G. Collars to which flexible duct is attached shall be beaded and a minimum of 2 in. in length. Wrap twice with UL 181 tape and secure with clamp or strap. Sleeves used for joining two sections of flexible duct shall be beaded and a minimum of 4 in. in length. The draw band shall be positioned behind the bead on the metal collar.
- H. Outer vapor barrier and insulation shall be slid over inner core and collar, wrapped twice with UL 151 tape and secured with a clamp or strap.
- I. Connections shall be per SMACNA "HVAC Duct Construction Standards - Metal and Flexible", Air Diffusion Council "Flexible Duct Performance and Installation Standards" and NAIMA Installation Standards.
- J. Flexible duct shall be supported at manufacturer's recommended intervals, but no greater distance than 2'-6" on center and prior to all 90 degree bends. Maximum permissible sag shall be 1/2 in. per foot of support spacing. Provide a minimum of one hanger on each run of flexible duct.
- K. A connection to rigid duct or equipment shall be considered a support joint. Long horizontal duct runs with sharp bends shall have additional supports before and after the bend approximately one duct diameter from the centerline of the bend.
- L. Hanger or saddle material in contact with the flexible duct shall be of sufficient width to prevent any restriction of the internal diameter of the duct when the weight of the supported section rests on the hanger or saddle material. In no case shall the material contacting the flexible duct be less than 1-1/2 in. wide. Factory installed suspension systems integral to the flexible duct are an acceptable alternative hanging method when the manufacturer's recommended procedures are followed.
- M. The hanger shall be strapped around the flexible duct and secured to the structure above. Hangers shall not be attached to other mechanical or electrical objects. Hangers may be attached to an approved trapeze. Ceiling grid shall not be used to fabricate a trapeze. Support hangers shall be installed horizontal. Screws shall not be used to penetrate the flexible duct to attach to the hanger.
- N. Provide flexible duct connections and splices in accordance with manufacturer's recommended installation instructions.
- O. Seal flexible duct connections with sealing materials listed and labeled in accordance with UL 181B. Mechanically secure connections with approved clamping materials.

3.4 TURNING VANES

- A. Install only in square elbows of equal dimensions.

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- B. Install as per latest SMACNA Standards.
- C. Secure vane runners to duct with spot welding, riveting or sheet metal screws.
- D. When installing in ductwork with internal insulation.
 - 1. Install runners in ductwork inside insulation and bolt through insulation and duct sides, welding bolts to insure rigid installation. Provide build-outs for duct Velocity-Pressure classes above 2 in. w.g.

3.5 DUCT CLEANLINESS AND CLEANING AFTER INSTALLATION

- A. Duct Cleanliness:
 - 1. All ductwork on the project shall meet the SMACNA Duct Cleanliness For New Construction Guidelines, "Advanced Level" of duct cleanliness for production, delivery, storage and installation of ductwork.
 - 2. Prior to shipment to the jobsite, all duct ends and openings must be covered with a heavy duty, dual-ply, clear polyethylene protective film. Open ends are to be kept covered during transport, storage, and installation. As ductwork is installed at the job site, open ends are to be covered to maintain cleanliness.
 - 3. The film must be securely affixed to protect against dirt and debris, and must be translucent to facilitate inspection of interior surfaces without removing the film. The film is have a elongation rating of 600% and a break strength of 13.1 lbs./in. The film shall contain no VOC's, and shall leave no residue on duct after removal.
 - 4. Manufacturer: Ductmate Industries ProGuard (heavy duty grade clear).
- B. Cleaning After Installation:
 - 1. Interior surfaces shall be free of dust and debris prior to initial start up. Protect equipment which may be harmed by excessive dirt with filters, or bypass during cleaning. Provide adequate access into ductwork for cleaning purposes. Any cleaning of duct systems shall comply with recommendations of NAIMA and NADCA.
 - 2. Clean external surfaces of foreign substances that might cause corrosion, deterioration of the metal, or where ductwork is to be painted.
 - 3. Clean debris from system before fans are turned on.
 - 4. Keep openings continuously closed during the construction period.

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5. Pay damages resulting from dirt blown on painted or other finished surfaces.
6. Repair or replace damaged fan wheels, dampers, or other system parts damaged as a result of debris.
7. Clean system as many times as required until the entire system is dirt free.

3.6 INSTALLATION OF ROUND DUCTWORK

- A. Use factory-fabricated couplings for joints.
- B. After the joint is slipped together, sheet metal screws are placed 1/2 in. from the joint bead for mechanical strength.
- C. Sealer is applied to the outside of the joint and covering the screw heads.
- D. Flanged joints shall be made with neoprene rubber gaskets.

3.7 TEST OF DUCTWORK

- A. Conduct duct leakage tests per SMACNA "HVAC Air Duct Leakage Test Manual" and per the requirements of the 2020 Energy Conservation Construction Code of New York State, for all ductwork systems designed to operate at static pressures of 3.0 in. w.g. or greater. Representative sections totaling no less than 25% of the total duct area, per system, for the designated pressure class shall be tested as well as all associated ductwork located out-of-doors. All areas shall be as selected by the Engineer. Positive pressure leakage testing is acceptable for negative pressure ductwork. The rate of air leakage (CL) must be less than or equal to 4.0, as determined by equation 4 - 8 in 2020 ECCCNY, which reads: $CL = F/P^{0.65}$ where F = measured leakage rate in CFM per 100 sq. ft. of duct surface, and P = static pressure of the test. When leakage above stated limits occurs, ascertain location of leaks and repair as required. Repeat tests as required to obtain allowable leakage rates. Prepare a report similar to that suggested by SMACNA and submit for review. Duct testing shall be conducted in the presence of the Owner's Representative.
- B. Provide test reports indicating pressure tests performed. Include date, section tested, test pressure and leakage rate.
- C. Ductwork not required to be tested for leakage, shall be checked and guaranteed to meet the standards of the specified SMACNA Duct Seal Class A. Air balancing and testing shall be used to determine satisfactory operation of duct systems. Balancing reports indicating excessive leakage amounts shall be required to rebuild, repair or seal ductwork having excessive leakage.

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3.8 DAMPERS AND AIR CONTROL DEVICES

- A. Provide volume dampers at all air outlets, diffusers, grilles and as noted on plans. Provide volume dampers at all low pressure supply, return and exhaust, branch ducts and as noted on the plans.
- B. Provide dampers necessary to permit proper balancing of air quantities. Comply with code requirements for smoke and fire control. Prevent introduction of uncontrolled outside air into building through roof and wall openings.
- C. When dampers are installed in acoustically lined ductwork, install with insulated "build-outs" per SMACNA.
- D. Install fire and smoke dampers in accordance with "Fire and Smoke Dampers" Section and applicable codes.
- E. Install all dampers furnished as part of "Building Management System" Section.

3.9 ACCESS DOORS

- A. Provide for access to upstream side of duct mounted reheat coils, dampers, damper motors, fire dampers, smoke dampers, smoke detectors, control devices, fan bearings, and equipment requiring periodic inspection or service. Provide labels for fire and smoke dampers as called for in Part 2 - Products.
- B. For ducts that are too small to install an access door of the minimum specified size, provide a 12 in. long section of removable ductwork for maintenance and inspection access. Removable ductwork shall be fastened between device requiring access and next duct section with duct flanges or Donaldson Torit clamp with PVC foam seal. For ducts that are required to be insulated, provisions shall be made to allow insulation to be easily removed and re-installed.

3.10 DUCT SUPPORTS

- A. Provide per SMACNA, same material as duct. Hanger bands to extend down sides and turn under bottom 2 in. Minimum two metal screws per hanger. Angle iron on larger duct spaced per building structural system but not greater than 8 ft. Provide extra support angles as required.
- B. Provide additional supports as required to support reheat coils, air terminal units, filter enclosures, and any other duct mounted equipment independent from the associated ductwork system.

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3.11 AIR AND WATERTIGHT DUCTWORK

- A. Where water and snow may accumulate on ductwork or where odors or corrosive gasses may collect, ductwork and plenums shall be made watertight by soldering, brazing or welding of joints. Grade ducts down toward waste points and/or toward louvers. Provide valve and drain piping from low point to waste point.
 - 1. Intake and exhaust plenums.
- B. Test for Watertightness: Before concealment, apply water by hose to check for leaks, witnessed by Owner's Representative.

3.12 ACOUSTIC-THERMAL DUCT LINING

- A. Increase metal duct dimensions to accommodate lining. Adhere lining to interior side of duct; minimum 90% coverage of Benjamin Foster 85-20 fire retardant adhesive, UL approved. Stapling method of attaching will not be permitted. Mechanical fasteners shall not pierce the sheet metal. Installing fasteners with spacing as per SMACNA Standards. Multiple layers of liner to achieve indicated thickness is prohibited.
- B. Abutting edges of acoustic linings shall be sealed with a fire resistant neoprene coating, and exposed edges of acoustic linings shall be installed with sheet metal nosing to prevent erosion.
- C. Lining shall not impart odor to the air, delaminate or be loosened by the airstream under normal operating conditions. Lining which is damaged during fabrication or shipment shall not be installed.
- D. Supply ductwork downstream of terminal units shall have 1-1/2 in. thick acoustical lining for a minimum of 10 feet. All air outlets shall be installed downstream of this minimum distance.
- E. Provide 1-1/2 in. thick acoustical lining for a minimum of 10 feet downstream of all supply and return fans.

3.13 SMOKE DETECTION

- A. Smoke detectors shall be furnished by Division 26 "Electrical". This Contractor shall install detectors located in ductwork. Clearly indicate locations of smoke detectors on the sheet metal shop drawings.
- B. Increase duct size at smoke detectors, where required for proper installation, per smoke detector manufacturer's recommendations. Coordinate minimum duct size required with Division 26 "Electrical"

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3.14 DUCT SEALING

A. Preparation:

1. Clean surfaces of dirt, oil, grease and loose of foreign matter that could impair adhesion, using soap and water or solvent.
2. Allow surfaces to dry completely before proceeding.

B. Installation of Sealant System:

1. Apply sealant system to duct joints, fasteners, and seams in accordance with manufacturer's instructions.
2. Apply sealant by brush, putty knife or caulk gun, to full coverage. Remove excess adhesive immediately.
3. Completely seal duct joint, fasteners and seams without voids, to a minimum 20 mil thick wet film.
4. Apply and store at ambient temperature of 40°F to 100°F; and protect from freezing until dry.

C. Field Quality Control:

1. Allow duct sealant system to cure a minimum of 72 hours before operating the system.
2. Do not apply external duct insulation or coatings until the joints have been inspected by the Owner's Representative.

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EXHIBIT I - DUCTWORK MATERIALS

<u>SERVICE</u>	<u>MATERIAL</u>	<u>SPECIAL REQUIREMENTS</u>
Supply, return, vent, relief, outside and exhaust	Lock forming quality, galvanized steel ASTM A653 and A924, galvaneal/paint grip if not insulated and exposed	Joints and features as called for
Exterior double wall ductwork	Pre-manufactured galvanized steel, double wall, 3 in. insulation between walls, solid inner liner with thickness per SMACNA, outer duct one gauge heavier. McGill Airflow LLC, or similar.	Horizontal top surfaces cross-broken for positive water drainage where shown as rectangular, Ductmate joints, seal Class A, and outdoor duct sealant applied per spec, watertight construction.
Exterior ductwork	Galvaneal/paint grip (ready for paint) if not insulated, otherwise same as above	Horizontal top surfaces crossbroken for positive water drainage, Ductmate joints, seal Class A, and outdoor duct sealant per spec
Accessories, dampers and air turns	Same material and gauge as parent duct	-----

END OF SECTION

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SECTION 23 31 10 - GREASE DUCT SYSTEM

PART 1 - GENERAL

1.1 GREASE DUCT SYSTEMS

- A. Provide factory built grease duct system laboratory tested and listed by the Underwriters Laboratories, Inc., for use with commercial cooking equipment as described in NFPA 96.
- B. Double wall ducting shall have an outer jacket of aluminized steel .025 in. thick in 6 in. through 24 in. diameter and 0.34 in. thick for larger diameters. Exception! Where exposed to weather, the outer jacket shall be 0.25 in. stainless steel, type 304. There shall be a minimum 1 in. air space between the walls. The inner liner shall be Type 304 stainless steel with a nominal thickness of 0.35 in. for all sizes.
- C. System shall be designed to provide access for inspection and cleaning at each change of duct direction; permit drainage of grease residue through a duct section; enable the system to allow for thermal expansion; and to allow for the specified fire suppression equipment to be integrated into the grease ductwork. Horizontal runs greater than 20 ft. per NFPA 96. Joints of the inner liner shall be sealed using V Bands and high temperature ceramic joint cement, as supplied by the manufacturer. Ducts extending above roof surfaces shall terminate as required by NFPA 96, and as called for.
- D. Ductwork, accessories, equipment, and arrangement shall be provided with features and connectors to suit a Dry Chemical Extinguishing System per NFPA 17.
- E. Provide ventilated roof thimbles, wall supports, wall guides, drain tees, access sections, adjustable lengths, plate support assemblies, duct drains, hood transitions, nozzle sections, and other factory make parts to suit the installations called for.
- F. Provide a drawing showing application details for approval.
- G. System shall be Selkirk Metalbestos Model PS Grease Duct.

1.2 INSTALLATION OF GREASE DUCT SYSTEMS

- A. Install per NFPA 96 and according to special instruction for Model PS systems as follows:
 - 1. Section A - General Information.

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2. Section B - Tees, Elbows, Increasers.
 3. Section C - Adjustable lengths, guiding and support.
 4. Section D - Plate supports.
 5. Section E - Wall supports and guides.
 6. Section F - Roof and wall penetrations.
- B. Provide Work above roof as follows:
1. Provide ventilated roof thimble storm collar and flashing. Flashing shall be of material and arrangement approved by Owner's Representative. Storm collar shall be stainless steel to match duct material.
 2. Extend storm collar and duct to upblast type exhaust fan.
 3. Provide packing and seal the entire system.
 4. Duct Enclosure And Surroundings:
 - a. All ductwork shall be housed in fire rated enclosures provided by General Contractor. Cooperate with the installing Contractor when locating ducts and supports so as to permit the installation of a proper fire resistant barrier.
 5. Combustibles of any kind will not be permitted within 6 in. of any part of duct system.

PART 2 PRODUCTS

1.3 GREASE DUCT SYSTEMS - DURADUCT MODEL KEX

- A. Pre-manufactured and noncombustible double wall kitchen exhaust duct system. Rated for 2 hours fire resistance with zero clearance to combustibles and is compliant with IMC, NBCC and NFPA codes.
- B. Shall be listed as meeting the requirements of ASTM E2336, the performance requirements of UL 1978, as well as being listed for compliance to the ICC-ES AC101.2 acceptance criteria.
- C. System shall use companion flange connections, No field welding.
- D. Duct shall have a rectangular footprint.

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- E. Shall be constructed with a code compliant 16 gauge steel inner liner and a robust and impact resistant metal outer casing, complaint to NFPA 4.3.2, resulting in a 3.75" wall thickness.
- F. System shall incorporate listed and code compliant access doors and through-penetration fire stopping systems are also incorporated into the design of the system. Other components such as end caps, terminations, drain sections, stainless steel liner and shell, sprinkler head access ports, roof flashings, hood and fan adaptors and duct support designs are included in the complete system scope.
- G. Provide a drawing showing application details for approval.
- H. System shall be DuraDuct KEX system.

END OF SECTION

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SECTION 23 33 13 - FIRE AND SMOKE DAMPERS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Provide labor, materials, equipment and services required for the complete installation as shown on the Contract Documents.

1.2 SUBMITTALS

- A. Submit product data, types, schedule of sizes, locations, and installation arrangements of all dampers.
- B. Submit manufacturer's UL listed installation details for each mounting arrangement.

1.3 QUALIFICATIONS

- A. Provide work in accordance with the latest requirements of the Mechanical Code of New York State, UL 555, UL 555S and UL555C. Fire dampers shall be Underwriter's Laboratories classified and labeled. Smoke dampers and operator assemblies shall be Underwriter's Laboratories (UL) classified and labeled as an assembly.

PART 2 - PRODUCTS

2.1 FAN ISOLATION DUCT SMOKE DAMPERS (UP TO 6 IN. SHUTOFF S.P.)

- A. Airfoil multiblade type damper of one piece extruded aluminum construction .080" thick suitable for installation in air handling units or high velocity duct systems up to 2000 fpm and 6 in. s.p. Silicone rubber blade edge seal, flexible stainless steel jamb seal, and stainless steel sleeve bearings. 12 gauge steel channel frame. UL listed and labeled.
 - 1. UL listed 120 volt electric motor operator. Operator to be mounted outside of the air stream.
 - 2. Square or rectangle as required. Duct transitions for dampers in round or oval ducts.
 - 3. With factory fabricated sleeve with fixed and slip flanges.
 - 4. Class II leak rating of 28 cfm/ft² at 8 in. w.g.

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5. Operator to be sized as required for the specific system operating pressure.
 6. Provide with damper position indicator switch package.
- B. Design Equipment: Ruskin Model SD102.
- C. Make: Ruskin, Air Balance, National Controlled Air, Greenheck, Nailor.

2.2 COMBINATION FIRE/SMOKE DAMPERS

- A. Airfoil multiblade type damper of galvanized steel construction suitable for installation in high velocity duct systems up to 3000 fpm and 4 in. s.p. with 16 gauge hat channel frame with corner reinforcement and blades equivalent to 14 gauge, silicone rubber blade edge seals, stainless steel bearings and flexible stainless steel jamb seals. UL listed and labeled.
1. UL listed 120 volt electric motor operator. Operator to be mounted outside of the air stream.
 2. Square, rectangle, or round as required. Duct transitions for dampers in oval ducts.
 3. With factory fabricated sleeve with fixed and slip flanges.
 4. Class I leak rating of 4.0 cfm/ft² at 1 in. w.g. (8.0 cfm/ft² at 4 in. w.g.)
 5. 1-1/2 hour fire rated. Fusible link temperature rating of 165°F.
 6. Provide with damper position indicator switch package.
- B. Design Equipment: Ruskin FSD60.
- C. Make: Ruskin, Air Balance, National Controlled Air, Greenheck, Nailor.

PART 3 - EXECUTION

3.1 LOCATIONS

- A. Provide fire dampers in all one, two and three hour rated wall and floor penetrations.
- B. Provide smoke dampers as called for in penetrations of smoke barriers.

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3.2 INSTALLATION

- A. Provide sleeve, angles, and access doors for installation in accordance with the latest requirements of SMACNA, NFPA, UL and damper manufacturer.
- B. Provide sheet metal access doors with labels, as called for in Specification Section 233100 in ductwork for dampers and accessories.
- C. Provide ceiling or wall access doors for dampers and accessories.
- D. Install dampers square and free from racking.
- E. Do not compress or stretch the damper frame into the duct or opening.
- F. Provide bracing for multiple section assemblies to support assembly weight and to hold against system pressure. Attach multiple damper section assemblies together in accordance with manufacturer's instructions. Install support mullions as reinforcement between assemblies as required.
- G. Division 26 "Electric" will provide signal wiring [and power wiring] for smoke dampers. Refer to "Building Management System" Section for additional requirements. Smoke detectors shall be furnished by Division 26 "Electric" 28 "Electronic Safety and Security". Install detectors located in ductwork within 5'-0" of the damper. Increase duct size at smoke detectors, where required for proper installation, per smoke detector manufacturer's recommendations. Coordinate minimum duct size and length for smoke detectors required with Division 26 "Electric" 28 "Electronic Safety and Security".

3.3 CERTIFICATION

- A. Contractor shall certify that dampers are accessible for servicing, are installed properly, and are operational. Submit three (3) copies of signed certification to the Owner's Representative for review.

3.4 IDENTIFICATION

- A. Provide damper tags and charts.
 - 1. Fasten tag to ductwork adjacent to the dampers.
 - 2. Number each damper and make chart listing.
 - a. Number.
 - b. Location.

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- c. Air system in which they are installed.
- B. Submit three (3) copies of chart to the Owner's Representative for review.

END OF SECTION

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SECTION 23 34 00 - FANS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Provide labor, materials, equipment and services as required for the complete installation designed in Contract Drawings.

1.2 SUBMITTALS

- A. Submit product data for all fans, motors, drives, and accessories. Include all fan curves fan operating point, and sound data.

1.3 QUALITY ASSURANCE

- A. Capacity, size and arrangement, static pressure, brake horsepower, component parts and accessories shall be provided as called for or scheduled. Guaranteed full capacity delivery through duct systems finally installed and under conditions listed. The manufacturer shall guarantee sound-power level ratings not exceeding those of the design equipment. All equipment shall be statically and dynamically balanced to acceptable tolerances with weights permanently fastened. Fan wheels shall be rebalanced in the field, if necessary.

- B. Pressure Classification:

<u>Maximum Total Sp</u>	<u>Class</u>
Up to 3-3/4 in. WG-STD	I
Up to 6-3/4 in. WG-STD	II
Up to 12-3/4 in. WG-STD	III

- C. Conventional Motors:

- 1. Motor sizes shall be as scheduled. Refer to Specification Section 230513 for motor types, efficiency requirements, and acceptable motor manufacturers. All belt-driven fan motors shall be mounted on either an adjustable slide base or a pivoting base.

- D. EC Motors:

- 1. Motors shall be Electronically Commutated Type (EC), variable speed, DC, brushless motors specifically designed for use with single phase, 277 volt (or 120 volt), 60 hertz electrical input.

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2. Motor shall be complete with and operated by a single-phase integrated controller/inverter that operates the wound stator and senses rotor position to electronically commutate the stator.
3. Motors shall be designed for synchronous rotation. Motor rotor shall be permanent magnet type with near zero rotor losses. Motor shall have built-in-soft start and soft speed change ramps.
4. Motor shall be able to be mounted with shaft in horizontal or vertical orientation. Motor shall be permanently lubricated with ball bearings. Motors shall be direct coupled to the blower.
5. Motor shall maintain a minimum of 85% efficiency over its entire operating range and have a turndown to 20% of full speed, (80% turndown).
6. Provide manual fan speed output control for field adjustment of the fan airflow setpoint.
7. Inductors shall be provided to minimize harmonic distortion and line noise.
8. Provide isolation between fan motor assembly and unit casing to eliminate any vibration from the fan to the terminal unit casing.
9. Provide a motor that is designed to overcome reverse rotation and not affect life expectancy.
10. The fan manufacturer shall provide a factory installed PWM controller for either manual or DDC controlled fan CFM adjustment. The manual PWM controller shall be field adjustable with a standard screwdriver. The remote PWM controller shall be capable of receiving a 0-10 VDC signal from the DDC controller (provided by the controls contractor) to control the fan CFM. When the manual PWM controller is used, the factory shall present the fan CFMs as shown on the schedule.
11. Acceptable Manufacturers: Emerson Ultratech, U.S. Motors-Nidec, GE-ECM, A.O. Smith or equivalent.

E. Drive Systems:

1. Provide fans with belt or direct drive systems as scheduled. V-belt drives as recommended by drive manufacturer, unless otherwise specified or scheduled.
 - a. Size drive for 200% of motor rating when motor is 10 HP and larger. Size for 150% of motor rating when motor is less than 10 HP.

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- b. Motors 5 HP and larger shall be provided with a minimum of two (2) belts. All belt sets shall be matched.
 - c. Cast iron or cast steel pulleys.
 - d. Provide belt and shaft guards for each driven device. Provide openings in both the motor and fan sections of the guard so that the motor and fan speeds can be checked without removing the belt guard.
 - e. Belts shall be oil and heat resistant, non-static type.
 - f. Drives shall be precision machined cast iron type, keyed and securely attached to the wheel and motor shafts.
 - g. All belt drive fan motor selections must include an allowance for medium drive losses as established by AMCA Publication 203.
- F. Motor Pulleys:
 - 1. 5 HP and Smaller: Adjustable type to produce 15% speed change above and below scheduled fan speed. 7-1/2 HP and Larger: Fixed type.
 - 2. 5 HP and Smaller: "A" section, 2.6 in. minimum pitch diameter.
 - 3. 7-1/2 HP to 20 HP: "B" section, 4.6 in. minimum pitch diameter.
 - 4. 25 HP and Larger: "C" section 7.0 in. minimum pitch diameter.
 - 5. Drive ratio not over 4:1.
- G. Bearings:
 - 1. Bearings shall be designed and individually tested specifically for use in air handling applications. Construction shall be heavy-duty regreasable ball type in a pillow block cast iron housing selected for a minimum L50 life in excess of 200,000 hours as maximum cataloged operating speed.
- H. Wheels and Propellers:
 - 1. All wheels and propellers shall be balanced in accordance with AMCA Standard 204-96, balance quality and vibration levels for fans. Wheel shall overlap an aerodynamic aluminum inlet cone to provide maximum performance and efficiency.
 - 2. Blades on all sizes shall be continuously welded to the backplate and deep spun inlet shroud.

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- 3. All hubs shall be keyed and securely attached to the fan shaft.
- I. Blower Shafts:
 - 1. All blower shafts shall be AISI-C-1045 hot rolled and accurately turned, ground and polished. Shafting shall be sized for a critical speed of at least 125% of maximum cataloged operating speed.
- J. Coating:
 - 1. All steel fan components shall contain an electrostatically applied, baked polyester powder coating. Paint must exceed 1,000 hour salt spray under ASTM B117 test method.
- K. Vibration isolation for units shall be furnished by the fan manufacturer unless otherwise noted. Provide guided spring type vibration isolators.
- L. Certifications:
 - 1. Fan shall be listed by Underwriters Laboratories (UL 705) and UL listed for Canada (CUL 705). Fan shall bear the AMCA certified ratings seal for sound and air performance.
 - 2. All units shall bear an engraved aluminum nameplate and shall be shipped in ISTA certified transit-tested packaging.

PART 2 - PRODUCTS

2.1 ROOF FANS

- A. Spun Aluminum Wall Centrifugal Kitchen Exhaust Ventilator:
 - 1. Construction:
 - a. The fan shall be bolted and welded construction utilizing corrosion resistant fasteners. The spun aluminum structural components shall be constructed of minimum 16 gauge marine alloy aluminum, bolted to a rigid aluminum support structure.
 - b. The aluminum base shall have continuously welded curb cap corners for maximum leak protection.
 - c. The discharge baffle shall have a rolled bead for added strength.
 - d. An integral conduit chase shall be provided through the curb cap and into the motor compartment to facilitate wiring connections.

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- e. Bearings and drives shall be mounted on a minimum 14 gauge steel power assembly, isolated from the unit structure with rubber vibration isolators. These components shall be enclosed in a weather-tight compartment, separated from the exhaust airstream. A 1 in. thick, three pound density foil back heat shield shall be utilized to protect the motor.
 - f. Hinged at curb so that entire fan can be tilted upward to permit inspection and cleaning, as required for commercial cooking equipment by NFPA 96. Provide service hold-open cables.
- 2. Wheel:
 - a. Wheel shall be centrifugal backward inclined, constructed of 100% aluminum, including a precision machined cast aluminum hub.
- 3. Certifications:
 - a. For grease laden vapor applications, fan shall be listed by Underwriters Laboratories (UL 762) and UL listed for Canada (Power ventilator for restaurant exhaust applications).
- 4. Accessories:
 - a. Hinged Base.
 - b. Disconnect Switch.
 - c. Fan Mounted Speed Control.
 - d. Grease Collection System.
 - e. Grease Trough.
- 5. Basis-of-Design: Cook VCRD-HP VF

PART 3 - EXECUTION

3.1 INSTALLATION OF EQUIPMENT

- A. Provide equipment in accordance with manufacturer's instructions. All fans shall meet the intent of the system performance requirements. Provide rubber in-shear vibration isolation for all fans unless otherwise called for. Provide necessary support steel for equipment. Provide guards for all exposed belts, shafts, and fan wheels. Change pulley sizes or adjust sheaves as required to make systems deliver specified quantities of air as listed on the Contract Drawings.

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END OF SECTION

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SECTION 23 36 00 - VARIABLE VOLUME TERMINAL UNITS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Provide labor, materials, equipment and services as required for the complete installation as shown on the Contract Drawings.

1.2 SUBMITTALS

- A. Submit product data for terminal units including room number, maximum and minimum CFM, accessories, pressure drops, discharge and sound power data by octave band. Clearly indicate box sizes being proposed.

PART 2 - PRODUCTS

2.1 TERMINAL UNITS

A. General Unit Construction:

1. Unit casing shall be constructed of 22 gauge welded galvanized steel. Each unit shall be internally lined with 1/2 in. minimum 1-1/2 lb./ft.³ fiberglass insulation which meets NFPA 90A and UL 181. Factory label each unit with size, location, minimum and maximum CFM, and calibration chart. Air terminal units shall be capable of operating at 10 in. w.g., pressure maximum without damage. Maximum casing leakage at 3 in. W.G. shall be 11 cfm.
2. Units to be certified under ARI Standard 880-94 Certification Program and carry ARI seal.
3. Units to be provided with a factory control enclosure suitable for field installed controls.
4. Units shall be provided with factory access door option.

B. Control and Volume Regulating Devices:

1. Internal unit damper shall be constructed of galvanized steel with blade-end seals for tight shut-off with a maximum damper leakage of 7 CFM against a maximum of 3 in. w.g. Damper shall be mounted on a galvanized steel shaft extending through the unit on torque free bearings. Terminal shall have normally open dampers. Minimum and maximum air quantities shall be factory set, but may be field adjustable. Neither the radiated or discharge sound power levels shall exceed the ratings of design equipment as scheduled on the Contract Drawings.

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C. Hydronic Reheat Coil:

1. Coil shall be factory installed on the terminal unit and shall be constructed of 1/2 in. copper tube with aluminum plate fins. Tested at the factory to 250 PSI hydrostatic pressure. Control valves shall be provided by the temperature control subcontractor as described in Section 230923. Output capacity and rows as scheduled on the Contract Drawings.

D. Terminal Volume Controller (Microprocessor Based):

1. Provide unit with airflow velocity and total pressure sensor suitable for up to 3000 fpm inlet velocity. Sensor shall be averaging type with multiple sampling points on cross grids. Pressure independent microprocessor based electronic controller shall modulate airflow to maintain space temperature.
2. Provide a 24 volt electric damper actuator. The actuator shall be reversible with a switch and have a visual position indicator. The stroke time shall be 75 - 150 seconds at 0.53 in. lbs. Torque. The unit shall have a 3 foot long plenum rated cable. The housing shall be NEMA type 2 with a flammability rating conforming to UL94. The actuator shall be maintenance free and have a minimum life span of 60,000 cycles. Actuator shall be Bellimo NM24-1US, or equal.
3. Provide factory mounted transformers for controller and actuator suitable for 120 volt, 1 phase-input power. Multiple boxes (approximately 6 to 8) shall be powered off of one terminal unit transformer through a low voltage power loop. Coordinate with the Control Contractor which terminal units require transformers.
4. Wall mounted thermistor type electric space sensor provided by .Controller shall interface with Building Management System to provide analog outputs for space temperature and airflow and accept analog inputs position the actuator for warm-up or pull-down and change space temperature set-point for night set-back, set-up or occupancy sensor status. Controller shall sequence reheat coil to maintain space.
5. The VAV box manufacturer shall provide the box and the airflow sensor, microprocessor based controller

E. Design Equipment: Nailor

F. See schedule on M7.1 for orientation and model.

G. Acceptable Makes: Anemostat, Carrier, Carnes, Envirotech, Krueger, Titus, Tuttle and Bailey, Nailor

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PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

- A. Suspended terminal units from the building structural system independent of the ceiling, ductwork and piping systems. If this cannot be accomplished, provide additional intermediate angle iron from which the units shall be suspended. Level each unit. Access to the terminal unit controls shall be accomplished by removal of ceiling panels or through an access door. Coordinate locations of access doors.

END OF SECTION

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SECTION 23 37 13 - REGISTERS AND DIFFUSERS

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Provide labor, materials, equipment and services required for the complete installation designed in Contract Documents.

1.2 SUBMITTALS

- A. Registers/Grilles/Diffusers: Submit product data including room schedule listing size, CFM, throw, direction of throw, accessories, finish, material type, color chart, pressure drop and noise criteria.

1.3 GENERAL REQUIREMENTS

- A. Each manufacturer shall check noise level ratings for registers and diffusers to insure that the sizes selected will not produce noise to exceed N.C. - 24, measured at occupant level; notify Owner's Representative of problems prior to submittal.
- B. Pressure drop, airflow and noise criteria selection is based on design equipment. Manufacturers not submitting design makes must provide written certification in front of submittal that equipment submitted has been checked against and performs equal to the design make.
- C. Borders and frames shall be coordinated with materials and ceiling systems to integrate with architectural ceiling details and finishes scheduled.
- D. Locations of ceiling mounted air terminal devices shall be coordinated with locations shown on architectural reflected ceiling plans.
- E. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw and pressure drop. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.

1.4 REQUIREMENTS FOR REGISTERS

- A. General:
 - 1. A register is defined as a grille plus a volume damper.

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2. Registers shall be installed "sight-proof" where possible, i.e.: High wall register with horizontal blades inclined up, or along a wall with blades facing the wall.
 3. Borders and frames shall be of the same material as register face unless specified otherwise.
- B. Mounting Frames:
1. Provide with screw holes in register face punched and countersunk at factory, and mounting frame drilled and tapped to suit. Sponge rubber gasket between frame and wall or ceiling for all surface mounted frames.
 2. Frame shall be overlap type and shall be suitable for type of ceiling where register is to be installed.
- C. Finishes:
1. Baked enamel (of colors as selected from the manufacturer's standard color chart) , as scheduled.
- D. Design Equipment: Titus unless otherwise noted.
- E. Manufacturers: Anemostat, Carnes, Krueger, Titus, Price, Tuttle and Bailey, Nailor.

1.5 REQUIREMENTS FOR DIFFUSERS

- A. General:
1. Provide four way blow unless otherwise noted.
 2. Where manufacturer's size recommendations require duct sizes or connections differing from design, Contractor shall provide at no change in contract price.
 3. Suitable for recessed mounting unless otherwise indicated.
 4. Provide square to round neck transitions as required.
 5. Provide sponge rubber gasket for all surface mounted frames.
- B. Finishes:
1. Baked enamel (of colors as selected from the manufacturer's standard color chart) , as scheduled.

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- C. Frame style shall be suitable for ceiling type in which diffuser is to be installed.
- D. Design Equipment: Titus unless otherwise noted.
- E. Manufacturers: Anemostat, Carnes, Krueger, Titus, Price, Tuttle and Bailey, Nailor.

PART 2 - PRODUCTS

2.1 SUPPLY TYPES

- A. Type 1 - (Smooth Face Type):
 - 1. Steel construction with 22 gauge back pan and 22 gauge face panel with rolled edges that finishes flush with ceiling system.
 - 2. Round neck - minimum 1-1/4 in. collar for duct connection.
 - 3. Frame suitable for ceiling type.
 - 4. With optional directional air flow pattern controllers that are concealed behind the face or in the neck.
 - 5. Face panel shall be removed and securely held in place to the back pan without noise or vibration.
 - 6. Horizontal airflow pattern.
 - 7. Panel Size: 24 in. x 24 in.
 - 8. Model: Titus OMNI.
- B. Type 2 - (Linear Diffuser):
 - 1. Adjustable 180° pattern controllers to change both direction and volume at discharge air.
 - 2. Multiple 1 in. slots and lengths as specified.
 - 3. Border type shall be suitable for ceiling.
 - 4. Extruded aluminum frames with black 16 gauge steel pattern controllers.
 - 5. Provide optional accessories to achieve continuous slots as required.
 - 6. Provide insulated plenum.

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7. Model: Titus Model ML-39.

2.2 RETURN/EXHAUST TYPES

A. Type A - (Return Grilles):

1. Steel construction with 22 gauge frame and blades, with horizontal bars on a 1/2 in. spacing set at 35° fixed deflection.
2. 1-1/4 in. wide flange.
3. The blades shall be parallel to long dimension.
4. Model: Titus 355-RL

B. Type B - (Exhaust Grilles):

1. Aluminum Construction.
2. 1-1/4 in. wide flange.
3. The blades shall be parallel to long dimension.
4. Model: Titus 355-FL

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install equipment in strict accordance with manufacturer's instructions. Rough in or install per reflected ceiling plan or in location instructed by Owner's Representative.
- B. Provide approved air extractors behind all duct mounted supply registers in exposed ductwork.
- C. When the final connection to an exhaust or return grille is made, a 12 in. minimum height plenum box must be supplied to all grilles. Plenum dimensions shall match grille size. Paint inside of plenum box flat black.
- D. Seal all supply and return registers, grilles and diffusers during construction operations to limit dust entering HVAC systems and ductwork. Seals may be removed just prior to testing and balancing, but not without the approval of the Owner's Representative.

END OF SECTION

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SECTION 23 37 23.16 - LOUVERS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Provide labor, materials, equipment and services required for the complete installation designed in Contract Documents.

1.2 SUBMITTALS TO THE ARCHITECT/ENGINEER

- A. Louvers including all blade types, finishes, and arrangements.
- B. Penthouses including materials, finishes and accessories.
- C. Provide original color charts for selection of finish.

PART 2 - PRODUCTS

2.1 LOUVERS

- A. Factory constructed high performance drainable, fixed, extruded aluminum 4 in. deep louvers.
- B. Provide mullions where blade lengths exceed 60 in.
- C. Sill extension and sill style as required by job conditions.
- D. Louver to be flanged or un-flanged as required for the wall type in which it will be installed.
- E. Heads, sills and jambs to be one piece structural members of 6063-T6 alloy with integral caulking slot and retaining beads.
- F. Mullions shall be sliding interlock with internal drain(s).
- G. Blades to be one piece extrusions with gutter(s) designed to catch and direct water to jamb and mullion drains.
- H. Extrusion thicknesses shall be as follows: Heads, Sills, jambs and mullions: 0.115". Fixed Blades: 0.125"
- I. Closed cell PVC compression gaskets shall be provided between bottom of the mullion or jamb and the top of the sill to insure leak tight connections.
- J. All fasteners to be aluminum or stainless steel.

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- K. All louvers to be furnished with 5/8 in. flattened expanded mesh, aluminum bird screen with a .055 in. thick extruded aluminum frame. Screens and screen frames to be standard mill finish.
- L. All louvers shall be finished with powder coating of a color to be selected at the time of submittal review. Coating to be 1.5 to 3 mil. thick full strength 100% resin Fluoropolymer coating. Finish to adhere to a 4H Hardness rating. The louver manufacturer shall supply an industry standard 20-year limited warranty against failure or excessive fading of the Fluoropolymer powder coat finish.
- M. Design Equipment: Greenheck
- N. Makes: Construction Specialties, Inc., American Warming & Ventilating Inc., Arrow United Industries, Louvers & Dampers, Inc., Ruskin, Nailor.

PART 3 - EXECUTION

3.1 GENERAL

- A. Install louvers as per manufacturer's recommendations.

3.2 LOUVERS

- A. Size called for is approximate wall/or masonry opening size. Adjust slightly to suit construction or coursing (review architectural drawings or field conditions for rough opening sizes.) Louvers will be installed by General Contractor Slope ductwork, and plenum to louver weephole or provide drain.
- B. Structural supports shall be designed and furnished by the louver manufacturer to carry a wind load in accordance with the 2015 International Building Code.

END OF SECTION

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SECTION 23 57 00 - HEAT EXCHANGERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes shell-and-tube heat exchangers.

1.2 DEFINITIONS

- A. TEMA: Tubular Exchanger Manufacturers Association.

1.3 SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include rated capacities, operating characteristics, and furnished specialties and accessories.
- B. Coordination Drawings: Equipment room, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
 - 1. Tube-removal space.
 - 2. Structural members to which heat exchangers will be attached.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For heat exchangers to include in emergency, operation, and maintenance manuals.

1.5 WARRANTY

- A. Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of domestic-water heat exchangers that fail in materials or workmanship within specified warranty period.
- B. Failures include, but are not limited to, the following:
 - 1. Structural failures including heat exchanger, storage tank, and supports.
 - 2. Deterioration of metals, metal finishes, and other materials beyond normal use.
- C. Warranty Periods: From Date of Substantial Completion.

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1. Shell-and-Tube, Domestic-Water Heat Exchangers:
 - a. Tube Coil: One (1) year.
 - b. Other Components: One (1) year.
2. Plate, Domestic-Water Heat Exchangers:
 - a. Brazed-Plate Type: One (1) year.
 - b. Plate-and-Frame Type: One (1) year.

PART 2 - PRODUCTS

2.1 SHELL-AND-TUBE HEAT EXCHANGERS

- A. Acceptable Manufacturers:
 1. Basis of Design Product; Subject to compliance with these requirements to provide. Bell & Gossett heat exchanger(s) or compatible product as manufactured by:
 - a. Armstrong
 - b. Patterson Kelley
 - c. Taco
 - d. Thrush
 - e. THS, Inc.; Technical Heat Transfer Services, Inc.
- B. Constructed and stamped ASME Code 125 psi wwp design, 250 psi test. Removable head and tube bundle and baffles with mounting saddles. 3/4 in. tubes, U-bend construction, 5 ft./second maximum tube velocity, fouling factor 0.0005.
 1. Construction:
 - a. Fabricate and label heat exchangers to comply with ASME Boiler and Pressure Vessel Code, Section VIII, "Pressure Vessels", Division 01, 'U' stamp.
 - b. Configuration: U-tube with removable bundle.
- C. Shell Materials: Steel.
- D. Head:
 1. Materials: Cast iron

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2. Flanged and bolted to shell.
- E. Tube:
 1. 90/10 copper-nickel tubes
 2. Tube diameter is determined by manufacturer based on service.
 3. Use double wall tubes for potable water applications.
- F. Tubesheet Materials: Steel
- G. Baffles: Steel
- H. Piping Connections: Factory fabricated of materials compatible with heat-exchanger shell. Attach tappings to shell before testing and labeling.
 1. NPS 2 and Smaller: Threaded ends according to ASME B1.20.1.
 2. NPS 2-1/2 and Larger: Flanged ends according to ASME B16.5 for steel and stainless steel flanges and according to ASME B16.24 for copper and copper-alloy flanges.
- I. Support Saddles:
 1. Fabricated of material similar to shell.
 2. Fabricate foot mount with provision for anchoring to support.
 3. Fabricate attachment of saddle supports to pressure vessel with reinforcement strong enough to resist heat-exchanger movement during seismic event when heat-exchanger saddles are anchored to building structure.
- J. Performance as indicated on plan schedules.
- K. Potable Water Applications: Double wall brazed plate heat exchanger shall consist of pressed Type 316L stainless steel plates as necessary to provide the required heat transfer area to meet the specified operating conditions. The heat exchanger shall be suitable for potable water applications and there shall be no exchange of fluids between the hot side and cold side in the event of a failure.

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2.2 ACCESSORIES

A. Hangers and Supports:

1. Field fabricated steel supports to ensure both horizontal and vertical support of heat exchanger.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas for compliance with requirements for installation tolerances and for structural rigidity, strength, anchors, and other conditions affecting performance of heat exchangers.
- B. Examine roughing-in for heat-exchanger piping to verify actual locations of piping connections before equipment installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SHELL-AND-TUBE HEAT-EXCHANGER INSTALLATION

- A. Equipment Mounting: Install floor supported heat exchangers on cast-in-place concrete equipment base(s).
 1. Construct bases to withstand, without damage to equipment, as required by code.
 2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18 in. centers around the full perimeter of concrete base.
 3. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
- B. Install heat exchangers on saddle supports.
- C. Heat-Exchanger Supports: Use factory-fabricated steel cradles and supports specifically designed for each heat exchanger.

3.3 CONNECTIONS

- A. Maintain manufacturer's recommended clearances for tube removal, service and maintenance.

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- B. Install piping adjacent to heat exchangers to allow space for service and maintenance of heat exchangers. Arrange piping for easy removal of heat exchangers.

3.4 CLEANING

- A. After completing system installation, including outlet fitting and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finishes.

END OF SECTION

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SECTION 23 73 13.1 - AIR HANDLING UNITS (AHU-8 and 9)

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Provide labor, materials, equipment and services as required for the complete installation as shown on the Contract Documents.

1.2 SUBMITTALS

- A. Submit unit performance including capacity, nominal and operating performance.
- B. Submit Mechanical Specifications for unit and accessories describing construction, components and options.
- C. Submit shop drawings indicating overall dimensions as well as installation, operation and service clearances. Indicate lift points and recommendations. Indicate unit shipping split locations, and split dimensions, installation and operating weights including dimensions.
- D. Provide fan curves with specified operating point clearly plotted.
- E. Submit data on electrical requirements. Include safety and start-up instructions.
- F. Submit sound data certified to ARI 260.

1.3 DELIVERY STORAGE AND HANDLING

- A. Unit shall be on a wooden pallet with skeleton crating prior to shipment to prevent damage during transport and thereafter while in storage awaiting installation.
- B. Follow Installation, Operation and Maintenance manual instructions for rigging, moving, and unloading the unit at its final location.
- C. Unit shall be handled carefully to avoid damage to components, enclosures and finish.
- D. Unit shall be stored in a clean, dry place protected from weather and construction traffic in accordance with Installation, Operation and Maintenance manual instructions.

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PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

- A. Unit shall be a factory-assembled, single-piece central station air handler. Unit may consist of a fan and coil section with factory-installed chilled water or direct expansion coil, preheat or reheat coil, heating coil section, filter section, mixing box or combination filter/mixing box, or access section as indicated on the equipment schedules. Unit base rail shall be 14 gage galvanized steel.
- B. Unit Cabinet:
 - 1. Unit panels shall be constructed of 20 gage galvanized steel. Casing panels shall be removable for easy access to the unit. All panels shall be gasketed to ensure a tight seal.
 - 2. Optional double wall construction shall be available with inner panels constructed of 20 gage steel.
 - 3. Hinged access doors shall be double wall with 1.5 lb dual-density fiberglass between galvanized steel panels.
 - 4. Insulation for casing panels on unit shall be 1-in. minimum thickness dual-density fiberglass insulation with a nominal density of not less than 1.5 lb per cubic foot.
 - 5. Insulation shall be secured to casing with waterproof adhesive.
 - 6. Condensate drain pans shall be sloped to prevent standing water and constructed of stainless steel; they shall have double wall construction with threaded drain connection.
- C. Fan Section:
 - 1. Fan sections shall be constructed of galvanized steel and shall have a formed channel base for integral mounting of fan, motor, and casing panels. Fan scroll, wheel, shaft, and bearings are to be rigidly secured to the base unit.
 - 2. Each unit shall have a single fan wheel and scroll. Fans shall be double width, double inlet type, with forward-curved blades. Wheels shall be bonderized steel with baked enamel, or galvanized steel.
 - 3. Fan wheels shall be keyed to the shaft and shall be designed for continuous operation at the maximum rated fan speed and motor horsepower. Fan wheels and shafts shall be selected to operate at least 25% below the first

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critical speed, and shall be statically and dynamically balanced as an assembly.

4. Fan shafts shall be solid steel, turned, ground and polished.
5. Fan bearings shall be self-aligning, pillow-block regreasable ball type selected for an average life of 200,000 hours at design operation conditions, per ANSI Code B3.15.
6. Fan motor shall be mounted within the fan section casing on slide rails having 2 adjusting screws. Motor shall be NEMA (National Electrical Manufacturing Association) Design B with sizes and electrical characteristics as shown on the equipment schedule.
7. Fan drive shall be designed for a 1.5 service factor and shall be factory mounted and aligned. Belt drive shall be variable or fixed-pitch type.

2.2 AIR HANDLING UNITS

A. Construction:

1. Unit panels shall be constructed of 20 gage galvanized steel. Casing panels shall be removable for easy access to the unit. All panels shall be gasketed to ensure a tight seal.
2. Optional double wall construction shall be available with inner panels constructed of 20 gage steel.
3. Hinged access doors shall be double wall with 1.5 lb dual-density fiberglass between galvanized steel panels.
4. Insulation for casing panels on unit shall be 1-in. minimum thickness dual-density fiberglass insulation with a nominal density of not less than 1.5 lb per cubic foot.
5. Insulation shall be secured to casing with waterproof adhesive.
6. Condensate drain pans shall be sloped to prevent standing water and constructed of stainless steel; they shall have double wall construction with threaded drain connection.

B. Coils:

- A. All coils shall have mill galvanized casings. Coils shall be factory leak tested at 450 psig air pressure.

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- B. Chilled water coils shall have aluminum plate fins with belled collars bonded to $\frac{1}{2}$ -in. minimum OD copper tubes by mechanical expansion. Coils shall have galvanized steel casings and copper headers with threaded steel pipe connections. Working pressure shall be 300 psig at 200°F. Coils shall be drainable and have non-trapping circuits. No turbulence-promoting devices will be permitted inside the tubes. Headers shall have drain and vent connections.
- C. Hot water coils shall have aluminum plate fins with belled collars bonded to copper tubes by mechanical expansion. Coils shall have galvanized steel casings and copper headers with threaded steel pipe connections. Working pressure shall be 175 psig at 400°F. Headers shall have drain and vent connections.
- C. Filter Sections:
 - 1. Each filter section shall be designed and constructed to house the specific type of filter specified on the equipment schedule.
 - 2. Flat filter sections shall accept filters of standard sizes. Sections shall include side access slide rails and hinged door access. Flat filter section shall be arranged with minimum depth in direction of airflow.
- D. VFD's:
 - 1. Factory-mounted variable frequency drives (VFDs) shall be wired to factory-supplied motors.
 - 2. Factory-supplied VFDs are programmed and started up from the factory and qualify the VFD, through ABB, for a 24-month warranty from date of commissioning or 30 months from date of sale, whichever occurs first.
 - 3. The VFD parameters are programmed into the controller and removable keypad. In the event that the VFD fails and needs replacement, the program can then be uploaded to the replacement VFD via the original keypad.
 - 4. The VFD package as specified herein shall be enclosed in a UL Listed type enclosure, exceeding NEMA enclosure design criteria (enclosures with only NEMA ratings are not acceptable), completely assembled and tested by the manufacturer in an ISO 9001 facility. The VFD tolerated voltage window shall allow the VFD to operate from a line of +30% nominal, and – 35% nominal voltage as a minimum.
 - a. Environmental operating conditions: VFDs shall be capable of continuous operation at –15 to 40°C (5 to 104°F) ambient

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temperature with no frost allowed as per VFD manufacturers documented/submittal data or VFD must be oversized to meet these temperature requirements. Not acceptable are VFDs that can only operate at 40°C intermittently (average during a 24-hour period) and therefore must be oversized. VFDs shall be capable of operating at altitude 0 to 3300 ft above sea level and less than 95% humidity, non-condensing. All circuit boards shall have conformal coating.

- b. Enclosure shall be rated UL Type 1 and shall be UL listed as a plenum rated VFD. VFDs without these ratings are not acceptable. Type 1 enclosures with only NEMA ratings are not acceptable (must be UL Type 1).
5. All VFDs shall have the following standard features:
- a. All VFDs shall have the same customer interface, including digital display, and keypad, regardless of horsepower rating. The keypad shall be removable, capable of remote mounting and allow for uploading and downloading of parameter settings as an aid for start-up of multiple VFDs.
 - b. The keypad shall include Hand-Off-Auto selections and manual speed control. The drive shall incorporate “bumpless transfer” of speed reference when switching between “Hand” and “Auto” modes. There shall be fault reset and “Help” buttons on the keypad. The Help button shall include “on-line” assistance for programming and troubleshooting.
 - c. There shall be a built-in timeclock in the VFD keypad. The clock shall have a battery back-up with 10 years minimum life span. The clock shall be used to date and time stamp faults and record operating parameters at the time of fault. If the battery fails, the VFD shall automatically revert to hours of operation since initial power up. Capacitor back-up is not acceptable. The clock shall also be programmable to control start/stop functions, constant speeds, PID (proportional integral derivative loop) parameter sets and output Form-C relays. The VFD shall have a digital input that allows an override to the timeclock (when in the off mode) for a programmable time frame. There shall be four (4) separate, independent timer functions that have both weekday and weekend settings.
 - d. The VFDs shall utilize pre-programmed application macros specifically designed to facilitate start-up. The Application Macros shall provide one command to reprogram all parameters and customer interfaces for a particular application to reduce

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programming time. The VFD shall have two user macros to allow the end-user to create and save custom settings.

- e. The VFD shall have cooling fans that are designed for easy replacement. The fans shall be designed for replacement without requiring removing the VFD from the wall or removal of circuit boards. The VFD cooling fans shall operate only when required. To extend the fan and bearing operating life, the VFD shall cycle the cooling fans on and off as required.
- f. The VFD shall be capable of starting into a coasting load (forward or reverse) up to full speed and accelerate or decelerate to set point without tripping or component damage (flying start).
- g. The VFD shall have the ability to automatically restart after an overcurrent, over-voltage, under-voltage, or loss of input signal protective trip. The number of restart attempts, trial time, and time between attempts shall be programmable.
- h. The overload rating of the drive shall be 110% of its normal duty current rating for 1 minute every 10 minutes, 130% overload for 2 seconds. The minimum FLA rating shall meet or exceed the values in the NEC/UL table 430.250 for 4-pole motors.
- i. The VFD shall have internal 5% impedance reactors to reduce the harmonics to the power line and to add protection from AC line transients. The 5% impedance may be from dual (positive and negative DC bus) reactors, or 5% AC line reactors. VFDs with only one DC reactor shall add an AC line reactor.
- j. The input current rating of the VFD shall be no more than 3% greater than the output current rating. VFDs with higher input current ratings require the upstream wiring, protection devices, and source transformers to be oversized per NEC 430.120. Input and output current ratings must be shown on the VFD nameplate.
- k. The VFD shall include a coordinated AC transient surge protection system consisting of 4 to 120 joule rated MOVs (phase to phase and phase to ground), a capacitor clamp, and 5% impedance reactors.
- l. The VFD shall provide a programmable loss-of-load (broken belt/broken coupling) Form-C relay output. The drive shall be programmable to signal the loss-of-load condition via a keypad warning, Form-C relay output, and/or over the serial communications bus. The loss-of-load condition sensing algorithm

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shall include a programmable time delay that will allow for motor acceleration from zero speed without signaling a false loss-of-load condition.

- m. The VFD shall have user programmable underload and overload curve functions to allow user defined indications of broken belt or mechanical failure/jam condition causing motor overload
 - n. The VFD shall include multiple “two zone” PID algorithms that allow the VFD to maintain PID control from two separate feedback signals (4 to 20 mA, 0 to 10V, and/or serial communications). The two zone control PID algorithm will control motor speed based on a minimum, maximum, or average of the two feedback signals. All of the VFD PID controllers shall include the ability for “two zone” control.
 - o. If the input reference (4 to 20 mA or 2 to 10 V) is lost, the VFD shall give the user the option of either (1) stopping and displaying a fault, (2) running at a programmable preset speed, (3) hold the VFD speed based on the last good reference received, or (4) cause a warning to be issued, as selected by the user. The drive shall be programmable to signal this condition via a keypad warning, Form-C relay output and / or over the serial communication bus.
 - p. The VFD shall have programmable “Sleep” and “Wake up” functions to allow the drive to be started and stopped from the level of a process feedback signal.
6. All VFDs to have the following adjustments:
- a. Three (3) programmable critical frequency lockout ranges to prevent the VFD from operating the load continuously at an unstable speed. The lockout range must be fully adjustable, from 0 to full speed.
 - b. Two (2) PID set point controllers shall be standard in the drive, allowing pressure or flow signals to be connected to the VFD, using the microprocessor in the VFD for the closed-loop control. The VFD shall have 250 mA of 24 VDC auxiliary power and be capable of loop powering a transmitter supplied by others. The PID set point shall be adjustable from the VFD keypad, analog inputs, or over the communications bus. There shall be two independent parameter sets for the PID controller and the capability to switch between the parameter sets via a digital input, serial communications or from the keypad. The independent parameter sets are typically used for night setback, switching between summer and winter set points, etc.

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- c. There shall be an independent, second PID loop that can utilize the second analog input and modulate one of the analog outputs to maintain the set point of an independent process (ie. valves, dampers, etc.). All set points, process variables, etc. to be accessible from the serial communication network.
- d. Two (2) programmable analog inputs shall accept current or voltage signals.
- e. Two (2) programmable analog outputs (0 to 20 mA or 4 to 20 mA). The outputs may be programmed to output proportional to Frequency, Motor Speed, Output Voltage, Output Current, Motor Torque, Motor Power (kW), DC Bus voltage, Active Reference, Active Feedback, and other data.
- f. Six (6) programmable digital inputs for maximum flexibility in interfacing with external devices. All digital inputs shall be programmable to initiate upon an application or removal of 24 VDC or 24 VAC.
- g. Three (3) programmable, digital Form-C relay outputs. The relay outputs shall include programmable on and off delay times and adjustable hysteresis. The relays shall be rated for maximum switching current 8 amps at 24 VDC and 0.4 A at 250 VAC; Maximum voltage 300 VDC and 250 VAC; continuous current rating of 2 amps RMS. Outputs shall be true Form-C type contacts; open collector outputs are not acceptable.
- h. Run permissive circuit: There shall be a run permissive circuit for damper or valve control. Regardless of the source of a run command (keypad, input contact closure, time-clock control, or serial communications), the VFD shall provide a dry contact closure that will signal the damper to open (VFD motor does not operate). When the damper is fully open, a normally open dry contact (end-switch) shall close. The closed end-switch is wired to a VFD digital input and allows VFD motor operation. Two separate safety interlock inputs shall be provided. When either safety is opened, the motor shall be commanded to coast to stop and the damper shall be commanded to close. The keypad shall display "start enable 1 (or 2) missing." The safety input status shall also be transmitted over the serial communications bus.
- i. The VFD control shall include a programmable time delay for VFD start and a keypad indication that this time delay is active. A Form C relay output provides a contact closure to signal the VAV boxes open. This will allow VAV boxes to be driven open before the motor

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- operates. The time delay shall be field programmable from 0 to 120 seconds. Start delay shall be active regardless of the start command source (keypad command, input contact closure, time-clock control, or serial communications).
- j. Seven (7) programmable preset speeds.
 - k. Two independently adjustable accelerate and decelerate ramps with 1 to 1800 seconds adjustable time ramps.
 - l. The VFD shall include a motor flux optimization circuit that will automatically reduce applied motor voltage to the motor to optimize energy consumption and reduce audible motor noise. The VFD shall have selectable software for optimization of motor noise, energy consumption, and motor speed control.
 - m. The VFD shall include a carrier frequency control circuit that reduces the carrier frequency based on actual VFD temperature that allows higher carrier frequency settings without derating the VFD.
 - n. The VFD shall include password protection against parameter changes.
7. The keypad shall include a backlit LCD display. The display shall be in complete English words for programming and fault diagnostics (alpha-numeric codes are not acceptable). All VFD faults shall be displayed in English words. The keypad shall include a minimum of 14 assistants including:
- a. Start-up assistant
 - b. Parameter assistants
 - c. PID assistant
 - d. Reference assistant
 - e. I/O assistant
 - f. Serial communications assistant
 - g. Option module assistant
 - h. Panel display assistant
 - i. Low noise set-up assistant

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- j. Maintenance assistant
 - k. Troubleshooting assistant
 - l. Drive optimizer assistants
8. All applicable operating values shall be capable of being displayed in engineering (user) units. A minimum of three operating values from the list below shall be capable of being displayed at all times. The display shall be in complete English words (alpha-numeric codes are not acceptable):
- a. Output Frequency
 - b. Motor Speed (RPM, %, or Engineering units)
 - c. Motor Current
 - d. Motor Torque
 - e. Motor Power (kW)
 - f. DC Bus Voltage
 - g. Output Voltage
9. The VFD shall include a fireman's override input. Upon receipt of a contact closure from the fire / smoke control station, the VFD shall operate in one of two modes: 1) Operate at a programmed predetermined fixed speed ranging from -500 Hz (reverse) to 500 Hz (forward). 2) Operate in a specific fireman's override PID algorithm that automatically adjusts motor speed based on override set point and feedback. The mode shall override all other inputs (analog/digital, serial communication, and all keypad commands), except customer defined safety run interlocks, and force the motor to run in one of the two modes above. "Override Mode" shall be displayed on the keypad. Upon removal of the override signal, the VFD shall resume normal operation, without the need to cycle the normal digital input run command.
10. Serial Communications:
- a. The VFD shall have an EIA-485 port as standard. The standard protocols shall be Modbus, Johnson Controls N2, Siemens Building Technologies FLN, and BACnet. Optional protocols for LonWorks, Profibus, EtherNet, BACnet IP, and DeviceNet shall be available. Each individual drive shall have the protocol in the base VFD. The use of third party gateways and multiplexers is not acceptable. All protocols shall be "certified" by the governing authority (i.e., BTL Listing for BACnet). Use of non-certified protocols is not allowed.

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- b. The BACnet connection shall be an EIA-485, MS/TP interface operating at 9.6, 19.2, 38.4, or 76.8 Kbps. The connection shall be tested by the BACnet Testing Labs (BTL) and be BTL Listed. The BACnet interface shall conform to the BACnet standard device type of an Applications Specific Controller (B-ASC). The interface shall support all BIBBs defined by the BACnet standard profile for a B-ASC including, but not limited to:
 - 1) Data Sharing – Read Property – B.
 - 2) Data Sharing – Write Property – B.
 - 3) Device Management – Dynamic Device Binding (Who-Is; I-Am).
 - 4) Device Management – Dynamic Object Binding (Who-Has; I-Have).
 - 5) Device Management – Communication Control – B.
- c. If additional hardware is required to obtain the BACnet interface, the VFD manufacturer shall supply one BACnet gateway per drive. Multiple VFDs sharing one gateway shall not be acceptable.
- d. Serial communication capabilities shall include, but not be limited to; run-stop control, speed set adjustment, proportional/integral/derivative PID control adjustments, current limit, accelerate/decelerate time adjustments, and lock and unlock the keypad. The drive shall have the capability of allowing the DDC (direct digital controls) to monitor feedback such as process variable feedback, output speed / frequency, current (in amps), % torque, power (kW), kilowatt hours (resettable), operating hours (resettable), and drive temperature. The DDC shall also be capable of monitoring the VFD relay output status, digital input status, and all analog input and analog output values. All diagnostic warning and fault information shall be transmitted over the serial communications bus. Remote VFD fault reset shall be possible.
- e. The VFD shall include an independent PID loop for customer use. The independent PID loop may be used for cooling tower bypass valve control, chilled water valve / hot water valve control, etc. Both the VFD PID control loop and the independent PID control loop shall continue functioning even if the serial communications connection is lost. As default, the VFD shall keep the last good set point command and last good DO (digital output) and AO (analog output)

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commands in memory in the event the serial communications connection is lost and continue controlling the process.

11. EMI/RFI filters. All VFDs shall include EMI/RFI (electromagnetic interface/radio frequency interface) filters. The onboard filters shall allow the VFD assembly to be CE Marked and the VFD shall meet product standard EN 61800-3 for the First Environment restricted level with up to 100 feet of motor cable. No Exceptions. Certified test reports shall be provided with the submittals confirming compliance to EN 61800-3, First Environment.
12. All VFDs through 75 hp at 480 V shall be protected from input and output power mis-wiring. The VFD shall sense this condition and display an alarm on the keypad. The VFD shall not sustain damage from this power mis-wiring condition.
13. Operational Functions:
 - a. The drive shall contain two separate acceleration/deceleration times with auto tuning for optimum setting (0.1 to 6000 seconds) with choice of linear, S, or C curves that shall be factory programmed to match the fan load and prevent nuisance overcurrent fault trips.
 - b. The drive shall be equipped with both local/remote and manual/auto keys on touchpad.
 - c. The drive shall be equipped with a quick setup key.
 - d. The drive shall contain 15 preset speeds, which can be activated from the keypad, terminal inputs, and host computer.
 - e. The drive shall have the capability of storable special custom user setting.
 - f. The drive shall restart into a rotating motor operating in either the forward or reverse direction and match that frequency.
 - g. The drive shall have adjustable soft stall (10% to 150%) which reduces frequency and voltage of the inverter to sustain a run in an overload situation factory programmed for each motor's characteristics.
 - h. The drive shall be capable of performing a time base pattern run using 4 groups of 8 patterns each using the 15 preset speed values for a maximum of 32 different patterns.

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- i. The drive shall have adjustable UL listed electronic overload protection (10% to 100%) factory programmed to match each motor's FLA/RLA (full load amps/rated load amps) ratings.
 - j. The drive shall have a custom programmable volt/hertz pattern.
14. Protective Features:
- a. The drive shall be rated for 200,000 AIC (ampere interrupting capacity). The use of input fuses to achieve this rating shall not be acceptable.
 - b. The drive shall have external fault input.
 - c. The drive shall be capable of resetting faults remotely and locally.
 - d. The drive shall be programmable to alert the following alarms:
 - 1) Over torque alarm.
 - 2) Inverter overload pre-alarm.
 - 3) Motor overload pre-alarm.
 - 4) Braking resistor overload pre-alarm.
 - 5) Inverter overheat pre-alarm.
 - 6) Undercurrent alarm.
 - 7) Overcurrent pre-alarm.
 - 8) Communication error alarm.
 - 9) Cumulative timer alarm.
 - 10) Executing retry.
 - e. The drive shall identify and display the following faults:
 - 1) Overcurrent during acceleration trip.
 - 2) Overcurrent during deceleration trip.
 - 3) Overcurrent during normal run trip.
 - 4) Overcurrent on the DC Bus during acceleration trip.
 - 5) Overcurrent on the DC Bus during deceleration trip.
 - 6) Overcurrent on the DC Bus during normal run trip.
 - 7) Load end overcurrent trip detected at start-up (output terminals, motor wiring, etc.).
 - 8) U-phase short circuit trip detected at start-up.
 - 9) V-phase short circuit trip detected at start-up.
 - 10) W-phase short circuit trip detected at start-up.
 - 11) Overvoltage during acceleration trip.
 - 12) Overvoltage during deceleration trip.
 - 13) Overvoltage during normal (constant speed) run trip.
 - 14) Inverter overloaded trip.

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- 15) Motor overloaded trip.
- 16) Inverter overheat trip.
- 17) Emergency off trip message.
- 18) EEPROM failure during write cycle.
- 19) EEPROM abnormality during initial reading.
- 20) RAM error.
- 21) ROM error.
- 22) CPU error.
- 23) Communication interruption error.
- 24) Gate array error.
- 25) Output current detection circuit error.
- 26) Option PCB error trip.
- 27) Low operating current trip.
- 28) Main circuit under voltage trip.
- 29) Over torque trip.
- 30) Software detected earth fault trip.
- 31) Hardware detected earth fault trip.
- 32) Inverter type form mismatch error.
- 33) EEPROM type form mismatch error.

15. Monitor Functions:

- a. The drive digital display shall be capable of displaying the following: Frequency, percent current, current amps, percent voltage I/O, voltage in volts I/O, RPM, GPM, I/O watts, torque, and input reference signal, kWh.
- b. The drive shall have 320 programmable parameters which can be changed while the drive is operating.
- c. The drive's 353 parameters shall be adjustable from the 8-key touchpad or computer link.
- d. The drive's 8-key touchpad shall be NEMA 12 rated.
- e. The drive's keypad shall be capable of being extended 15 ft from the drive.
- f. The drive shall contain a reset of all parameters to factory default settings or user defaults (whichever one is chosen).
- g. The drive shall have 2 programmable analog outputs programmable to 17 choices.
- h. The drive shall have one programmable relay output programmable to 67 choices.

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- i. The drive shall have 8 programmable digital inputs programmable to 54 choices.
 - j. The drive shall have a pulse train output proportional to frequency (48, 96, 360 times frequency).
 - k. The drive shall have an elapsed time meter.
- E. Design Equipment:
 - 1. Indoor Style Units: Carrier 39LA, LC

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Provide equipment in accordance with manufacturer's recommendations and compatible with intent of the respective system performance requirements.
- B. Provide vibration isolators in accordance with manufacturer's recommendations, and as called for. Provide necessary steel supporting framework for equipment requiring same. Braced against swaying.
- C. Change pulley sizes as many times as necessary, as part of Contract, to make systems deliver specified quantities of air.
- D. Provide 6 in. high concrete pads for all floor mounted air-handling units.
- E. Install piping adjacent to machine to allow service and maintenance. Do not block access doors or coil pull-space with piping.
- F. Pan Drains:
 - 1. Connect condensate drain pans with full-size piping.
 - 2. Construct trap with offset dimension and seal depth per manufacturer's recommendations. Install cleanouts at changes in direction.
 - 3. Indoor Units: Extend to nearest equipment or floor drain.
- G. Start-Test-Check:
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including piping and electrical connections. Report results in writing.

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2. Engage a factory-authorized service representative to perform startup service.
3. Verify that shipping, blocking, and bracing are removed.
4. Verify that unit is secure on mountings and supporting devices and that connection to piping, ducts, and electrical systems are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
5. Leak Test: After installation, fill water and steam coils with water and test coils and connections for leaks. Repair leaks and retest until no leaks exist.
6. Charge refrigerant coils with refrigerant and test for leaks. Repair leaks and retest until no leaks exist.
7. Fan Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation. Remove malfunctioning units, replace with new units, and retest.
8. Verify that specified filters are installed. Check for leakage around filters.
9. Verify that cooling coil drain pans have a positive slope to drain.
10. Verify that the cooling coil condensate drain trap maintains an air seal.
11. Clean air-handling units internally, on completion of installation, according to manufacturer's written instructions. Clean fan interiors to remove foreign material and construction dirt and dust. Vacuum clean fan wheels, cabinets, and coils entering air face.
12. After completing system installation and testing, adjusting, and balancing modular indoor air handling and air-distribution systems, clean filter housings and install new filters.

END OF SECTION

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SECTION 23 73 13.2 - AIR HANDLING UNITS (AHU-3)

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Provide labor, materials, equipment and services as required for the complete installation as shown on the Contract Documents.

1.2 SUBMITTALS

- A. Submit unit performance including capacity, nominal and operating performance.
- B. Submit Mechanical Specifications for unit and accessories describing construction, components and options.
- C. Submit shop drawings indicating overall dimensions as well as installation, operation and service clearances. Indicate lift points and recommendations. Indicate unit shipping split locations, and split dimensions, installation and operating weights including dimensions.
- D. Provide fan curves with specified operating point clearly plotted.
- E. Submit data on electrical requirements. Include safety and start-up instructions.
- F. Submit sound data certified to ARI 260.

1.3 DELIVERY STORAGE AND HANDLING

- A. Unit shall be on a wooden pallet with skeleton crating prior to shipment to prevent damage during transport and thereafter while in storage awaiting installation.
- B. Follow Installation, Operation and Maintenance manual instructions for rigging, moving, and unloading the unit at its final location.
- C. Unit shall be handled carefully to avoid damage to components, enclosures and finish.
- D. Unit shall be stored in a clean, dry place protected from weather and construction traffic in accordance with Installation, Operation and Maintenance manual instructions.

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PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

- A. Units shall ship in the number of sections necessary to meet project requirements and shall ship in as many splits as specified in selection software. Split options as follows:
 - 1. Shipped in sections — shipping split.
- B. Unit shall be factory-supplied, central station air handler. The air-handling unit may consist of a fan with the following factory-installed components as indicated on the equipment schedule.
 - 1. Filter Section:
 - a. 4-in. flat filters.
 - 2. Coil Section:
 - a. Chilled water coil.
 - b. Steam coil.
- C. Fan Section:
 - 1. Horizontal draw-thru (supply, return, and exhaust).

2.2 AIR HANDLING UNITS

- A. Construction:
 - 1. Unit shall be constructed of a complete frame with easily removable panels. Removal of any panel shall not affect the structural integrity of the unit.
 - 2. All units shall be supplied with 14-gage or heavier, G-90 galvanized steel base rails. Bolt-on legs are NOT acceptable. Perimeter lifting lugs for overhead lifting shall be provided on each shipping section. Sliding units in place of lifting lugs shall not be acceptable.
 - 3. Unit shall be thermally broken to minimize the conduction path from the inside of the casing to the outside.
 - 4. Casing panels (top, sides, and bottom) shall be constructed of galvanized steel (18 gauge optional), and shall have one of the following exterior finishes as specified:

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- a. Unpainted G-90 galvanized steel.
- 5. Casing panels (top, sides, and bottom) shall be constructed of galvanized steel (18 gauge optional) or stainless steel, and shall have one of the following interior finishes as specified:
 - a. Unpainted G-90 galvanized steel.
- 6. Casing panels (top, sides, and bottom) shall be one piece, double-wall construction with foam insulation sealed between the inner and outer panels. Panel assemblies shall not carry an R-value of less than 13.
- 7. Casing deflection shall not exceed a L/240 ratio when subject to an internal pressure of ± 8 -in. wg and shall exhibit no permanent deformation at ± 9 -in. wg. L is defined as the longest linear panel or cabinet length (measured to AHRI 1350 Cd level 2).
- 8. Casing leakage rate shall be less than 1% at 8 in. wg of nominal unit airflow or 50 cfm, whichever is greater. Leakage rate shall be tested and documented on a routine basis on random production units. Optionally, factory witness leak testing and/or test reports shall be available.
- 9. Side panels shall be easily removable for access to unit and shall seal against a full perimeter automotive style gasket to ensure a tight seal.
- 10. The panel retention system shall comply with UL 1995 which states all moving parts (for example, fan blades, blower wheels, pulleys, and belts) that, if accidentally contacted, could cause bodily injury, shall be guarded against accidental contact by an enclosure requiring tools for removal.
- 11. Accessibility options shall be as follows:
 - a. Hinged, lockable double-wall access door on either side with removable access panel(s) on the other side..
- 12. Fan supports, structural members, panels, or flooring shall not be welded, unless aluminum, stainless steel, or other corrosion-resistant material is used. Painted welds on unit exterior steel or galvanized steel are not acceptable.
- 13. All coil sections shall be doublewall construction with foam insulation sealed between the inner and outer panels. Panel assemblies shall not carry an R-value of less than 13. Single height coil sections shall have removable frame sections to facilitate vertical coil extraction.

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B. Bearings:

1. Self-aligning, grease lubricated, anti-friction with lubrication fittings extended to drive side of fan section. Optional grease fittings extended to the exterior of the casing are available. All bearing life calculations shall be done in accordance with ABMA 9 for ball bearings and ABMA 11 for roller bearings.
2. Size 03 to 110 forward-curved fans: Cartridge type bearings for Class I fans. Heavy-duty pillow block type, self-aligning, regreasable ball or roller type bearings selected for a minimum average life (L50) of 200,000 hours or optionally for an (L50) of 500,000 hours.

C. Shafts:

1. Fan shafts shall be solid steel, turned, ground, polished and coated with a rust inhibitor.

D. V-Belt Drive:

1. Drive shall be designed for a minimum 1.2 service factor as standard with a 1.5 service factor option and/or a factory-supplied extra set of belts. Drives shall be fixed pitch with optional variable pitch for motors 15 hp and less. All drives shall be factory mounted, with sheaves aligned and belts properly tensioned.

E. Supply Fans:

1. Forward-curved fan sections shall have one double-width double-inlet (DWDI) fan wheel and scroll. They shall be constructed of galvanized steel with baked enamel. They shall be designed for continuous operation at the maximum rated fan speed and motor horsepower. Fans shall have an AMCA class rating corresponding to the static pressure at which the fan is designed to operate (Class I or II). Completed fan assembly shall be dynamically balanced in accordance with AHRI Guideline G and ANSI S2.19 at design operating speed using contract drive and motor if ordered.
2. Isolated fan assembly vibration shall not exceed 0.248 in. per second when mounted on active isolators. Vibration shall be measured in both vertical and horizontal directions at the specified fan operating speed using specified motor. For testing purposes, accelerometers shall be mounted on the motor near the bearing locations and removed before shipment.
3. All fan sled components shall provide corrosion protection to pass 100-hour salt spray test per ASTM B-117.

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4. Fan wheels for all AF, FC, belt drive PF, and direct drive PF with NEMA "T" frame motors shall be keyed to the shaft. Fan wheels for direct drive PF with EC motors shall be mounted directly to the rotor of the EC motor. All shall be designed for continuous operation at maximum rated fan speed and motor horsepower. Fan wheels and shafts shall be selected with a maximum operating speed 25% below the first critical.
 5. Belt drive fan motor shall be mounted within the fan section casing on slide rails equipped with adjusting screws. Belt drive and direct drive with NEMA "T" frame motors shall be premium efficiency, open drip-proof or totally enclosed fan cooled NEMA (National Electrical Manufacturers Association) Design A or B with size and electrical characteristics as shown on the equipment schedule. Motor shall be mounted on a horizontal flat surface and shall not be supported by the fan or its structural members. All three-phase motors shall have a $\pm 10\%$ voltage utilization range and a 1.15 minimum service factor. Motor shall be compliant with the Energy Independence and Security Act (EISA) of 2007 where applicable. Single-phase motors shall be available up to and including 5 hp..
- B. Performance Ratings:
1. Supply fan performance shall be rated and certified in accordance with AHRI Standard 430, latest edition.
- C. Sound Ratings:
1. Manufacturer shall submit first through eighth octave sound power for fan discharge and casing radiated sound. Sound ratings shall be tested in accordance with AHRI 260.
- D. Mounting:
1. AF, FC, Belt-drive PF, Direct-drive PF with NEMA motor: Fan scroll, wheel, shaft, bearings, drives, and motor shall be mounted on a common base assembly. The base assembly is isolated from the outer casing with factory-installed isolators and rubber vibration absorbent fan discharge seal. A canvas style duct connection between fan discharge and cabinet is not acceptable. Units shall use 2-in. deflection spring isolators.
- E. Fan Accessories:
1. Forward-curved fans:
 - a. Variable frequency drives.

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2. Flexible Connection:

- a. The base assembly is isolated from the outer casing with factory-installed isolators and rubber vibration absorbent fan discharge seal. A canvas style duct connection between fan discharge and cabinet is not acceptable.

F. Coils:

1. All water, steam and direct expansion (DX) refrigerant coils shall be provided to meet the scheduled performance. All coil performance shall be certified in accordance with AHRI Standard 410. All water and direct expansion coils shall be tested at 450 psig air pressure. Direct expansion coils shall be designed and tested in accordance with ANSI/ASHRAE 15 Safety Code for Mechanical Refrigeration (latest edition). Factory-supplied $\frac{1}{2}$ -in. OD coils shall be covered under the standard product one-year limited warranty. All steam coils, integral face and bypass coils and $\frac{5}{8}$ -in. OD coils shall be warranted for a period not in excess of 12 months from their shipment from the manufacturer. Coil epoxy coating shall be covered under a 5-year limited warranty from the date of shipment from the manufacturer.

G. General Fabrication:

1. All water and refrigerant coils shall have minimum $\frac{1}{2}$ -in. OD copper tubes mechanically expanded into fins to ensure high thermal performance with lower total flow and pumping requirements. Minimum tube wall thickness shall be 0.016 inches. Optional tube wall thickness of 0.025 in. shall be supplied, if specified.
2. Optionally, water coils shall have minimum $\frac{5}{8}$ -in. OD copper tubes mechanically expanded into fins to ensure high thermal performance with lower total flow and pumping requirements. Minimum tube wall thickness shall be 0.020 inches. Optional tube wall thickness of 0.035 in. shall be supplied, if specified.
3. Aluminum plate fin type with belled collars. Optional copper plate fins shall be supplied, if specified. Fin type shall be sine wave construction.
4. Aluminum-finned coils shall be supplied with die-formed casing and tube sheets of mill galvanized steel or stainless steel as specified. Copper-finned coils shall be supplied with stainless steel casing and tube sheets.

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H. Hydronic Heating and Cooling Coils:

1. Headers shall be constructed of steel with steel MPT connections. Headers shall have drain and vent connections accessible from the exterior of the unit. Optional non-ferrous headers and red brass MPT connections shall be supplied if specified.
2. Configuration: Coils shall be drainable, with non-trapping circuits. Coils will be suitable for a design working pressure of 300 psig at 200°F.

I. Steam Distribution (Non-Freeze Type) Heating Coils:

1. Headers shall be steel with MPT connections.
2. Inner steam distributing tubes shall be $\frac{5}{8}$ -in. OD, 0.020 in. wall thickness, located within 1 in. OD, 0.030 in. wall outer condensing tubes. Working pressure shall be 175 psig at 400°F.
3. Thermal performance shall be AHRI Standard 1060 certified and bear the AHRI Certified Product Seal. Cassettes shall be listed in the AHRI Certified Products Directory and bear the AHRI Certified Product Seal.

J. Filter Sections:

Flat filter sections shall accept either 2-in. or 4-in. filters. Sections shall include side access slide rails. Optional 6-in. filter racks shall be capable of accepting 4-in. final filters.

K. VFD's:

1. Referenced Standards and Guidelines:
 - a. Institute of Electrical and Electronic Engineers (IEEE):
 - 1) IEEE 519-1992, Guide for Harmonic Content and Control.
 - b. Underwriters Laboratories (as appropriate):
 - 1) UL508
 - 2) UL508A
 - 3) UL508C
 - c. National Electrical Manufacturer's Association (NEMA):
 - 1) ICS 7.0, AC Adjustable Speed Drives.

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- d. International Electrotechnical Commission (IEC):
 - 1) EN/IEC 61800-3
 - e. National Electric Code (NEC):
 - 1) NEC 430.120, Adjustable-Speed Drive Systems
 - f. International Building Code (IBC):
 - 1) IBC 2006, 2009, 2012, and 2015 Seismic – referencing ASC 7-05 and ICC AC-156
2. Qualifications:
- a. VFDs and options shall be UL508 listed as a complete assembly. The base VFD shall be UL listed for 100 kA SCCR without the need for external input fuses.
 - b. CE Mark – The base VFD shall conform to the European Union Electromagnetic Compatibility directive, a requirement for CE marking. The VFD shall meet product standard EN 61800-3 for the First Environment restricted level (Category C2). Base drives that only meet the Second Environment (Category C3, C4) shall be supplied with filters to bring the drive in compliance with the First Environment levels.
 - c. The entire VFD assembly, including the bypass (if specified), shall be seismically certified and labeled as such in accordance with the 2006, 2009, 2012, and 2015 International Building Code (IBC):
 - 1) VFD manufacturer shall provide Seismic Certification and Installation requirements at time of submittal.
 - 2) Seismic importance factor of 1.5 rating is required, and shall be based upon actual shake test data as defined by ICC AC-156.
 - 3) Seismic ratings based upon calculations alone are not acceptable. Certification of Seismic rating must be based on testing done in all three axis of motion.
 - 4) Special seismic certification of equipment and components shall be provided by OSHPD preapproval.
3. Factory-mounted variable frequency drives (VFDs) shall be wired to factory-supplied motors.

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4. Factory-supplied VFDs are programmed and started up from the factory and qualify the VFD, through ABB, for a 36-month warranty from date of commissioning or 40 months from date of sale, whichever occurs first.
5. The VFD parameters are programmed into the controller and removable keypad. In the event that the VFD fails and needs replacement, the program can then be uploaded to the replacement VFD via the original keypad.
6. The VFD package as specified herein and defined on the VFD schedule shall be enclosed in a UL Type enclosure (enclosures with only NEMA ratings are not acceptable), completely assembled and tested by the manufacturer in a facility where the management system governing the manufacture of this product is ISO 9001:2015 certified.
7. The VFD shall provide full rated output from a line of $\pm 10\%$ of nominal voltage. The VFD shall continue to operate without faulting from a line of $+30\%$ to -35% of nominal voltage.
8. VFDs shall be capable of continuous full load operation under the following environmental operating conditions:
 - a. -15 to 40°C (5 to 104°F) ambient temperature. Operation to 50°C shall be allowed with a 10% reduction from VFD full load current.
 - b. Altitude 0 to 3300 feet above sea level. Operation to 6600 ft shall be allowed with a 10% reduction from VFD full load current.
 - c. Humidity less than 95%, non-condensing.
9. All VFDs shall have the following standard features:
 - a. All circuit boards shall be coated to protect against corrosion.
 - b. All VFDs shall have the same customer interface, including digital display, and keypad, regardless of horsepower rating. The keypad shall be removable, capable of remote mounting and allow for uploading and downloading of parameter settings as an aid for start-up of multiple VFDs.
 - c. The keypad shall include Hand-Off-Auto selections and manual speed control. The drive shall incorporate "bumpless transfer" of speed reference when switching between "Hand" and "Auto" modes. There shall be fault reset and "Help" buttons on the keypad. The Help button shall include "on-line" assistance for programming and troubleshooting.

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- d. There shall be a built-in time clock in the VFD keypad. The clock shall have a battery backup with 10 years minimum life span. The clock shall be used to date and time stamp faults and record operating parameters at the time of fault. VFD programming shall be held in non-volatile memory and is not dependent on battery power.
- e. The VFDs shall utilize pre-programmed application macros specifically designed to facilitate start-up. The Application Macros shall provide one command to reprogram all parameters and customer interfaces for a particular application to reduce programming time. The VFD shall have two user macros to allow the end-user to create and save custom settings.
- f. The VFD shall be capable of starting into a coasting load (forward or reverse) up to full speed and accelerate or decelerate to set point without tripping or component damage (flying start).
- g. The VFD shall have the ability to automatically restart after an over-current, over-voltage, under-voltage, or loss of input signal protective trip. The number of restart attempts, trial time, and time between attempts shall be programmable.
- h. The overload rating of the drive shall be 110% of its normal duty current rating for 1 minute every 10 minutes, 130% overload for 2 seconds every minute. The minimum FLA rating shall meet or exceed the values in the NEC/UL table 430.250 for 4-pole motors.
- i. VFDs through 200 HP shall have internal swinging (non-linear) chokes providing impedance equivalent to 5% to reduce the harmonics to the power line. Swinging choke shall be required resulting in superior partial load harmonic reduction. Linear chokes are not acceptable. 5% impedance may be from dual (positive and negative DC bus) chokes, or 5% swinging AC line chokes. VFDs with only one DC choke shall add an AC line choke.
- j. The input current rating of the VFD shall not be greater than the output current rating. VFDs with higher input current ratings require the upstream wiring, protection devices, and source transformers to be oversized per NEC 430.122. Input and output current ratings must be shown on the VFD nameplate.
- k. The VFD shall include a coordinated AC transient surge protection system consisting of 4 MOVs (phase to phase and phase to ground), a capacitor clamp, 1600 PIV Diode Bridge and internal chokes. The MOV's shall have a minimum 125 joule rating per

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phase across the diode bridge. VFDs that do not include coordinated AC transient surge protection shall include an external TVSS (Transient Voltage Surge Suppressor).

- l. The VFD shall provide a programmable loss-of-load (broken belt/broken coupling) Form-C relay output. The drive shall be programmable to signal the loss-of-load condition via a keypad warning, Form-C relay output, and/or over the serial communications bus. The loss-of-load condition sensing algorithm shall include a programmable time delay that will allow for motor acceleration from zero speed without signaling a false loss-of-load condition.
 - m. The VFD shall include multiple “two zone” PID algorithms that allow the VFD to maintain PID control from two separate feedback signals (4 to 20mA, 0 to 10V, and/or serial communications). The two zone control PID algorithm will control motor speed based on a minimum, maximum, or average of the two feedback signals. All of the VFD PID controllers shall include the ability for “two zone” control.
 - n. If the input reference is lost, the VFD shall give the user the option of either (1) stopping and displaying a fault, (2) running at a programmable preset speed, (3) hold the VFD speed based on the last good reference received, or (4) cause a warning to be issued, as selected by the user. The drive shall be programmable to signal this condition via a keypad warning, Form-C relay output and/or over the serial communication bus.
 - o. The VFD shall have programmable “Sleep” and “Wake up” functions to allow the drive to be started and stopped from the level of a process feedback signal.
- 10. All VFDs to have the following adjustments:
 - a. Three (3) programmable critical frequency lockout ranges to prevent the VFD from operating the load continuously at an unstable speed. The lockout range must be fully adjustable, from 0 to full speed.
 - b. Two (2) PID Set point controllers shall be standard in the drive, allowing pressure or flow signals to be connected to the VFD, using the microprocessor in the VFD for the closed-loop control. The VFD shall have 250 mA of 24 VDC auxiliary power and be capable of loop powering a transmitter supplied by others. The PID set point shall be adjustable from the VFD keypad, analog inputs, or over the communications bus. There shall be two independent parameter sets

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for the PID controller and the capability to switch between the parameter sets via a digital input, serial communications or from the keypad. The independent parameter sets are typically used for night setback, switching between summer and winter set points, etc.

- c. There shall be an independent, second PID loop that can utilize the second analog input and modulate one of the analog outputs to maintain the set point of an independent process (i.e. valves, dampers, etc.). All set points, process variables, etc. to be accessible from the serial communication network.
- d. Two (2) programmable analog inputs shall accept current or voltage signals.
- e. Two (2) programmable analog outputs (0 to 20 mA or 4 to 20 mA). The outputs may be programmed to output proportional to Frequency, Motor Speed, Output Voltage, Output Current, Motor Torque, Motor Power (kW), DC Bus voltage, Active Reference, Active Feedback, and other data.
- f. Six (6) programmable digital inputs for maximum flexibility in interfacing with external devices. All digital inputs shall be programmable to initiate upon an application or removal of 24VDC.
- g. Three (3) programmable, digital Form-C relay outputs. The relay outputs shall include programmable on and off delay times and adjustable hysteresis. The relays shall be rated for maximum switching current 8 amps at 24 VDC and 0.4 A at 250 VAC; Maximum voltage 300 VDC and 250 VAC; continuous current rating of 2 amps RMS. Outputs shall be true Form-C type contacts; open collector outputs are not acceptable. Drives that have only two (2) relay outputs must provide an option card that provides additional relay outputs.
- h. Run permissive circuit - There shall be a run permissive circuit for damper or valve control. Regardless of the source of a run command (keypad, input contact closure, time-clock control, or serial communications), the VFD shall provide a dry contact closure that will signal the damper to open (VFD motor does not operate). When the damper is fully open, a normally open dry contact (end-switch) shall close. The closed end-switch is wired to a VFD digital input and allows VFD motor operation. Two separate safety interlock inputs shall be provided. When either safety is opened, the motor shall be commanded to coast to stop and the damper shall be commanded to close. The keypad shall display "start enable 1

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(or 2) missing.” The safety input status shall also be transmitted over the serial communications bus.

- i. The VFD control shall include a programmable time delay for VFD start and a keypad indication that this time delay is active. A Form C relay output provides a contact closure to signal the VAV boxes open. This will allow VAV boxes to be driven open before the motor operates. The time delay shall be field programmable from 0 to 120 seconds. Start delay shall be active regardless of the start command source (keypad command, input contact closure, time-clock control, or serial communications), and when switching from drive to bypass.
 - j. Seven (7) programmable preset speeds.
 - k. Two independently adjustable accel and decel ramps with 1 to 1800 seconds adjustable time ramps.
 - l. The VFD shall include a motor flux optimization circuit that will automatically reduce applied motor voltage to the motor to optimize energy consumption and reduce audible motor noise. The VFD shall have selectable software for optimization of motor noise, energy consumption, and motor speed control.
 - m. The VFD shall include a carrier frequency control circuit that reduces the carrier frequency based on actual VFD temperature that allows higher carrier frequency settings without derating the VFD.
 - n. The VFD shall include password protection against parameter changes.
11. The keypad shall include a backlit LCD display. The display shall be in complete English words for programming and fault diagnostics (alpha-numeric codes are not acceptable). All VFD faults shall be displayed in English words. The keypad shall include a minimum of 14 assistants including:
- a. Start-up assistant.
 - b. Parameter assistants:
 - 1) PID assistant
 - 2) Reference assistant
 - 3) I/O assistant
 - 4) Serial communications assistant

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- 5) Option module assistant
 - 6) Panel display assistant
 - 7) Low noise set-up assistant
- c. Maintenance assistant.
- d. Troubleshooting assistant.
- e. Drive optimizer assistants.
- 12. All applicable operating values shall be capable of being displayed in engineering (user) units. A minimum of three operating values from the list below shall be capable of being displayed at all times. The display shall be in complete English words (alpha-numeric codes are not acceptable):
 - a. Output Frequency
 - b. Motor Speed (RPM,%, or Engineering units)
 - c. Motor Current
 - d. Motor Torque
 - e. Motor Power (kW)
 - f. DC Bus Voltage
 - g. Output Voltage
- 13. The VFD shall include a fireman's override input. Upon receipt of a contact closure from the fire / smoke control station, the VFD shall operate in one of two modes: 1) Operate at a programmed predetermined fixed speed ranging from -500Hz (reverse) to 500Hz (forward). 2) Operate in a specific fireman's override PID algorithm that automatically adjusts motor speed based on override set point and feedback. The mode shall override all other inputs (analog/digital, serial communication, and all keypad commands), except customer defined safety run interlocks, and force the motor to run in one of the two modes above. "Override Mode" shall be displayed on the keypad. Upon removal of the override signal, the VFD shall resume normal operation, without the need to cycle the normal digital input run command.
- 14. Serial Communications
 - a. The VFD shall have an EIA-485 port as standard. The standard protocols shall be Modbus, Johnson Controls N2, Siemens Building Technologies FLN, and BACnet. Optional protocols for LonWorks, Profibus, EtherNet, BACnet IP, and DeviceNet shall be available.

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Each individual drive shall have the protocol in the base VFD. The use of third party gateways and multiplexers is not acceptable. All protocols shall be "certified" by the governing authority (i.e. BTL Listing for BACnet). Use of non-certified protocols is not allowed.

- b. The BACnet connection shall be an EIA-485, MS/TP interface operating at 9.6, 19.2, 38.4, or 76.8 Kbps. The connection shall be tested by the BACnet Testing Labs (BTL) and be BTL Listed. The BACnet interface shall conform to the BACnet standard device type of an Applications Specific Controller (B-ASC). The interface shall support all BIBBs defined by the BACnet standard profile for a B-ASC including, but not limited to:
 - 1) Data Sharing – Read Property – B.
 - 2) Data Sharing – Write Property – B.
 - 3) Device Management – Dynamic Device Binding (Who-Is; I-Am).
 - 4) Device Management – Dynamic Object Binding (Who-Has; I-Have).
 - 5) Device Management – Communication Control – B.
- c. Serial communication capabilities shall include, but not be limited to; run-stop controls, speed set adjustment, and lock and unlock the keypad. The drive shall have the capability of allowing the BAS to monitor feedback such as process variable feedback, output speed / frequency, current (in amps), % torque, power (kW), kilowatt hours (resettable), operating hours (resettable), and drive temperature. The BAS shall also be capable of monitoring the VFD relay output status, digital input status, and all analog input and analog output values. All diagnostic warning and fault information shall be transmitted over the serial communications bus. Remote VFD fault reset shall be possible.
- d. Serial communication in bypass (if bypass is specified) shall include, but not be limited to; bypass run-stop control, the ability to force the unit to bypass, and the ability to lock and unlock the keypad. The bypass shall have the capability of allowing the BAS to monitor feedback such as, current (in amps), kilowatt hours (resettable), operating hours (resettable), and bypass logic board temperature. The BAS shall also be capable of monitoring the bypass relay output status, and all digital input status. All bypass diagnostic warning and fault information shall be transmitted over the serial communications bus. Remote bypass fault reset shall be possible.

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- e. The VFD / bypass shall allow the BAS to control the drive and bypass digital and analog outputs via the serial interface. This control shall be independent of any VFD function. The analog outputs may be used for modulating chilled water valves or cooling tower bypass valves. The drive and bypass' digital (Form-C relay) outputs may be used to actuate a damper, open a valve or control any other device that requires a maintained contact for operation. In addition, all of the drive and bypass' digital inputs shall be capable of being monitored by the BAS system. This allows for remote monitoring of which (of up to 4) safeties are open.
 - f. The VFD shall include an independent PID loop for customer use. The independent PID loop may be used for cooling tower bypass value control, chilled water value / hot water valve control, etc. Both the VFD PID control loop and the independent PID control loop shall continue functioning even if the serial communications connection is lost. As default, the VFD shall keep the last good set point command and last good DO and AO commands in memory in the event the serial communications connection is lost and continue controlling the process.
15. EMI/RFI filters. All VFDs shall include EMI/RFI filters. The onboard filters shall allow the VFD assembly to be CE Marked and the VFD shall meet product standard EN 61800-3 for the First Environment restricted level (Category C2) with up to 100 feet of motor cable. Second environment (Category C3, C4) is not acceptable. No Exceptions. Certified test reports shall be provided with submittals confirming compliance to EN 61800-3, First Environment (C2).
16. Drive options shall be furnished and mounted by the drive manufacturer as defined on the VFD schedule. All optional features shall be UL Listed by the drive manufacturer as a complete assembly and carry a UL508 label.
- a. Drive Isolation Fuses - To ensure maximum availability of bypass operation, fast acting fuses, exclusive to the VFD, shall be provided to allow the VFD to disconnect from the line prior to clearing upstream branch circuit protection. This maintains bypass operation capability in the event of a VFD failure. Bypass designs which have no such fuses, or that incorporate fuses common to both the VFD and the bypass, will not be accepted. Third contactor "isolation contactors" are not an acceptable alternative to fuses, as contactors could weld closed and are not an NEC recognized disconnecting device.
 - b. The bypass shall maintain positive contactor control through the voltage tolerance window of nominal voltage +30%, -35%. This

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feature is designed to avoid contactor coil failure during brown out/low line conditions and allow for input single phase operation when in the VFD mode. Designs that will not allow input single phase operation in the VFD mode are not acceptable.

- c. Motor protection from single phase power conditions - the bypass system must be able to detect a single phase input power condition while running in bypass, disengage the motor in a controlled fashion, and give a single phase input power indication. Bypass systems not incorporating single phase protection in bypass mode are not acceptable.
- d. The bypass system shall be designed for stand-alone operation and shall be completely functional in both Hand and Automatic modes even if the VFD has been removed from the system for repair/replacement. Serial communications shall remain functional even with the VFD removed. Bypass systems that do not maintain full functionality with the drive removed are not acceptable.
- e. Serial communications – the bypass shall be capable of being monitored and/or controlled via serial communications. On-board communications protocols shall include ModBus RTU; Johnson Controls N2; Siemens Building Technologies FLN (P1); and BACnet MS/TP.
 - 1) Serial communication capabilities shall include, but not be limited to: bypass run-stop control, the ability to force the unit to bypass, and the ability to lock and unlock the keypad. The bypass shall have the capability of allowing the BAS to monitor feedback such as, current (Amps), kilowatt hours (resettable), operating hours (resettable), and bypass logic board temperature. The BAS shall also be capable of monitoring the bypass relay output status, and all digital input status. All bypass diagnostic warning and fault information shall be transmitted over the serial communications bus. Remote bypass fault reset shall be possible. The following additional status indications and settings shall be transmitted over the serial communications bus and/or via a Form-C relay output – keypad “Hand” or “Auto” selected, bypass selected, and broken belt indication. The BAS system shall also be able to monitor if the motor is running in the VFD mode or bypass mode over serial communications. A minimum of 50 field serial communications points shall be capable of being monitored in the bypass mode.

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- 2) The bypass serial communications shall allow control of the drive/bypass (system) digital outputs via the serial interface. This control shall be independent of any bypass function or operating state. The system digital (relay) outputs may be used to actuate a damper, open a valve or control any other device that requires a maintained contact for operation. All system analog and digital I/O shall be capable of being monitored by the BAS system.
- f. There shall be an adjustable motor current sensing circuit for the bypass and VFD modes to provide proof of flow (broken belt) indication. The condition shall be indicated on the keypad display, transmitted over the BAS and/or via a Form-C relay output contact closure. The broken belt indication shall be programmable to be a system (drive and bypass) indication. The broken belt condition sensing algorithm shall be programmable to cause a warning or system shutdown.
- g. The digital inputs for the system shall accept 24VDC. The bypass shall incorporate an internally sourced power supply and not require an external control power source. The bypass power board shall supply 250 mA of 24 VDC for use by others to power external devices.
- h. There shall be a coordinated run permissive circuit for damper or valve control. Regardless of the source of a run command (keypad command, time-clock control, digital input, or serial communications) the bypass shall provide a dry contact closure that will signal the damper to open before the motor can run. When the damper is fully open, a normally open dry contact (end-switch) shall close. The closed end-switch is wired to a bypass system input and allows motor operation. Up to four separate safety interlock inputs shall be provided. When any safety is opened, the motor shall be commanded to coast to stop, and the damper shall be commanded to close. This feature will also operate in Fireman's override/smoke control mode.
- i. The bypass control shall monitor the status of the VFD and bypass contactors and indicate when there is a welded contactor contact or open contactor coil. This failed contactor condition shall be indicated on the bypass LCD display, programmed to activate a Form-C relay output, and/or over the serial communications protocol.
- j. The bypass control shall include a programmable time delay bypass start including keypad indication of the time delay. A Form C relay

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output commands the VAV boxes open. This will allow VAV boxes to be driven open before the motor operates at full speed in the bypass mode. The time delay shall be field programmable from 0 to 120 seconds.

- k. There shall be a keypad adjustment to select manual or automatic transfer to bypass. The user shall be able to select via keypad programming which drive faults will result in an automatic transfer to bypass mode and which faults require a manual transfer to bypass. The user may select whether the system shall automatically transfer from drive to bypass mode on the following drive fault conditions:
 - 1) Over current
 - 2) Over voltage
 - 3) Under voltage
 - 4) Loss of analog input
- l. The following operators shall be provided:
 - 1) Bypass Hand-Off-Auto
 - 2) Drive mode selector
 - 3) Bypass mode selector
 - 4) Bypass fault reset
- m. The bypass shall include the ability to select the operating mode of the system (VFD/Bypass) from either the bypass keypad or digital input.
- n. The bypass shall include a two line, 20 character LCD display. The display shall allow the user to access and view:
 - 1) Energy savings – in US dollars
 - 2) Bypass motor amps
 - 3) Bypass input voltage-average and individual phase voltage
 - 4) Bypass power (kW)
 - 5) Bypass faults and fault logs
 - 6) Bypass warnings
 - 7) Bypass operating time (resettable)
 - 8) Bypass energy (kilowatt hours – resettable)
 - 9) I/O status
 - 10) Parameter settings/programming

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- 11) Printed circuit board temperature
- o. The following indicating lights (LED type) or keypad display indications shall be provided. A test mode or push to test feature shall be provided.
 - 1) Power-on (Ready)
 - 2) Run enable
 - 3) Drive mode selected
 - 4) Bypass mode selected
 - 5) Drive running
 - 6) Bypass running
 - 7) Drive fault
 - 8) Bypass fault
 - 9) Bypass H-O-A mode
 - 10) Automatic transfer to bypass selected
 - 11) Safety open
 - 12) Damper opening
 - 13) Damper end-switch made
- p. The Bypass controller shall have six programmable digital inputs, and five programmable Form-C relay outputs. This I/O allows for a total System (VFD and Bypass) I/O count of 24 points as standard. The bypass I/O shall be available to the BAS system even with the VFD removed.
- q. The on-board Form-C relay outputs in the bypass shall be programmable for any of the following indications.
 - 1) System started
 - 2) System running
 - 3) Bypass override enabled
 - 4) Drive fault
 - 5) Bypass fault
 - 6) Bypass H-O-A position
 - 7) Motor proof-of-flow (broken belt)
 - 8) Overload
 - 9) Bypass selected
 - 10) Bypass run
 - 11) System started (damper opening)
 - 12) Bypass alarm
 - 13) Over temperature
- r. The bypass shall provide a separate terminal strip for connection of freeze, fire, smoke contacts, and external start command. All external safety interlocks shall remain fully functional whether the system is in

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VFD or Bypass mode. The remote start/stop contact shall operate in VFD and bypass modes. The terminal strip shall allow for independent connection of up to four (4) unique safety inputs.

- s. The bypass shall include a supervisory control mode. In this bypass mode, the bypass shall monitor the value of the VFDs analog input (feedback). This feedback value is used to control the bypass contactor on and off state. The supervisory mode shall allow the user to maintain hysteresis control over applications such as cooling towers and booster pumps.
- t. The user shall be able to select the text to be displayed on the keypad when an external safety opens. Example text display indications include "FireStat," "FreezStat," "Over pressure" and "Low suction." The user shall also be able to determine which of the four (4) safety contacts is open over the serial communications connection.
- u. Smoke Control Override Mode (Override 1) – The bypass shall include a dedicated digital input that will transfer the motor from VFD mode to Bypass mode upon receipt of a dry contact closure from the Fire/Smoke Control System. The Smoke Control Override Mode action is not programmable and will always function as described in the bypass User's Manual documentation. In this mode, the system will ignore low priority safeties and acknowledge high priority safeties. All keypad control, serial communications control, and normal customer start/stop control inputs will be disregarded. This Smoke Control Mode shall be designed to meet the intent of UL864/UUKL.
- v. Fireman's Override Mode (Override 2) – the bypass shall include a second, programmable override input which will allow the user to configure the unit to acknowledge some digital inputs, all digital inputs, ignore digital inputs or any combination of the above. This programmability allows the user to program the bypass unit to react in whatever manner the local Authority Having Jurisdiction (AHJ) requires. The Override 2 action may be programmed for "Run-to-Destruction." The user may also force the unit into Override 2 via the serial communications link.

17. VFD with Integral Disconnect:

- a. UL listed by the drive manufacturer as a complete assembly.
- b. UL 508 labeled.

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c. Capable of being locked by three padlocks.

18. Modulated.

K. Design Equipment:

1. Indoor Style Units: Carrier 39MN

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Provide equipment in accordance with manufacturer's recommendations and compatible with intent of the respective system performance requirements.
- B. Provide vibration isolators in accordance with manufacturer's recommendations, and as called for. Provide necessary steel supporting framework for equipment requiring same. Braced against swaying.
- C. Change pulley sizes as many times as necessary, as part of Contract, to make systems deliver specified quantities of air.
- D. Provide 6 in. high concrete pads for all floor mounted air-handling units.
- E. Install piping adjacent to machine to allow service and maintenance. Do not block access doors or coil pull-space with piping.
- F. Pan Drains:
 - 1. Connect condensate drain pans with full-size piping.
 - 2. Construct trap with offset dimension and seal depth per manufacturer's recommendations. Install cleanouts at changes in direction.
 - 3. Indoor Units: Extend to nearest equipment or floor drain.
- G. Start-Test-Check:
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including piping and electrical connections. Report results in writing.
 - 2. Engage a factory-authorized service representative to perform startup service.
 - 3. Verify that shipping, blocking, and bracing are removed.

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4. Verify that unit is secure on mountings and supporting devices and that connection to piping, ducts, and electrical systems are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
5. Leak Test: After installation, fill water and steam coils with water and test coils and connections for leaks. Repair leaks and retest until no leaks exist.
6. Charge refrigerant coils with refrigerant and test for leaks. Repair leaks and retest until no leaks exist.
7. Fan Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation. Remove malfunctioning units, replace with new units, and retest.
8. Verify that specified filters are installed. Check for leakage around filters.
9. Verify that cooling coil drain pans have a positive slope to drain.
10. Verify that the cooling coil condensate drain trap maintains an air seal.
11. Clean air-handling units internally, on completion of installation, according to manufacturer's written instructions. Clean fan interiors to remove foreign material and construction dirt and dust. Vacuum clean fan wheels, cabinets, and coils entering air face.
12. After completing system installation and testing, adjusting, and balancing modular indoor air handling and air-distribution systems, clean filter housings and install new filters.

END OF SECTION

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SECTION 23 73 13.3 - AIR HANDLING UNITS (INDOOR)

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Provide labor, materials, equipment and services as required for the complete installation as shown on the Contract Documents.

1.2 SUBMITTALS

- A. Submit unit performance including capacity, nominal and operating performance.
- B. Submit Mechanical Specifications for unit and accessories describing construction, components and options.
- C. Submit shop drawings indicating overall dimensions as well as installation, operation and service clearances. Indicate lift points and recommendations. Indicate unit shipping split locations, and split dimensions, installation and operating weights including dimensions.
- D. Provide fan curves with specified operating point clearly plotted.
- E. Submit data on electrical requirements. Include safety and start-up instructions.
- F. Submit sound data certified to ARI 260.

1.3 DELIVERY STORAGE AND HANDLING

- A. Unit shall be on a wooden pallet with skeleton crating prior to shipment to prevent damage during transport and thereafter while in storage awaiting installation.
- B. Follow Installation, Operation and Maintenance manual instructions for rigging, moving, and unloading the unit at its final location.
- C. Unit shall be handled carefully to avoid damage to components, enclosures and finish.
- D. Unit shall be stored in a clean, dry place protected from weather and construction traffic in accordance with Installation, Operation and Maintenance manual instructions.

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PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

- A. Indoor air handling units shall include filters (see schedule), supply fans, and the following:
 - 1. DX evaporator coil
 - 2. reheat coil
 - 3. mixing box
 - 4. Electric heaters
 - 5. Low voltage terminal block for field installed controls by others.
- B. Unit shall have a draw-through supply fan configuration and discharge air vertically.
- C. Unit shall be shipped in three sections and factory tested including leak testing of the coils and run testing of the supply fans and factory wired system. Run test report shall be supplied with the unit in the control compartment's literature packet, and also available electronically after the unit ships.
- D. Unit shall have decals and tags to indicate lifting and rigging, service areas and caution areas for safety and to assist service personnel.
- E. Unit components shall be labeled, including pipe stub outs, refrigeration system components and electrical and controls components.
- F. Installation, Operation and Maintenance manual shall be supplied within the unit.
- G. Laminated color-coded wiring diagram shall match factory installed wiring and shall be affixed to the interior of the control compartment's hinged access door.
- H. Unit nameplate shall be provided in two locations on the unit, affixed to the exterior of the unit and affixed to the interior of the control compartment's hinged access door.

2.2 AIR HANDLING UNITS

- A. Construction
 - 1. All cabinet walls, access doors, and roof shall be fabricated of double wall, impact resistant, rigid polyurethane foam panels.
 - 2. Unit insulation shall have a minimum thermal resistance R-value of 6.25. Foam insulation shall have a minimum density of 2 pounds/cubic foot and shall be tested in accordance with ASTM D1929-11 for a minimum flash

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ignition temperature of 610°F. Unit construction shall be double wall with G90 galvanized steel on both sides and a thermal break. Double wall construction with a thermal break prevents moisture accumulation on the insulation, provides a cleanable interior, reduces heat transfer through the panel and prevents exterior condensation on the panel.

3. Unit shall be designed to reduce air leakage and infiltration through the cabinet. Sealing shall be included between panels and between access doors and openings to reduce air leakage. Piping and electrical conduit through cabinet panels shall include sealing to reduce air leakage.
4. Access doors shall be flush mounted to cabinetry.
5. Unit shall include a 5-inch forklift base.
6. Units shall include double-sloped 304 stainless steel drain pan. Drain pan connection shall be on the right hand side of unit with a 1" MPT fitting.
7. Cooling coil shall be mechanically supported above the drain pan by multiple supports that allow drain pan cleaning and coil removal.
8. Unit shall include factory wired control panel compartment LED service lights.
9. Unit shall include exterior corrosion protection which shall be capable of withstanding at least 2,500 hours, with no visible corrosive effects, when tested in a salt spray and fog atmosphere in accordance with ASTM B 117-95 test procedure.

B. Electrical:

1. Unit shall be provided with an internal control panel with separated low and high voltage control wiring. Access to internal control panel shall be through service access door with removable pin hinges and lockable quarter turn handle.
2. Unit shall be provided with standard power block for connecting power to the unit.
3. Unit shall include a factory installed 24V control circuit transformer.
4. Unit shall have a 5kAIC SCCR.
5. Unit shall include high and low voltage quick connects for easy wiring at installation.

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C. Supply Fans:

1. Unit shall include direct drive, unhooded, backward curved, plenum supply fans.
2. Blower and motor assembly shall be dynamically balanced.
3. Motor shall be a high efficiency electronically commutated motor (ECM).
4. Blower and motor assembly shall be mounted on rubber isolators.
5. ECM driven supply fan shall include a factory installed potentiometer within the control compartment for cfm setpoint. The factory provided terminal block shall include a jumper wire that can be removed when wired to field provided 0-10 VDC control signal.
6. Access to supply fan shall be through removable bolted access panels on the top and bottom of the unit.

D. Cooling Coil:

1. Access to cooling coil shall be through hinged access door with lockable quarter turn handles.
2. Access to reheat coil shall be through hinged access door with lockable quarter turn handles.
3. Evaporator Coil:
 - a. Coil shall be designed for use with R-410A refrigerant and constructed of copper tubes with aluminum fins mechanically bonded to the tubes and aluminum end casings. Fin design shall be sine wave rippled.
 - b. Coil shall have two circuits and interlaced circuitry.
 - c. Coil shall be 6 row high capacity and 12 fins per inch.
 - d. Coil shall be hydrogen leak tested.
 - e. Coil shall be furnished with factory installed thermostatic expansion valves. The sensing bulbs shall be field installed on the suction line immediately outside the cabinet.

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- f. Coil shall have right hand external piping connections. Liquid and suction connections shall be sweat connection. Coil connections shall be labeled, extend beyond the unit casing, and be factory sealed on both the interior and exterior of the unit casing to minimize air leakage.

E. Refrigeration System:

- 1. Air handling unit and matching condensing unit shall be capable of operation as an R-410A split system air conditioner.
- 2. Each refrigeration circuit shall be equipped with thermostatic expansion valve type refrigerant flow control.
- 3. Modulating hot gas reheat shall be provided on the lead refrigeration circuit. Air handling unit shall be provided with hot gas reheat coil, a check valve on the liquid line, and a check valve on the hot gas reheat line. The matching condensing unit must include modulating 3-way reheat valve, liquid line receiver, electronic controller, supply air temperature sensor and a dehumidification control signal terminal. This allows the system to have a dehumidification mode of operation and includes supply air temperature control to prevent supply air temperature swings and overcooling of the space. Reheat line connections shall be labeled, extend beyond the unit casing and be located near the suction and liquid line connections for ease of field connection. Connections shall be factory sealed on both the interior and exterior of the unit casing to minimize air leakage.

F. Mixing Box:

- 1. Damper access shall be through service access door with piano hinges and lockable quarter turn handles.
- 2. Unit shall contain a mixing box with front return air opening and front outside air opening.
- 3. Return air opening shall contain an adjustable, motor operated outside air damper assembly constructed of extruded aluminum, hollow core, airfoil blades with rubber edge seals and end seals. Damper blades shall be gear driven and designed to have no more than 20 cfm of leakage per sq ft. at 4 in. w.g. air pressure differential across the damper. Low leakage dampers shall be Class 2 AMCA certified, in accordance with AMCA Standard 511. Dampers shall be modulated.
- 4. Outside air opening shall contain an adjustable, motor operated outside air damper assembly constructed of extruded aluminum, hollow core,

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airfoil blades with rubber edge seals and end seals. Damper blades shall be gear driven and designed to have no more than 20 cfm of leakage per sq ft. at 4 in. w.g. air pressure differential across the damper. Low leakage dampers shall be Class 2 AMCA certified, in accordance with AMCA Standard 511. Dampers shall be modulated.

G. Electric Heating

1. Unit shall include an electric heater consisting of electric heating coils, fuses, contactors, and a high temperature limit switch, with capacities as shown on the plans.
2. Electric heating access shall be through bolted service access panel with handle.
3. Electric heating coils shall be located in the reheat position downstream of the supply fan.
4. Electric heater shall have full modulation capacity controlled by an SCR (Silicon Controlled Rectifier). A 0-10 VDC heating control signal shall be field provided to control the amount of heating.

F. Controls:

1. Unit shall be provided with a proof of airflow switch. When airflow is not detected, the supply fans will shut down.
2. Unit shall be provided with an internal control panel with separated low and high voltage control wiring.
3. Access to internal control panel shall be through an access door with removable pin hinges and lockable quarter turn handles.
4. Field Installed DDC Controls by Others.
 - a. Controls shall be field provided and field installed by others. Unit shall be provided with a terminal block and a supply air setpoint potentiometer.

G. Substitute Equipment shall include at a minimum:

1. R-410A refrigerant.
2. ECM driven direct drive backward curved plenum supply fans.
3. Double wall cabinet construction.

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4. Insulation with a minimum R-value of 6.25.
5. Double-sloped stainless steel drain pans.
6. Hinged access doors with lockable handles.
 - a. LED service lights in the control panel.
 - b. Designed, engineered, and manufactured in the United States of America.
 - c. All other provisions of the specifications must be satisfactorily addressed.

H. Design Equipment:

1. Indoor Style Units: AAON V3

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Provide equipment in accordance with manufacturer's recommendations and compatible with intent of the respective system performance requirements.
- B. Provide vibration isolators in accordance with manufacturer's recommendations, and as called for. Provide necessary steel supporting framework for equipment requiring same. Braced against swaying.
- C. Change pulley sizes as many times as necessary, as part of Contract, to make systems deliver specified quantities of air.
- D. Provide 6 in. high concrete pads for all floor mounted air-handling units.
- E. Install piping adjacent to machine to allow service and maintenance. Do not block access doors or coil pull-space with piping.
- F. Pan Drains:
 1. Connect condensate drain pans with full-size piping.
 2. Construct trap with offset dimension and seal depth per manufacturer's recommendations. Install cleanouts at changes in direction.
 3. Indoor Units: Extend to nearest equipment or floor drain.

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G. Start-Test-Check:

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including piping and electrical connections. Report results in writing.
2. Engage a factory-authorized service representative to perform startup service.
3. Verify that shipping, blocking, and bracing are removed.
4. Verify that unit is secure on mountings and supporting devices and that connection to piping, ducts, and electrical systems are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
5. Leak Test: After installation, fill water and steam coils with water and test coils and connections for leaks. Repair leaks and retest until no leaks exist.
6. Charge refrigerant coils with refrigerant and test for leaks. Repair leaks and retest until no leaks exist.
7. Fan Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation. Remove malfunctioning units, replace with new units, and retest.
8. Verify that specified filters are installed. Check for leakage around filters.
9. Verify that cooling coil drain pans have a positive slope to drain.
10. Verify that the cooling coil condensate drain trap maintains an air seal.
11. Clean air-handling units internally, on completion of installation, according to manufacturer's written instructions. Clean fan interiors to remove foreign material and construction dirt and dust. Vacuum clean fan wheels, cabinets, and coils entering air face.
12. After completing system installation and testing, adjusting, and balancing modular indoor air handling and air-distribution systems, clean filter housings and install new filters.

END OF SECTION

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SECTION 26 05 00 - BASIC ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Provide all labor, tools, materials, accessories, parts, transportation, taxes, and related items, essential for installation of the work and necessary to make work, complete, and operational. Provide new equipment and material unless otherwise called for. References to codes, specifications and standards called for in the specification sections and on the drawings mean, the latest edition, amendment and revision of such referenced standard in effect on the date of these contract documents. All materials and equipment shall be installed in accordance with the manufacturer's recommendations.

1.2 LICENSING

- A. The Contractor shall hold a license to perform the work as issued by the authority having jurisdiction.
- B. Plumbing contract work shall be performed by, or under, the direct supervision of a licensed master plumber.
- C. Electrical contract work shall be performed by, or under, the direct supervision of a licensed electrician.

1.3 PERMITS

- A. Apply for and obtain all required permits and inspections, pay all fees and charges including all service charges. Provide certificate of approval from the Authorities Having Jurisdiction prior to request for final payment.
- B. Provide electrical inspection certificate of approval from Middle Department Inspection Agency, Commonwealth Inspection Agency, or an Engineer approved Inspection Agency prior to request for final payment.

1.4 CODE COMPLIANCE

- A. Provide work in compliance with the following:
 - 1. 2020 Building Code of New York State.
 - 2. 2020 Existing Building Code of New York State.
 - 3. 2020 Fire Code of New York State.
 - 4. 2020 Plumbing Code of New York State.

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5. 2020 Mechanical Code of New York State.
6. 2020 Fuel Gas Code of New York State.
7. 2020 Property Maintenance Code of New York State.
8. 2020 Energy Conservation Code of New York State
9. Accessible and Usable Buildings and Facilities, ICC A117.1 (2009).
10. New York State Department of Labor Rules and Regulations.
11. New York State Department of Health.
12. 2017 National Electrical Code (NEC)
13. Occupational Safety and Health Administration (OSHA).
14. Local Codes and Ordinances.
15. Life Safety Code, NFPA 101.

1.5 GLOSSARY

ACI	American Concrete Institute
AGA	American Gas Association
AGCA	Associated General Contractors of America, Inc.
AIA	American Institute of Architects
AISC	American Institute of Steel Construction
AFBMA	Anti-Friction Bearing Manufacturer's Association
AMCA	Air Moving and Conditioning Association, Inc.
ANSI	American National Standards Institute
ARI	Air Conditioning and Refrigeration Institute
ASHRAE	American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc.
ASME	American Society of Mechanical Engineers
ASPE	American Society of Plumbing Engineers
ASTM	American Society for Testing Materials
AWSC	American Welding Society Code
AWWA	American Water Works Association

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FM	Factory Mutual Insurance Company
IBR	Institute of Boiler & Radiation Manufacturers
IEEE	Institute of Electrical and Electronics Engineers
IRI	Industrial Risk Insurers
NEC	National Electrical Code
NEMA	National Electrical Manufacturer's Association
NESC	National Electrical Safety Code
NFPA	National Fire Protection Association
NYS/DEC	New York State Department of Environmental Conservation
SBI	Steel Boiler Institute
SMACNA	Sheet Metal and Air Conditioning Contractors National Association
UFPO	Underground Facilities Protective Organization
UL	Underwriter's Laboratories, Inc.
OSHA	Occupational Safety and Health Administration
XL - GAP	XL Global Asset Protection Services

1.6 DEFINITIONS

Acceptance	Owner acceptance of the project from Contractor upon certification by Owner's Representative.
As Specified	Materials, equipment including the execution specified/shown in the contract documents.
Basis of Design	Equipment, materials, installation, etc. on which the design is based. (Refer to the article, Equipment Arrangements, and the article, Substitutions.)
Code Requirements	Minimum requirements.
Concealed	Work installed in pipe and duct shafts, chases or recesses, inside walls, above ceilings, in slabs or below grade.
Coordination Drawings	Show the relationship and integration of different construction elements and trades that require careful coordination during fabrication or installation, to fit in the space provided or to function as intended.
Delegated-Design Services	Performance and Design criteria for Contractor provided professional services. Where professional design services or certifications by a design professional are specifically required of a Contractor, by the

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	Contract Documents. Provide products and systems with the specific design criteria indicated. If criteria indicated is insufficient to perform services or certification required, submit a written request for additional information to the Engineer. Submit wet signed and sealed certification by the licensed design professional for each product and system specifically assigned to the Contractor to be designed or certified by a design professional. Examples: structural maintenance ladders, stairs and platforms, pipe anchors, seismic compliant system, wind, structural supports for material equipment, sprinkler hydraulic calculations.
Equal, Equivalent, Equal To, Equivalent To, As Directed and As Required	Shall all be interpreted and should be taken to mean "to the satisfaction of the Engineer".
Exposed	Work not identified as concealed.
Extract	Carefully dismantle and store where directed by Owner's Representative and/or reinstall as indicated on drawings or as described in specifications.
Furnish	Purchase and deliver to job site, location as directed by the Owner's Representative.
Inspection	Visual observations by Owner's site Representative.
Install	Store at job site if required, proper placement within building construction including miscellaneous items needed to affect placement as required and protect during construction. Take responsibility to mount, connect, start-up and make fully functional.
Labeled	Refers to classification by a standards agency.
Manufacturers	Refer to the article, Equipment Arrangements, and the article, Substitutions.
Prime Professional	Architect or Engineer having a contract directly with the Owner for professional services.
Product Data	Illustrations, standard schedules, performance charts, instructions, brochures, wiring diagrams, finishes, or other information furnished by the Contractor to illustrate materials or equipment for some portion of the work.
Provide (Furnish and Install)	Contractor shall furnish all labor, materials, equipment and supplies necessary to install and place in operating condition, unless otherwise specifically stated.
Relocate	Disassemble, disconnect, and transport equipment to new locations,

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	then clean, test, and install ready for use.
Remove	Dismantle and take away from premises without added cost to Owner, and dispose of in a legal manner.
Review and Reviewed	Should be taken to mean to be followed by "for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents".
Roughing	Pipe, duct, conduit, equipment layout and installation.
Samples	Physical full scale examples which illustrate materials, finishes, coatings, equipment or workmanship, and establishes standards by which work will be judged.
Satisfactory	As specified in contract documents.
Shop Drawings	Fabrication drawings, diagrams, schedules and other instruments, specifically prepared for the work by the Contractor or a Sub-contractor, manufacturer, supplier or distributor to illustrate some portion of the work.
Site Representative	Owner's Inspector or "Clerk of Works" at the work site.
Submittals Defined (Technical)	Any item required to be delivered to the Engineer for review as requirement of the Contract Documents. The purpose of technical submittals is to demonstrate for those portions of the work for which a submittal is required, the manner in which the Contractor proposes to conform to the information given and design concepts expressed and required by the Contract Documents.

1.7 EXISTING CONDITIONS

- A. Contractor shall review all available record documents of existing construction or other existing conditions and hazardous material information. Owner does not guarantee that existing conditions are the same as those indicated in these documents. Contractor shall record existing conditions via measured drawings and preconstruction photographs or video. Inventory and record the condition of items to be removed and salvaged. Provide photographs or video of conditions that might be misconstrued as damage caused by salvage, removal or construction operations.
- B. Owner will occupy portions of the building immediately adjacent to the area(s) of removals. Conduct removals so Owner's operations are not disrupted. Contractor shall locate, identify, disconnect and seal or cap mechanical, plumbing, fire protection and/or electrical systems serving areas of removals, unless noted otherwise in the contract documents. Contractor shall arrange shut-down of systems with the Construction Manager. Piping and ductwork indicated to be removed shall be removed and capped or plugged with compatible materials. If services/systems are required to be removed, relocated

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or abandoned, provide temporary services/systems the bypass area(s) of removals to maintain continuity of services/systems to other parts of the building, as required.

1.8 SHOP DRAWINGS/PRODUCT DATA/SAMPLES

- A. Provide submittals on all items of equipment and materials to be furnished and installed. Submittals shall be accompanied by a transmittal letter, stating name of project and contractor, name of vendor supplying equipment, number of drawings, titles, specification sections (name and number) and other pertinent data called for in individual sections. Submittals shall have individual cover sheets that shall be dated and contain: Name of project; name of prime professional; name of prime contractor; description or names of equipment, materials and items; and complete identification of locations at which materials or equipment are to be installed. Individual piecemeal or incomplete submittals will not be accepted. Similar items, (all types specified) shall be submitted at under one cover sheet per specification section (e.g. lighting fixtures, valves, plumbing fixtures, etc.). Submittals shall include all required documentation for each product listed in the specification section at the same time as a complete package. Number each submittal by trade. Indicate deviations from contract requirements on Letter of Transmittal. Submittals will be given a general review only. Corrections or comments made on the Submittals during the review do not relieve Contractor from compliance with requirements of the drawings and specifications. The Contractor is responsible for: confirming and correcting all quantities; checking electrical characteristics and dimensions; selecting fabrication processes and techniques of construction; coordinating his work with that of all other trades; and performing his work in a safe and satisfactory manner. If submitting hard copies, submit four (4) copies for review.
- B. The Engineer will review up to two (2) submissions of any single submittal. The Contractor will be invoiced on an hourly rate basis for the time spent reviewing the same shop drawing in excess of twice.
- C. If submittals are to be submitted electronically, all requirements in Item A apply. Submittals shall be emailed in PDF format to specific email address provided by the Construction Manager, General Contractor, Architect or Project Manager. Name of project shall be in subject line of email. Send emails to mealbasubmittalclerk@meengineering.com.
- D. Refer to Division 01 for additional requirements.

1.9 PROTECTION OF PERSONS AND PROPERTY

- A. Contractor shall assume responsibility for construction safety at all times and provide, as part of contract, all trench or building shoring, scaffolding, shielding, dust/fume protection, mechanical/electrical protection, special grounding, safety

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railings, barriers, and other safety feature required to provide safe conditions for all workmen and site visitors.

1.10 EQUIPMENT ARRANGEMENTS

- A. The contract documents are prepared using one manufacturer as the Basis of Design, even though other manufacturers' names are listed. If Contractor elects to use one of the listed manufacturers other than Basis of Design, submit detailed drawings, indicating proposed installation of equipment. Show maintenance clearances, service removal space required, and other pertinent revisions to the design arrangement. Make required changes in the work of other trades, at no increase in any contract. Provide larger motors, feeders, breakers, and equipment, additional control devices, valves, fittings and other miscellaneous equipment required for proper operation, and assume responsibility for proper location of roughing and connections by other trades. Remove and replace doorframes, access doors, walls, ceilings, or floors required to install other than Basis of Design. If revised arrangement submittal is rejected, revise and resubmit specified Basis of Design item which conforms to Contract Documents.

1.11 SUBSTITUTIONS

- A. If Contractor desires to bid on any other kind, type, brand, or manufacture of material or equipment than those named in specifications, secure prior approval. To request such approval, Contractor shall submit complete information comparing (item-for-item) material or equipment offered with design material or equipment. Include sufficient information to permit quick and thorough comparison, and include performance curves on same basis, capacities, power requirements, controls, materials, metal gauges, finishes, dimensions, weights, etc., of major parts. If accepted, an addendum will be issued to this effect ahead of bid date. Unless such addendum is issued, substitution offered may not be used.
- B. Refer to Division 01 for additional requirements.

1.12 CONTINUITY OF SERVICES

- A. The building will be in use during construction operations. Maintain existing systems in operation within all rooms of building at all times. Refer to "General Conditions of the Contract for Construction" for temporary facilities for additional contract requirements. Schedules for various phases of contract work shall be coordinated with all other trades and with Owner's Representative. Provide, as part of contract, temporary mechanical and electrical connections and relocations as required to accomplish the above. Obtain approval in writing as to date, time, and location for shutdown of existing mechanical/electrical facilities or services.

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1.13 ROUGHING

- A. The Contract Drawings have been prepared in order to convey design intent and are diagrammatic only. Drawings shall not be interpreted to be fully coordinated for construction.
- B. Due to small scale of Drawings, it is not possible to indicate all offsets, fittings, changes in elevation, interferences, etc. Make necessary changes in contract work, equipment locations, etc., as part of a contract to accommodate work to avoid obstacles and interferences encountered. Before installing, verify exact location and elevations at work site. **DO NOT SCALE** plans. If field conditions, details, changes in equipment or shop drawing information require an important rearrangement, report same to Owner's Representative for review. Obtain written approval for all major changes before installing.
- C. Install work so that items both existing and new are operable and serviceable. Eliminate interference with removal of coils, motors, filters, belt guards and/or operation of doors. Provide easy, safe, and code mandated clearances at controllers, motor starters, valve access, and other equipment requiring maintenance and operation. Provide new materials, including new piping and insulation for relocated work.
- D. Coordinate work with other trades and determine exact route or location of each duct, pipe, conduit, etc., before fabrication and installation. Coordinate with Architectural Drawings. Obtain from Owner's Representative exact location of all equipment in finished areas, such as thermostat, fixture, and switch mounting heights, and equipment mounting heights. Coordinate all work with the architectural reflected ceiling plans and/or existing Architecture. Mechanical and electrical drawings show design arrangement only for diffusers, grilles, registers, air terminals, lighting fixtures, sprinklers, speakers, and other items. Do not rough-in contract work without reflected ceiling location plans.
- E. Before roughing for equipment furnished by Owner or in other Divisions, obtain from Owner and other Divisions, approved roughing drawings giving exact location for each piece of equipment. Do not "rough in" services without final layout drawings approved for construction. Cooperate with other trades to insure proper location and size of connections to insure proper functioning of all systems and equipment. For equipment and connections provided in this contract, prepare roughing drawing as follows:
 - 1. Existing Equipment: Measure the existing equipment and prepare for installation in new location.
 - 2. New Equipment: Obtain equipment roughing drawings and dimensions, then prepare roughing-in-drawings. If such information is not available in time, obtain an acknowledgement in writing, then make space arrangements as required with Owner's Representative.

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1.14 COORDINATION DRAWINGS

- A. Before construction work commences, Divisions for all trades shall submit coordination drawings in the form of CAD drawing files, drawn at not less than 1/4 in. scale. Such drawings will be required throughout all areas, for all Contracts. These drawings shall show resolutions of trade conflicts in congested areas. Mechanical Equipment Rooms shall be drawn early in coordination drawing process simultaneous with all other congested areas. Prepare Coordination Drawings as follows:
1. Division 23 shall prepare the base plan CAD coordination drawings showing all ductwork, all pertinent heating piping, and equipment. These drawings may be CAD files of the required Ductwork Shop Drawings. The drawings shall be coordinated with lighting fixtures, sprinklers, air diffusers, other ceiling mounted items, ceiling heights, structural work, maintenance clearances, electric code clearance, reflected ceiling plans, and other contract requirements. Reposition proposed locations of work after coordination drawing review by the Owner's Representative. Provide adjustments to exact size, location, and offsets of ducts, pipes, conduit, etc., to achieve reasonable appearance objectives. Provide these adjustments as part of contract. Minor revisions need not be redrawn.
 2. Division 23 shall provide CAD files and submit the base plan CAD Coordination Drawings to all Divisions.
 3. Divisions 21 and 22 shall draw the location of piping and equipment on the base plan CAD Coordination Drawings, indicating areas of conflict and suggested resolutions.
 4. Divisions 26, 27 and 28 shall draw the location of lighting fixtures, cable trays, and feeders over 1-1/2 in. on the base plan CAD Coordination Drawings, indicating areas of conflict and suggested resolution.
 5. The General Construction Trade shall indicate areas of architectural/structural conflicts or obstacles on the CAD Coordination Drawings, and coordinate to suit the overall construction schedule.
 6. The Construction Manager shall expedite all Coordination Drawing work and coordinate to suit the overall construction schedule. In the case of unresolved interferences, he shall notify the Owner's Representative. The Owner's Representative will then direct the various trades as to how to revise their drawings as required to eliminate installation interferences.
 7. If a given trade proceeds prior to resolving conflicts, then if necessary, that trade shall change its work at no extra cost in order to permit others

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to proceed with a coordinated installation. Coordination approval will be given by areas after special site meetings involving all Divisions.

- B. The purpose of the coordination drawing process is to identify and resolve potential conflicts between trades, and between trades and existing or new building construction, before they occur in construction. Coordination drawings are intended for the respective trade's use during construction and shall not replace any Shop Drawings, or record drawings required elsewhere in these contract documents.

1.15 REMOVAL WORK

- A. Where existing equipment removals are called for, submit complete list to Owner's Representative. All items that Owner wishes to retain that do not contain asbestos or PCB material shall be delivered to location directed by Owner. Items that Owner does not wish to retain shall be removed from site and legally disposed of. Removal and disposal of material containing asbestos, lead paint, mercury and PCB's shall be in accordance with Federal, State and Local law requirements. Where equipment is called for to be relocated, contractor shall carefully remove, clean and recondition, then reinstall. Remove all abandoned piping, wiring, equipment, lighting, ductwork, tubing, supports, fixtures, etc. Visit each room, crawl spaces, and roofs to determine total Scope of Work. The disturbance or dislocation of asbestos-containing materials causes asbestos fibers to be released into the building's atmosphere, thereby creating a health hazard to workmen and building occupants. Consistent with Industrial Code Rule 56 and the content of recognized asbestos-control work, the Contractor shall apprise all of his workers, supervisory personnel, subcontractors, Owner and Consultants who will be at the job site of the seriousness of the hazard and of proper safeguards and work procedures which must be followed, as described in New York State Department of Labor Industrial Code Rule 56.
- B. For materials indicated to contain lead, that are being affected by demolition or construction, the contractor shall comply with all Federal, State and Local law requirements regarding worker exposure to lead disturbance and abatement procedures.
- C. Refer to the Owner's Lead Paint Survey. The Survey identifies the surfaces within the buildings that were tested for lead by collecting paint samples and performing laboratory analysis. If any unidentified surfaces are to be impacted the lead content shall be tested by analytical determinations conducted by a qualified laboratory approved by the Owner. The contractor shall review the current owner's lead paint reports on file before starting any work which may disturb existing surfaces.
- D. Refer to Division 02 for additional information regarding hazardous materials.

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1.16 REFRIGERANT RECOVERY

- A. Existing equipment to be removed, as shown on the plans may contain refrigerant and refrigerant oils. This refrigerant and refrigerant oil must be handled in accordance with Federal, State and Local law requirements.
- B. Removal and recovery of refrigerant shall be in accordance with the current edition of Section 608 of the Clean Air Act of 1990, including all final regulations.
- C. Refrigerant recovery must be performed by a technician, certified by an EPA-approved certification program, using refrigerant recovery and recycling equipment certified by an EPA-approved testing organization.
- D. Owner "reserves the right of first refusal" on ownership of recovered refrigerant. Should Owner choose to maintain ownership of refrigerant, refrigerant shall be reclaimed, cleaned by this Contractor to ARI 700-1993 Standard of Purity, by an EPA certified refrigerant reclaimer. Refrigerant shall be turned over to the Owner in suitable marked containers to be stored on site, at a place of the Owner's choosing.

1.17 EQUIPMENT AND MATERIAL REQUIREMENTS

- A. Provide materials that meet the following minimum requirements:
 - 1. Materials shall have a flame spread rating of 25 or less and a smoke developed rating of 50 or less, in accordance with NFPA 255.
 - 2. All equipment and material for which there is a listing service shall bear a UL label.
 - 3. Potable water systems and equipment shall be built according to AWWA Standards.
 - 4. Gas-fired equipment and system shall meet AGA Regulations and shall have AGA label.
 - 5. All electrical equipment and systems, as a whole, shall be tested and listed by an OSHA approved Nationally Recognized Testing Laboratory (NRTL) for the intended use in accordance with the applicable standards and have a physical label indicating such.
 - 6. Fire protection equipment shall be UL listed and FM approved.
- B. Exterior and wet locations shall utilize materials, equipment supports, mounting, etc. suitable for the intended locations. Metals shall be stainless steel, galvanized or with baked enamel finish as a minimum. Finishes and coatings shall be continuous and any surface damaged or cut ends shall be field corrected

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in accordance with the manufacturer's recommendations. Hardware (screws, bolts, nuts, washers, supports, fasteners, etc.) shall be:

1. Stainless steel where the associated system or equipment material is stainless steel or aluminum.
2. Hot dipped galvanized or stainless steel where the associated system or equipment is steel, galvanized steel or other.

1.18 CUTTING AND PATCHING

- A. Each trade shall include their required cutting and patching work unless shown as part of the General Construction Contract. Refer to General Conditions of the Contract for Construction, for additional requirements. Cut and drill from both sides of walls and/or floors to eliminate splaying. Patch cut or abandoned holes left by removals of equipment or fixtures. Patch adjacent existing work disturbed by installation of new work including insulation, walls and wall covering, ceiling and floor covering, other finished surfaces. Patch openings and damaged areas equal to existing surface finish. Cut openings in prefabricated construction units in accordance with manufacturer's instructions.

1.19 PAINTING

- A. Paint all insulated and bare piping, pipe hangers and supports exposed to view in mechanical equipment rooms, penthouse, boiler rooms and similar spaces. Paint all bare piping, ductwork and supports exposed to the out-of-doors with rust inhibiting coatings. Paint all equipment that is not factory finish painted (i.e. expansion tanks, etc.).
- B. All painting shall consist of one (1) prime coat and two (2) finish coats of non-lead oil base paint, unless otherwise indicated herein. Provide galvanized iron primer for all galvanized surfaces. All surfaces must be thoroughly cleaned before painting. Review system color coding prior to painting with the Owner's Representative or Architect.
- C. All items installed after finished painting is completed and any damaged factory finish paint on equipment furnished under this contract must be touched up by the Contractor responsible for same.
- D. Include painting for patchwork with color to match adjacent surfaces. Where color cannot be adequately matched, paint entire surface. Provide one (1) coat of primer and two (2) finish coats or as called for in the Specifications.
- E. All primers and paint used in the interior of the building shall comply with the maximum Volatile Organic Compound (VOC) limits called for in the current version of U.S. Green Building Council LEED Credits EQ 4.1 and EQ 4.2.

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- F. Refer to Division 9 - Finishes, for additional information.

1.20 EXISTING CEILING REMOVAL AND RE-INSTALLATION

- A. In a renovation project, any existing ceiling removal and re-installation work required for the completion of a Contractors or Subcontractors work, shall be removed and re-installed by that Contractor or Subcontractor. This applies in any areas not called for to have a new ceiling installed.
- B. The ceiling removal and re-installation shall include lay-in ceiling tile and grid, to the extent necessary to accomplish the work. Removed ceiling tile and grid shall be safely stored during the course of the work, and it shall be re-installed to the original existing condition.
- C. The ceiling removal and re-installation shall include gypsum board or plaster ceilings and the associated suspension systems. Removed ceiling areas shall be patched with materials to match the existing ceiling, and painted to match. If paint cannot be matched exactly, paint the entire ceiling a similar color.

1.21 CONCEALMENT

- A. **Conceal all contract work** above ceilings and in walls, below slabs, and elsewhere throughout building. If concealment is impossible or impractical, notify Owner's Representative before starting that part of the work and install only after their review. In areas with no ceilings, install only after Owner's Representative reviews and comments on arrangement and appearance.

1.22 CHASES

- A. New Construction:
 - 1. Certain chases, recesses, openings, shafts, and wall pockets will be provided as part of General Construction Trade. Mechanical and Electrical trades shall provide all other openings required for their contract work.
 - 2. Check Architectural and Structural Design and Shop Drawings to verify correct size and location for all openings, recesses and chases in general building construction work.
 - 3. Assume responsibility for correct and final location and size of such openings.
 - 4. Rectify improperly sized, improperly located or omitted chases or openings due to faulty or late information or failure to check final location.

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5. Provide 18 gauge galvanized sleeves and inserts. Extend all sleeves 2 in. above finished floor. Set sleeves and inserts in place ahead of new construction, securely fastened during concrete pouring. Correct, by drilling, omitted or improperly located sleeves. Assume responsibility for all work and equipment damaged during course of drilling. Firestop all unused sleeves.
 6. Provide angle iron frame where openings are required for contract work, unless provided by General Construction trade.
- B. In Existing Buildings:
1. Drill holes for floor and/or roof slab openings.
 2. Multiple pipes smaller than 1 in. properly spaced and supported may pass through one 6 in. or smaller diameter opening.
 3. Seal voids in fire rated assemblies with a fire-stopping seal system to maintain the fire resistance of the assembly. Provide 18 gauge galvanized sleeves at fire rated assemblies. Extend sleeves 2 in. above floors.
 4. In wall openings, drill or cut holes to suit. Provide 18 gauge galvanized sleeves at shafts and fire rated assemblies. Provide fire-stopping seal between sleeves and wall in drywall construction. Provide fire stopping similar to that for floor openings.
- 1.23 PENETRATION FIRESTOPPING
- A. Refer to Division 07 for project-wide fire stopping information.
- 1.24 NON-RATED WALL PENETRATIONS
- A. Each trade shall be responsible for sealing wall penetrations related to their installed work, including but not limited to ductwork, piping, conduits, etc. See individual specification sections for requirements.
- 1.25 SUPPORTS
- A. Provide required supports, beams, angles, hangers, rods, bases, braces, and other items to properly support contract work. Modify studs, add studs, add framing, or otherwise reinforce studs in metal stud walls and partitions as required to suit contract work. If necessary, in stud walls, provide special supports from floor to structure above.
- B. For precast panels/planks and metal decks, support mechanical/electrical work as determined by manufacturer and the Engineer. Provide heavy gauge steel

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mounting plates for mounting contract work. Mounting plates shall span two or more studs. Size, gauge, and strength of mounting plates shall be sufficient for equipment size, weight, and desired rigidity.

- C. For finished areas without a finished ceiling system such as classrooms, offices, conference rooms, etc., where decking and structure is exposed, and ductwork/piping/conduit is exposed: All mounting brackets, channel support systems and mounting hardware for ductwork, piping, lighting, etc. shall be concealed and approved by the Architect/Engineer prior to the installation. AirCRAFT cable style hanging for ductwork is required. It is recommended that room mockups be done and receive Architect/Engineer approval prior to proceeding with installation.
- D. Equipment, piping, conduit, raceway, etc. supports shall be installed to minimize the generation and transmission of vibration.
- E. Materials and equipment shall be solely supported by the building structure and connected framing. Gypboard, ceilings, other finishes, etc. shall not be used for support of materials and equipment.

1.26 ACCESS PANELS

- A. Provide access panels for required access to respective trade's work. Location and size shall be the responsibility of each trade. Access panels provided for equipment shall provide an opening not smaller than 22 in. by 22 in. Panels shall be capable of opening a minimum of 90 degrees. Bear cost of construction changes necessary due to improper information or failure to provide proper information in ample time. Access panels over 324 square inches shall have two cam locks. Provide proper frame and door type for various wall or ceiling finishes. Access panels shall be equal to "Milcor" as manufactured by Inland Steel Products Co., Milwaukee, Wisconsin. Provide General Construction trade with a set of architectural plans with size and locations of access panels.

1.27 CONCRETE BASES

- A. Provide concrete bases for all floor mounted equipment. Provide 3,000 lb. concrete, chamfer edges, trowel finish, and securely bond to floor by roughening slab and coating with cement grout. Bases 4 in. high (unless otherwise indicated); shape and size to accommodate equipment. Provide anchor bolts in equipment bases for all equipment provided for the project, whether mounted on new concrete bases or existing concrete bases.

1.28 HVAC EQUIPMENT CONNECTIONS

- A. Contractor is responsible for draining, filling, venting, chemically treating and restarting any systems which are affected by work shown on the Contract Documents unless specifically noted otherwise.

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- B. Provide final steam, condensate, hot water, glycol, chilled and condenser water, drain, vent, oil line and gas connections to all equipment as required by the equipment. Provide final connections, including domestic water piping, wiring, controls, and devices from equipment to outlets left by other trades. Provide equipment waste, drip, overflow and drain connections extended to floor drains.
- C. Provide for Owner furnished and Contractor furnished equipment all valves, piping, piping accessories, traps, pressure reducing valves, gauges, relief valves, vents, drains, insulation, sheet metal work, controls, dampers, as required.
- D. Refer to manufacturer drawings and specifications for requirements of medical equipment, laboratory equipment and special equipment. Verify connection requirements before bidding.

1.29 PLUMBING EQUIPMENT CONNECTIONS

- A. Contractor is responsible for draining, filling, venting, chemically treating and restarting any systems which are affected by work shown on the Contract Documents unless specifically noted otherwise.
- B. Provide roughing and final water, waste, vent, gas, air, vacuum, diesel and/or oxygen connections to all equipment. Provide loose key stops, sanitary "P" traps, tailpiece, adapters, gas or air cocks, and all necessary piping and fittings from roughing point to equipment. Provide installation of sinks, faucets, traps, tailpiece furnished by others. Provide cold water line with gate valve and backflow prevention device at locations called for. Provide continuation of piping and connection to equipment that is furnished by others. Provide relief valve discharge piping from equipment relief valves.
- C. Provide valved water outlet adjacent to equipment requiring same. Provide equipment type floor drains, or drain hubs, adjacent to equipment.
- D. Install controls and devices furnished by others.
- E. Refer to Contract Documents for roughing schedules, and equipment and lists indicating scope of connections required.
- F. Provide for Owner furnished and Contractor furnished equipment all valves, piping, piping accessories, traps, pressure reducing valves, gauges, relief valves, vents, drains, as required.
- G. Refer to Manufacturer drawings and specifications for requirements of medical equipment, laboratory equipment and special equipment. Verify connection requirements before bidding.

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1.30 ELECTRICAL EQUIPMENT CONNECTIONS

- A. Provide complete power connections to all electrical equipment. Provide control connections to equipment. Heavy duty NEC rated disconnect ahead of each piece of equipment. Ground all equipment in accordance with NEC.
- B. Provide for Owner furnished and Contractor furnished equipment all power wiring, electric equipment, control wiring, switches, lights, receptacles, and connections as required.
- C. Refer to Manufacturer's drawings/specifications for requirements of medical equipment, laboratory equipment, radiological equipment and special equipment. Verify connection requirements before bidding.

1.31 STORAGE AND PROTECTION OF MATERIALS AND EQUIPMENT

- A. Store Materials on dry base, at least 6 in. aboveground or floor. Store so as not to interfere with other work or obstruct access to buildings or facilities. Provide waterproof/windproof covering. Remove and provide special storage for items subject to moisture damage. Protect against theft or damage from any cause. Replace items stolen or damaged, at no cost to Owner.
- B. Refer to Division 01 for additional information.
- C. Division 23 shall provide airtight plastic covers over all supply and return air openings prior to the start of construction by any trade. The plastic shall be maintained airtight throughout the project construction and removed only with the approval of the Owner's Representative.
- D. Ductwork shall be delivered to the site from the fabrication shop with air tight plastic covers over all ends of the ducts. The plastic covers shall be in place during transportation and shall be removed prior to installation.

1.32 FREEZING AND WATER DAMAGE

- A. Take all necessary precautions with equipment, systems and building to prevent damage due to freezing and/or water damage. Repair or replace, at no change in contract, any such damage to equipment, systems, and building. Perform first seasons winterizing in presence of Owner's operating staff.

1.33 LUBRICATION CHART

- A. Provide lubrication chart, 8-1/2 in. x 11 in. minimum size, typed in capital letters, mounted under clear laminated plastic; secure to wall in area of equipment. List all motors and equipment in contract. Obtain and list necessary information by name/location of equipment, manufacturer recommended types of lubrication and schedule. Lubricate motors as soon as installed and perform lubrication

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maintenance until final acceptance. Divisions 22 and 26 shall add contract items to the chart provided by Division 23 or provide separate charts.

1.34 OWNER INSTRUCTIONS

- A. Before final acceptance of the work, furnish necessary skilled labor to operate all systems by seasons. Instruct designated person on proper operation, and care of systems/equipment. Repeat instructions, if necessary. Obtain written acknowledgement from person instructed prior to final payment. Contractor is fully responsible for system until final acceptance, even though operated by Owner's personnel, unless otherwise agreed in writing. List under clear plastic, operating, maintenance, and starting precautions procedures to be followed by Owner for operating systems and equipment.

1.35 OPERATION AND MAINTENANCE MANUALS

- A. Submit by email (preferred) or digital media, thru the normal project submittal process. Include a copy of each final approved Shop Drawing, wiring diagrams, piping diagrams, spare parts lists, final testing and balancing report, as-built drawings and manufacturer's instructions. Include typewritten instructions, describing equipment, starting/operating procedures, emergency operating instructions, summer-winter changeover, freeze protection, precautions and recommended maintenance procedures. Include name, address, and telephone number of installing contractor and of supplier manufacturer Representative and service agency for all major equipment items. Provide a table of contents page and dividers based upon specification section numbers. Submit in a compiled and bookmarked PDF format as outlined below.
- B. Provide content for Operation and Maintenance Manuals as specified in individual Specification Sections, and as reviewed and approved at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.
 - 1. Engineer and Commissioning Agent will comment on whether content of operation and maintenance submittals is acceptable.
 - 2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.
- C. Submit Operation and Maintenance Manuals in the following format:
 - 1. Submit by uploading to web-based project software site, or by email to Architect, as a formal project submittal in conformance with the project specific submittal procedures. Enable reviewer comments on draft submittals.

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2. 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.
 3. File Names and Bookmarks: Bookmark individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in the 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.
- D. Initial Manual Submittal: Submit draft copy of each manual at least 30 days before commencing Owner training. Engineer and Commissioning Agent will comment on whether general scope and content of manual are acceptable.
- E. Final Manual Submittal: Submit O&M manual in final form prior to requesting inspection for Substantial Completion and at least 2 weeks before commencing Owner training. Engineer and Commissioning Agent will return copy with review comments.
1. Correct or revise O&M manual to comply with Engineer's and Commissioning Agent's comments. Submit copies of each corrected manual within 2 weeks of receipt of Engineer's and Commissioning Agent's comments.
- F. Refer to Division 01 for additional requirements.

1.36 RECORD DRAWINGS

- A. The Contractor shall obtain at his expense one (1) set of construction Contract Drawings, (including non-reproduction black and white prints or electronic files) for the purpose of recording as-built conditions.
- B. The Contractor shall perform all survey work required for the location and construction of the work and to record information necessary for completion of the record drawings. Record drawings shall show the actual location of the constructed facilities in the same manner as was shown on the bid drawings. All elevations and dimensions shown on the drawings shall be verified or corrected so as to provide a complete and accurate record of the facilities as constructed.
- C. It shall be the responsibility of the Contractor to mark **EACH** sheet of the contract documents in red and to record thereon in a legible manner, any and all approved field changes and conditions as they occur. A complete file of approved field sketches, diagrams, and other changes shall also be maintained. At completion of the work, the complete set of red marked contract documents,

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plus all approved field sketches and diagrams shall be submitted to the engineer and used in preparation of the record drawings.

- D. A complete set of red marked contract drawings shall be submitted, at one time, as the "Record" set. If there are no changes to a specific drawing, the contractor shall indicate "NO CHANGES" on that drawing. ALL drawings shall be included in the "Record" set.
- E. The complete set of red marked Contract Documents or electronic files shall be certified by the Contractor as reflecting record conditions and submitted to the engineer for review.
- F. The Contractor shall have the marked up set scanned, if they are not already electronic files, and then submit them to the Engineer as the "Record Set".
- G. Refer to Division 01 for additional requirements.

1.37 FINAL INSPECTION

- A. Upon completion of all Engineering Site Observation list items, the Contractor shall provide a copy of the Engineering Site Observation Report back to the Engineer with each items noted as completed or the current status of the item.

1.38 COMMISSIONING

- A. Refer to General Commissioning Requirements in Division 01 for additional requirements

1.39 TEMPORARY HEATING AND COOLING

- A. Refer to the General Conditions of the Contract for Construction and Supplemental General Conditions.
- B. Systems and equipment installed as part of this project shall not be used for temporary heating or cooling.

1.40 MAINTENANCE OF HVAC SYSTEMS DURING TEMPORARY USE PERIODS

- A. Provide each air handling system with a set of prefilters in addition to the permanent filters. Furnish four sets of prefilters for each system for use when system is operated for temporary heating or cooling. During such use, change prefilters as often as directed by Owner's Representative. Provide MERV-8 filters in all open ended ducts, return grilles and registers to keep dust out of ductwork. Change as often as necessary. Remove all such temporary filters upon completion. Use supply fans only. Do not operate return fans.

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- B. Blank-off outside air intake opening during temporary heating period. Install first set of permanent filters and prefilters.
- C. Adjust dampers on supply system.
- D. Set all heating coil control valves for manual operation.
- E. Do not install any grilles or diffusers at room terminal ends of ducts until permission is given.
- F. Assume responsibility for systems and equipment at all times, even though used for temporary heat or ventilating. Repair or replace all dented, scratched or damaged parts of systems prior to final acceptance.
- G. Remove concrete, rust, paint spots, other blemishes, then clean.
- H. Just prior to final acceptance, remove used final filter and install new set. Deliver all unused sets of prefilters to the Owner and obtain written receipt. Properly lubricate system bearings before and during temporary use. Maintain thermostats, freeze stats, overload devices, and all other safety controls in operating condition.

1.41 TEMPORARY FACILITIES

- A. Refer to the Division 01 Sections, General Conditions and Supplemental General Conditions.

1.42 TEMPORARY LIGHT AND POWER

- A. Refer to the Division 01 Sections, General Conditions and Supplemental General Conditions.

1.43 CLEANING

- A. It is the Contractor's responsibility to keep clean all equipment and fixtures provided under this contract for the duration of the project. Each trade shall keep the premises free from an accumulation of waste material or rubbish caused by his operations. The facilities require an environment of extreme cleanliness, and it is the Contractor's responsibility to adhere to the strict regulations regarding procedures on the existing premises. After all tests are made and installations completed satisfactorily:
 - 1. Thoroughly clean entire installation, both exposed surfaces and interiors.
 - 2. Remove all debris caused by work.
 - 3. Remove tools, surplus, materials, when work is finally accepted.

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1.44 SYSTEM START-UP AND TESTING

- A. Prior to commencement of work, the Division(s) effecting such system shall survey all building mechanical, plumbing, fire protection and electrical systems and components and make written notice to the Owner regarding any damage, missing items and/or incomplete systems. Prior to the conclusion of this project, the Contractor shall verify with the Owner's Representative that all building systems have been returned to their original conditions.
- B. Start-up and testing of HVAC systems shall occur while the building is not occupied by Owner and only after notice to the Owner's Representative is made at least 24 hours in advance. Division 23 shall be responsible for providing temporary filter media over all supply air registers and diffusers during the HVAC system start-up procedure. Division 23 shall provide airtight plastic covers over all supply and return air openings prior to the start of construction by any contractor. The plastic shall be maintained airtight throughout the project construction and removed only with the approval of the Owner's Representative.

1.45 TRANSFER OF ELECTRONIC FILES

- A. M/E Engineering, P.C. will provide electronic files for the Contractor's use in the preparation of sheet metal shop drawings, coordination drawings, or record drawings related to the project, subject to a \$50.00 charge per drawing file and the following terms and conditions:
 - 1. The Contractor shall submit a formal request for electronic drawing files on the M/E Engineering, P.C. website, by utilizing the following website link: <http://www.meengineering.com/contact-pages/contractor-request>.
 - 2. M/E Engineering, P.C. makes no representation as to the compatibility of these files with the Contractor's hardware or the Contractor's software beyond the specific release of the referenced specifications.
 - 3. M/E Engineering can only provide CAD files of M/E/P/FP drawing levels for which we are the Engineer of Record. CAD files of Architectural backgrounds, reflected ceiling plans, structural plans, etc. must be obtained separately from the Architect of Record.
 - 4. Data contained on these electronic files is part of M/E Engineering, P.C.'s instruments of service shall not be used by the Contractor or anyone else receiving data through or from the Contractor for any purpose other than as convenience in the preparation of shop drawings for the referenced project. Any other use or reuse by the Contractor or by others will be at the Contractor's sole risk and without liability or legal exposure to M/E Engineering, P.C. The Contractor agrees to make no claim and hereby waive, to the fullest extent permitted by law, any claim or cause of action of any nature against M/E Engineering, P.C., its officers, directors,

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employees, agents or sub-consultants which may arise out of or in connection with the Contractor's use of the electronic files.

5. Furthermore, the Contractor shall, to the fullest extent permitted by law, indemnify and hold harmless, M/E Engineering, P.C. from all claims, damages, losses and expenses, including attorney's fees arising out of or resulting from the Contractor's use of these electronic files.
6. These electronic files are not contract documents. Significant difference may arise between these electronic files and corresponding hard copy contract documents due to addenda, change orders or other revisions. M/E Engineering, P.C. makes no representation regarding the accuracy or completeness of the electronic files the Contractor receives. In the event that a conflict arises between the signed contract documents prepared by M/E Engineering, P.C. and electronic files, the signed contract documents shall govern. The Contractor is responsible for determining if any conflicts exist. By the Contractor's use of these electronic files the Contractor is not relieved of the Contractor's duty to comply with the contract documents, including and without limitation, the need to check, confirm and coordinate all dimensions and details, take field measurements, field verify conditions and coordinate the Contractor's work with that of other contractors for the project.

1.46 VIDEO RECORDING OF TRAINING SESSIONS

- A. The contractor shall video record all training sessions required by their discipline. Video shall be in Windows Media Player video format saved on flash drives. Two (2) copies on flash drives are to be provided as a formal submittal. . Flash drives are to be tagged with project name, training session name(s), installing Contractor and date of training. The flash drive shall include a scanned version of the training session sign in list(s), including the presenter and the owner's participants.

1.47 ENERGY INCENTIVES

- A. The Contractor, his Subcontractors and Suppliers shall provide to the Owner all paperwork necessary to support the Owners pursuit of incentives related to energy conservation as offered by the utility company or state sponsored incentive programs. This shall include at a minimum, receipts, and quantities and data sheets for energy efficient equipment such as: lighting, motors, variable frequency drives, etc.

1.48 INFECTION CONTROL

- A. Construction procedures, temporary partitions, negative air systems, cleaning procedures, HVAC system isolation, dust control, etc. shall be in accordance with

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the infection control standards set forth by the Facility. A copy of the facilities standards are available from the Owner upon request.

END OF SECTION

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SECTION 260501 - BASIC MATERIALS AND METHODS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. The drawings are diagrammatic, unless detailed dimensioned drawings are included, and show only approximate locations of equipment, fixtures, panelboards, conduits, and wiring devices. Exact locations are subject to the approval of the Owner's Representative. The general run of electrical feeders, branch circuits, and conduits, indicated on the drawings, is not intended to be the exact routing. Exact routings of conduit shall suit the job conditions.
- B. Circuit designations, in the form of "Home Runs" on branches, indicate the designation of the branch circuit, the size and the quantity of branch circuit conductors, and the panel board or interconnection box from which the branch circuit is served.
- C. Make measurements at the site and in the building during construction for all systems installed as the work progresses in such a manner that the equipment, piping, vents, ducts, conduit, and boxes will fit in the space available. Maintain headroom and if in unfinished areas, be as neatly installed, as obscure and "out-of-the-way" as physically possible. Where more than one trade is involved in an area, space or chase, all shall cooperate and install their own work to utilize the space equally between them in proportion to their individual requirements. In general, ductwork shall be given preference except where grading of piping becomes a problem, followed by piping then electrical wiring. If, after installation of any equipment, piping, ducts, conduit, and boxes, it is determined that ample maintenance and passage space has not been provided, rearrange work and /or furnish other equipment as required for ample maintenance space.
- D. Any changes in the size or location of the material or equipment supplied, which may be necessary in order to meet field conditions or in order to avoid conflicts between trades, shall be brought to the immediate attention of the Owner's Representative and approval received before such alterations are made.

1.2 QUALITY ASSURANCE

- A. Electric equipment shall be installed in a neat and workmanlike manner. All methods of construction, details of workmanship, that are not specifically described or indicated in the contract documents, shall be subject to the control and approval of the Owner's Representative.
- B. Equipment and materials shall be of the quality and manufacture indicated in their respective sections of the specifications. The equipment specified is based upon the acceptable manufacturers listed. Equipment types, device ratings,

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dimensions, etc., correspond to the nomenclature dictated by those manufacturers. Where "or equal" is stated, equipment shall be equal in every way to that of the equipment specified and subject to approval. All equipment shall be tested at the factory. Unless specified elsewhere, standard factory inspection and operational tests will be acceptable.

1.3 SUBMITTALS

A. Submit product data for the following equipment, materials and products, including all fittings and accessories:

1. Conduit
2. Wireway and Wire Trough
3. Cable Tray
4. Channel Support Systems
5. Conductors
- 6.
7. Cables
8. Cable Termination and Splice Kits
9. Wiring Devices Including Dimmers
10. Telephone/Data Communication Outlets
11. Television Outlets
12. Water Proofing Seals
13. Flashing, Sealing, Firestopping Materials
14. Salvageable Materials
15. Testing reports prior to energizing equipment and materials.

1.4 SALVAGEABLE MATERIALS

A. Salvageable materials will be reviewed and identified by the Owner. Items selected by the Owner shall be delivered to a selected location on the Owner's property by this contract in an equal condition to prior this work.

B. Items normally accepted as salvage by the Owner:

1. Panelboards and covers
2. Circuit breakers
3. Disconnects (100 AMP and up)

PART 2 - PRODUCTS

2.1 MATERIALS

A. Conduit, Raceway and Tubing:

1. Rigid Metal Conduit (RMC) shall be hot-dipped galvanized or electro-galvanized steel, UL listed "rigid metal conduit."

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- a. Acceptable Manufacturers:
 - 1) Republic Conduit
 - 2) Allied Tube and Conduit
 - 3) Wheatland Tube Company
 - 4) Approved equal
2. Electrical Metallic Tubing (EMT) shall be electro-galvanized steel; UL listed.
 - a. Acceptable Manufacturers:
 - 1) Republic Conduit
 - 2) Allied Tube and Conduit
 - 3) Wheatland Tube Company
 - 4) Approved equal
3. Flexible Metal Conduit shall be constructed one continuous length of electro-galvanized, spirally wound steel strip with interlocking convolutions and interior surfaces free from burrs and sharp edges. Shall be UL listed "flexible metal conduit" or "liquidtight flexible metal conduit" as required.
 - a. Acceptable Manufacturers:
 - 1) Republic Conduit
 - 2) Allied Tube and Conduit
 - 3) Wheatland Tube Company
 - 4) American Flexible Conduit Company
4. Rigid Non-Metallic Conduit (Schedule 40 for concrete encasement, Schedule 80 for direct burial or where exposed) shall be UL listed "rigid non-metallic conduit" for application in underground, encased, and exposed applications in accordance with the NEC". The conduit shall be made from polyvinyl chloride (PVC) and shall be rated for 90°C conductors. Conduit and fittings shall be tested in accordance with the testing requirements defined in NEMA TC-2, NEMA TC-3, UL-651 and UL-514.
 - a. Acceptable Manufacturers:
 - 1) Carlon
 - 2) Heritage Plastics
 - 3) PW Eagle

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B. Conduit Fittings:

1. Fittings for rigid metal conduit shall be fully threaded and shall be of the same material as the respective raceway system. Fittings for electrical metallic tubing shall be single screw indenter fittings for conduits up to 2 in. and double screw indenter fittings for conduits 2 in. and larger. Connectors shall also have insulated throat or plastic insulating bushing up to and including 1 in. size. For sizes 1-1/4 in. and larger, provide plastic insulating bushing. Die-cast, pressure cast fittings shall not be used. Fittings for rigid non-metallic conduit shall be solvent cemented in accordance with the manufacturer's instructions.

a. Acceptable Manufacturers:

- 1) O.Z. Gedney
- 2) Steel City
- 3) Thomas & Betts
- 4) Crouse-Hinds
- 5) Carlon

2. Expansion Fittings shall be watertight, combination expansion and deflection type designed to compensate for movement in any direction. Fittings shall have flexible copper braid bonding jumpers, neoprene sleeve and stainless steel bands, use aluminum body fittings for rigid aluminum conduit.

a. Acceptable Manufacturers:

- 1) Crouse-Hinds, Type "XD"
- 2) O.Z./Gedney, Type "DX"
- 3) Approved equal

C. Wireway and Wire Trough:

1. Wireway and Wire Trough shall be hinged cover type wireway with provisions for full lay-in along the entire length of run. Wireway shall be steel, enclosed with gray enamel finish. Provide NEMA 1 units for interior/dry/clean locations and NEMA 12 for interior dry maintenance/shop/utility locations. Size to meet NEC fill requirements or larger as noted on Contract Documents. Provide knockouts along runs. Recess in wall where required for flush mounted equipment. Hinge shall be on the bottom of front face for horizontal mounting. Provide all elbows, tees, pullboxes, fittings, hangers, reducers, supports, supports, etc., to meet installation requirements.

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a. Acceptable Manufacturers:

- 1) Square D "Square Duct"
- 2) General Electric
- 3) Hoffman
- 4) Meco

D. Channel Support Systems:

1. Channel Support Systems shall be provided for racking of conduit, trapeze suspensions, equipment support, cable racks and panel racks. Channel shall be steel with electroplated zinc finish for interior dry locations. Provide necessary accessories such as bolts, screws, anchors, connection plates, and straps as required to perform the necessary functions. Wet location and exterior channel support systems shall be steel with hot dipped galvanized finish and stainless steel hardware as a minimum. Cut ends shall be touched up with suitable matching finish.

a. Acceptable Manufacturers:

- 1) Unistrut
- 2) Globe
- 3) Kindorf
- 4) B-Line

E. Conductors and Cables:

1. Conductors shall be insulated for 600 volts, unless otherwise noted, and shall be standard AWG and kcmil sizes. Conductors shall be 98% copper, thermal plastic or cross-linked polymer insulated, heat and moisture resistant. Conductor sizes No. 18 AWG and smaller shall be a solid single strand; No. 16 AWG and larger shall be multiple stranded. Minimum conductor size shall be #12 AWG except smaller sizes may be used for communications and special systems. Conductor sizes shall be as called for. Conductors shall be labeled with UL seal and be marked with the manufacturer's name, wire size and insulation type. Insulation for all 600 volt conductors shall be Type THHN/THWN-2 or Type XHHW-2, unless otherwise noted. All exterior and underground conductors shall be XHHW-2. Luminaire fixture wire shall conform to the latest Underwriters Laboratories requirements. Flexible cords and cables for general portable use shall be Type SO or SOOW or as noted. Cables for special use shall be of the type specified for the application.

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a. Color Coding:

- 1) All circuits shall be color coded according to the following schedule.

	Three Phase 120/208V 240V	Three Phase 277/480V	Single Phase 120/240V
Ground	Green	Green	Green
Neutral	White	Gray	White
A or L1	Black	Brown	Black
B or L2	Red	Orange	Red
C or L3	Blue	Yellow	---

b. Acceptable Manufacturers:

- 1) General Cable
 - 2) Prysmian
 - 3) South Wire
 - 4) Okonite
 - 5) Senator
2. Metal Clad, Type "MC" Cable shall consist of thermal plastic insulated copper conductors of size and quantity indicated, protected by a positive interlocked armor of galvanized steel. The conductors shall be twisted together and shall have an overall moisture and fire resistant fibrous covering. The cable shall have an integral green insulated full size equipment grounding conductor running its entire length. Where dimming is called for the cable is allowed to include dimming control wiring with a voltage rating to match the power. The cable shall meet the requirements of the NEC for "Type MC" Metal Clad Cable and shall bear the UL Label.

a. Acceptable Manufacturers:

- 1) Southwire
- 2) AFC Cable
- 3) Approved equal

F. Terminal Lugs and Connectors:

1. The lug shall be capable of continuous operation at the current rating of the cable it is used on. The lug shall be UL listed per UL 486A, using industry standard crimping tools and dies. Terminal lugs shall be solderless, pressure type with UL label for "CU/AL" conductor terminations. The lug shall be a closed-end compression (crimp) type,

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constructed of seamless, alloy suitable for copper and/or aluminum conductors to match the conductor. The lug shall be made with a chamfered inside end, for ease of conductor insertion. Both one and two hole lugs shall be NEMA sized for standard stud sizes and spacing. The lug shall be designed for use at the system voltage.

a. Acceptable Manufacturers:

- 1) 3M Scotchlok 30,000 and 31,000 Series
- 2) Burndy
- 3) O.Z./Gedney
- 4) Thomas and Betts

2. The conductor connection shall be capable of continuous operation at the current rating of the cables it is used on. The connection shall be UL listed per UL 486A, using industry standard crimping tools and dies. The connector shall be an inline compression (crimp) type, constructed of seamless, tin-plated copper. The connector shall be constructed with chamfered inside-ends and with center cable stops. The connector shall be designed for use at the system voltage.

a. Acceptable Manufacturers:

- 1) 3M Scotchlok 10,000 and 11,000 Series
- 2) Burndy
- 3) O.Z./Gedney
- 4) Thomas and Betts

3. "Split-bolt" Connectors shall be solderless type.

a. Acceptable Manufacturers:

- 1) Burndy
- 2) Kearney
- 3) O.Z./Gedney
- 4) Thomas and Betts
- 5) Anderson

4. "TWIST ON" Connectors shall be spiral steel spring type and insulated with vinyl cap and skirt.

a. Acceptable Manufacturers:

- 1) 3-M Company "Scotch-Lok"
- 2) Ideal "Wing-Nuts"
- 3) Approved equal

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G. Boxes:

1. Outlet boxes shall be galvanized steel, not less than 2-1/2 in. deep, unless restricted by the surroundings, 4 in. square or octagonal, with knockouts. Boxes and associated fittings, plates and devices shall be mechanically fastened (screwed), friction fitting is not acceptable. Outlet boxes exposed to moisture, surface mounted, exterior, wet or damp locations shall be cadmium cast alloy complete with external threaded hubs and gasketed screw fastened covers. Minimum box size shall be as indicated in the NEC for the conductors and devices installed. Boxes shall be approved for the environmental condition where they will be installed.
 - a. Acceptable Manufacturers:
 - 1) Steel City
 - 2) Raco
 - 3) Appleton
 - 4) Crouse Hinds
2. Telephone/Data Communications Outlet Boxes:
 - a. 4 in. x 4 in. outlet box with single gang plaster ring with and conduit routed to accessible ceiling space. Cover plate shall match the receptacle cover type.
3. Pull and junction boxes shall be constructed of not less than 14 gauge galvanized steel with trim for flush or surface mounting in accordance with the location to be installed. Provide screw-on type covers. Boxes installed in damp or wet locations shall be of rain tight construction with gasketed cover and threaded conduit hubs. In no case shall boxes be sized smaller than as indicated NEC for conduit and conductor sizes installed. Boxes shall be approved for the environmental condition of the location where they will be installed.
 - a. Acceptable Manufacturers:
 - 1) Hoffman
 - 2) Keystone
 - 3) Approved equal

H. Terminal and Equipment Cabinets:

1. Terminal and equipment cabinets shall be code gauge galvanized steel with removable endwalls. Fronts shall be of code gauge steel, flush or surface type (as indicated) with concealed trim clamps, concealed hinges, flush lock, and grey baked enamel finish. Boxes and front shall be UL

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listed and shall be minimum 35 in. H x 24 in. W x 6 in. D. Provide removable insulated plywood terminal board mounted on inside back wall of cabinet.

a. Acceptable Manufacturer:

- 1) Square D "Mono-Flat"
- 2) Approved equal

I. Wiring Devices:

1. Wiring Devices (toggle switches, key switches, receptacles, dimmers, occupancy sensors, etc.) shall be specification grade as a minimum. Switch handle and receptacle face shall be as directed by the Architect. Provide device cover plates of rounded nylon colored to match the device in finished areas and rounded raised (Steel City 450/460 series) only for surface mounted locations in unfinished areas. Provide neoprene gasketed cast aluminum/zinc box with hinged (for receptacle) rain tight cast aluminum/zinc lockable while in use cover with stainless steel hardware for devices designated "WP".

a. Acceptable Manufacturers:

- 1) Pass and Seymour
- 2) Hubbell
- 3) Leviton

2. Toggle/Snap Switches:

- a. Units shall be quiet operation, quick make/quick break, rated for 20A/120-277V/1hp at 120/277V, side/back wired, with nylon/polycarbonate toggle, self grounding mounting screw clip plate (not staple), ground terminal and silver alloy contacts. Units shall meet latest Federal Specification WS-896, NEMA WD-1 and UL Test 20. Single pole units shall be Hubbell HBL1221, P&S 20AC1 or Leviton 1221-2. Provide two pole, three way, four way, illuminated handle, keyed, etc. type of the same quality and model.
- b. Momentary Contact: Units shall be as indicated above (20A, 277V, nylon handle, side/back wired), three position, two circuit/three wire with spring return to center position, provide where indicated and as needed for proper system operation. Hubbell HBL 1557, P&S 1250, Leviton 1256 or approved equal. Provide keyed operation or pilot light where indicated. When used

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for lighting controls for vacancy sensor control, provide jumper across the circuit terminals.

3. Receptacles:
 - a. Provide receptacles where indicated on the drawings and where called for. Provide type receptacle as indicated and if not indicated then utilize general receptacle.
 - b. General Receptacle: Units shall be NEMA 5-20R, duplex, 20A, 125V, side/back wired, #14 to 10AWG screw terminals with nylon face, indented brass contacts for three point connection, self grounding stainless steel mounting screw clip plate and green ground terminal. Shall meet requirements of Federal Specification W-C-596, NEMA WD-6 and UL 498.
 - 1) Units shall have 0.03" thick brass contacts, 0.04 inch galvanized steel mounting strap and be: Hubbell BR20, P&S BR20 or Leviton BR20. Commercial grade
 - c. Ground Fault Interrupting Receptacles: Units shall be as specified above for General Receptacle and have 5mA interrupting ground fault level, test/reset front buttons, full through feed capability, power off on reverse wired sensing, 10kA short circuit current rating, be tamper/weather resistant and in compliance with UL 943. Unit shall self-test function to periodically test the components automatically and indicate a failure condition utilizing an LED. Shall be Hubbell GFR5362, P&S 2096TR or Leviton S7599TR.
 - d. Hospital Grade Ground Fault Interrupting Receptacles: Units shall be as specified above for General Receptacle, Hospital Grade and Ground Fault Interrupting type. Shall be Hubbell GF8300SG, P&S 2095HGTRX or Leviton 7599HG.
 - e. USB Power Receptacle: Units shall be as specified above for General Receptacle but have two 15A 125V outlets and two USB charging (3.1A total, 5VDC, USB 2.0/3.0) outlets. Overall depth shall not exceed 1.35 in. Shall be Hubbell USB20A5 or approved equal.
 - f. Special Receptacles: provide other type receptacles as indicated herein or on the drawings. Such receptacles shall be Hubbell, P&S or Leviton highest grade available.

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- 4. Television Outlets:
 - a. 4 in. x 4 in. outlet box with single gang plaster ring with conduit routed to accessible ceiling space. Cover plate shall match the receptacle cover type.
- J. Waterproofing Seals:
 - 1. Provide expanding link type seal, for installation between duct/conduit, and sleeve or core-drilled hole in concrete.
 - 2. Make: Link Seal, manufactured by Thunderline Corp.
- K. Flashing, Sealing, Fire-stopping:
 - 1. Fire-Stopping for Openings Through Fire and Smoke Rated Wall and Floor Assemblies:
 - a. Provide materials and products listed or classified by an approved independent testing laboratory for "Through-Penetration Fire-Stop Systems". The system shall meet the requirements of "Fire Tests of Through-Penetration Fire-Stops" designated ASTM E814.
 - b. Provide fire-stop system seals at all locations where piping, tubing, conduit, electrical busways/cables/wires, ductwork and similar utilities pass through or penetrate fire rated wall or floor assembly. Provide fire-stop seal between sleeve and wall for drywall construction.
 - c. The minimum required fire resistance ratings of the wall or floor assembly shall be maintained by the fire-stop system. The installation shall provide an air and watertight seal.
 - d. The methods used shall incorporate qualities, which permit the easy removal or addition of electrical conduits or cables without drilling or use of special tools. The product shall adhere to itself to allow repairs to be made with the same material and permit the vibration, expansion and/or contraction of any items passing through the penetration without cracking, crumbling and resulting reduction in fire rating.
 - 2. Acceptable Manufacturers:
 - a. Dow Corning Fire-Stop System Foams and Sealants
 - b. Nelson Electric Fire-Stop System Putty, CLK and WRP
 - c. S-100 FS500/600, Thomas & Betts
 - d. Carborundum Fyre Putty

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- e. 3-M Fire Products

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Unless otherwise noted, wiring for all systems indicated in the contract documents shall consist of insulated conductors installed in raceways. Raceways shall be continuous from outlet box to outlet box and from outlet box to cabinet, junction or pull box. Secure and bond raceways to all boxes and cabinets so that each system of raceways is electrically continuous throughout. Unless otherwise indicated on the drawings, install all wiring in the following raceway system:
 - 1. Wiring 600 Volts or Less in Dry Locations: Electrical metallic tubing or type MC cable.
 - 2. Wiring 600 Volts or Less in Outdoors, Above Grade Locations: Rigid metal conduit.
 - 3. All Wiring Installed in Hazardous Locations: Galvanized rigid metal conduit.
 - 4. All Wiring Installed in Corrosive Locations: Schedule 80 rigid non-metallic conduit.
 - 5. Flexible metal conduit shall be used for final connection to all motors, final connection to rotating or vibrating equipment, final connections to dry type transformers and final connections to recessed lighting fixtures. Liquidtight flexible conduit shall be used in all wet or damp locations. Maximum length of flexible conduit shall be 36 in., except that from outlet boxes to lighting fixture maximum length shall be 6 ft. Provide green insulated equipment grounding conductor in all flexible metal conduit.
 - 6. Where allowed, branch circuits may be type MC cable between homerun junction box and equipment/device connection in drywall partitions only. Homerun junction box to be a maximum of 20 ft. from equipment/device.
- B. Raceways:
 - 1. Sized as indicated on the drawings. Where sizes are not indicated, raceways shall be sized as required by the National Electrical Code in accordance with the quantity, size, and type of the insulation conductors to be installed. Raceways shall be minimum 1/2 in. trade size for branch circuit wiring and minimum 3/4 in. trade size for all telephone intercommunications, instrumentation, fire alarm, television and computer systems and for all branch circuit "Home Runs" to panelboards.

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2. Installed to provide adequate grounding between all outlets and the established electrical system ground.
3. Cut square, free of burrs due to field cutting or manufacture, and bushed where necessary. Bolt length shall not extend more than 1/4 in. beyond a nut.
4. Installed with exterior surfaces not less than 6 in. from any surface with normal operating temperature of 200°F or higher.
5. Plugged at the ends of each roughed-in raceway with an approved cap or disc to prevent the entrance of foreign materials during construction.
6. Concealed throughout except where exposure is permitted by the Owner's Representative. All exposed raceways shall be painted to match existing adjacent surface finish as directed by the Architect.
7. Installed parallel or perpendicular to floors, walls and ceilings where exposed wiring is permitted.
8. Installed with a minimum of bends and offsets. All bends shall be made without kinking or destroying the cross section contour of the raceway. Factory made bends are acceptable and should be considered for raceways larger than 2 in.
9. Installed with UL approved rain-tight and concrete-tight couplings and connectors.
10. Firmly fastened within 3 ft. of each outlet box, junction box, cabinet or fitting. Raceways shall not be attached to or supported by wooden plug anchors or supported from mechanical work such as ductwork, piping, etc.
11. Installed with a #14 AWG fish wire in all telephone, intercommunication, "Spare" or "Empty" conduit runs to facilitate future installation of conductors.
12. Installed with expansion fittings at all building expansion joints such that no undue stress is placed on any electrical raceway due to the proper functioning of expansion joints.
13. Arranged in a neat manner for access and allow for access to work installed by other trades.
14. Raceways installed in concrete slabs shall be located so as not to affect structural integrity of slab, and such that conduit shall have a minimum of 1 in. of concrete cover on all sides. Obtain approval from the Owner's

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Representative prior to installing conduit larger than 1 in. trade size in concrete slabs. Raceways in slabs shall be for floor box use only, or routing vertically through.

15. If it is necessary to burn holes through webs of beams or girders, call such points to the attention of the Owner's Representative and receive written approval both as to location and size of hole before proceeding with work. All holes shall be burned no larger than absolutely necessary.
16. Become familiar with the general construction of the building and place sleeves, inserts, etc., as required. All penetrations through existing floors shall be core drilled and sleeved.
17. Wherever a cluster of four (4) or more raceways rise out of floor exposed, provide neatly formed 6 in. high concrete envelop, with chamfered edges, around raceways.
18. All raceways shall be supported adequately by malleable iron pipe clamps or other approved methods. In exterior or wet locations, supports shall allow not less than 1/4 in. air space between raceway and wall. Firmly fasten raceway within 3 ft. of each outlet box, junction box, cabinet or fitting. The following table lists maximum spacing between conditions, strength of supporting members, etc.
19. Furnish and install such supports at no additional cost to owner.

Conduit Trade Size	Type of Run	Horizontal Spacing in Feet	Vertical Spacing in Feet
1/2 in., 3/4 in.	Concealed	7	10
1 in., 1-1/4 in.	Concealed	8	10
1-1/2 in. and larger	Concealed	10	10
1/2 in., 3/4 in.	Exposed	5	7
1 in., 1-1/4 in.	Exposed	7	8
1-1/2 in. and larger	Exposed	10	10

20. Where raceways puncture roof, install pitch pockets as required in order that the roof warranty is maintained. Coordinate with representative of roofing material manufacturer.
21. At each flush mounted panelboard, terminal cabinet, control cabinet, etc., provide four (4) spare 3/4 in. raceways from panelboard, etc., to an area above the nearest accessible ceiling space. Make 90° turn above the ceiling, arranged for further continuation of raceway, and cap.

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22. Provide a bushing at each conduit termination unless fitting at box where conduit terminates has hubs designed in such a manner to afford equal protection to conductors. Provide grounding type insulated bushings on all conduit sizes 2 in. trade size and larger and on all feeder raceways regardless of size. Provide standard bushings for conduits 1 in. and smaller unless otherwise stated.
 23. Differing Temperatures: For raceways routed between areas with differing temperatures (interior to exterior, walk in coolers/freezers, environmental chambers, etc.) install raceway as follows:
 - a. Provide a thermal break, 4 in. minimum of stainless steel conduit within space wall/separation.
 - b. Seal raceway penetration through the wall/separation.
 - c. Provide a box on each side of the space wall/separation.
 - d. Provide raceway interior sealant (duct seal or suitable foam) to provide a complete air barrier after conductors are installed.
 - e. Mounting of raceway and boxes on equipment shall be coordinated and approved by the equipment manufacturer.
 24. Raceway installed in wet/damp locations or on exterior walls shall have a spacer manufactured for this purpose provided to maintain a space/void between the mounting surface and the raceway.
- C. Outlet Boxes:
1. Consider location of outlets shown on drawings as approximate only. Study architectural, process piping, mechanical, plumbing, structural, roughing-in, etc., drawings and note surrounding areas in which each outlet is to be located. Locate outlet so that when fixtures, motors, cabinets, equipment, etc., are placed in position, outlet will serve its desired purpose. Where conflicts are noted between drawings, contact Owner's Representative for decision prior to installation. Comply with the NEC relative to position of outlet boxes in finished ceilings and walls.
 2. Prior to installation, relocate any outlet location a distance of 5 ft. in any direction from location indicated on drawings if so directed by the Owner's Representative. Prior to completion of wall construction, adjust vertical height of any outlet from height indicated if so directed by Owner's Representative. The above modifications shall be made at no additional cost to the Owner.

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3. Where outlets at different mounting heights are indicated on drawings adjacent to each other (due to lack of physical space to show symbol on drawings), install outlets on a common vertical line.
 4. Where switch outlets are shown adjacent to strike side of door, locate edge of outlet box approximately 3 in. from door frame.
 5. Outlet boxes in separate rooms shall not be installed "back-to-back" without the approval of the Owner's Representative.
 6. Outlet boxes shall be sized to accommodate the wiring, splices and device(s) to be installed in accordance with the NEC.
 7. Outlet boxes installed in plaster, gypsum board or wood paneled hollow cavity walls shall be installed flush with raised plaster covers or raised tile covers. Boxes shall be mechanically fastened and supported by two (2) adjacent structural members (studs) with cross brackets (Garvin Industries Model BMB or approved equal).
 8. Outlet boxes installed in tile, brick or concrete block walls shall be installed flush and have extra-deep type raised tile covers or shall be 3-1/2 in. deep boxes with square corners and dimensions to accommodate conductors installed.
 9. Surface ceiling mounted outlet boxes shall be minimum 4 in. square, 1-1/2 in. deep, galvanized sheet metal.
 10. Surface wall mounted outlet boxes shall be cast type boxes.
 11. Floor outlet boxes shall be installed flush with finished floor, adjust level and tile as required. Where finished floor is terrazzo, provide boxes specifically designed for installation in terrazzo. Where floors are to receive carpet or flooring material, coordinate with appropriate trade and provide insert. Rectangular covers shall be parallel and perpendicular with the building or, if used, floor tile/floor joints/pattern. Coordinate cover type with the flooring and device type.
 12. Install a device cover plate over each and every outlet indicated on drawings. Do not install plates until painting, cleaning and finishing of surfaces surrounding the outlet are complete. Install single one-piece multi-gang covers over multi-gang devices.
- D. Receptacles:
1. Provide hospital grade receptacle for all hospital construction.

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2. Ground opening shall be up for vertical installation and on the left for horizontal installation.
- E. Toggle Switches:
1. Switches shall be installed in accessible locations near room/space entryway(s).
 2. Provide lighted handle switches in mechanical rooms, elevator pits, electric rooms, etc.
 3. Switches shall have neutral pulled through the box even if not used.
- F. Junction and Pull Boxes:
1. Install junction and pull boxes in readily accessible locations. Access to boxes shall not be blocked by equipment, piping, ducts and the like. Provide all necessary junction or pull boxes required due to field conditions and size as require by the National Electrical Code.
- G. Equipment Mounting Heights: Coordinate with architectural interior and exterior elevations.
1. Unless otherwise noted, mount devices and equipment at heights measured from finished floor to device/equipment centerline as follows:
 - a. Toggle switches (up position "on") 46 in.
 - b. Wall lighting controls (dimmer, digital switch, etc. 46 in.
 - c. Receptacle outlets (long dimension vertical, ground" pole farthest from floor) 18 in.
 - d. Receptacle outlets above counters 8 in. above counters
 - e. Receptacle outlets, above hot water or steam baseboard heaters. Do not install receptacle outlets above electric baseboard heaters 30 in.
 - f. Receptacle outlets, hazardous areas; also for refrigerators 48 in.

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g.	Receptacle outlets, weatherproof, above-grade	24 in.
h.	Telephone outlets	18 in.
i.	Telephone outlets, wall mounted	46 in.
j.	T.V. outlet	18 in.
k.	Fire alarm manual stations	46 in.
l.	Fire alarm combination audio/visual and standalone visual device (entire strobe lens at heights indicated)	80 in. to bottom of the notification device
m.	Standalone fire alarm audio device	90 in. (min) to 96 in. (max)
n.	Distribution panelboards, to top of backbox	72 in.
o.	Terminal cabinets, control cabinets, to top of backbox	72 in.
p.	Disconnect switches, motor starters, enclosed circuit breakers.	48 in.

2. Where structural or other interferences prevent compliance with mounting heights listed above, consult Owner's Representative for approval to change location before installation.

H. Hangers and Supports:

1. Provide steel angles, channels and other materials necessary for the proper support and erection of motor starters, distribution panelboards, large disconnect switches, large circuit breakers, pendant mounted lighting fixtures, etc.
2. Panelboards, disconnect switches, circuit breakers, cabinets, large pull boxes, adjustable speed drives, cable support boxes and starters shall be secured to the building structure and not supported from conduits. Small panelboards, etc., as approved by Owner's Representative, may be supported on walls. Racks for support of conduits and heavy electrical equipment shall be secured to building construction by substantial structural supports.

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I. Identification:

1. Provide engraved lamicoid identification nameplates on switchboards, main service disconnects, transfer switches, motor control centers and on all panelboards using designation shown in panelboard schedule. Include voltage, phase, equipment served, voltage source to panel or equipment.
2. Provide engraved lamicoid identification nameplates for each circuit breaker in the main distribution panel listing the panelboard or equipment connected to each device.
3. Provide engraved lamicoid identification nameplates on all items of equipment including individual circuit breaker enclosures and disconnect switches, listing the equipment connected to the particular device provided under Specification Section 262000, including, but not limited to: starters, disconnect switches, adjustable speed drives, circuit breakers, etc. Include voltage, phase, equipment served, voltage source to panel or equipment.
4. Provide complete type written directory for each panelboard listing room number, function, etc., for each circuit breaker. Directory shall be placed in a plastic clear sleeve in the interior of the panelboard door. Provide type written updated panelboard directories for existing panelboards affected by this work.
5. Nameplates shall be engraved black, with white core, with Helvetica medium 3/16 in. lettering. 1/8 in. lettering is acceptable where space of 3/16 in. is not available.
6. Identify junction and pullboxes for particular service and circuit such as power, emergency power, lighting, fire alarm, telephone, interphone, public address, nurse call, etc. using stencil lettering on cover.
7. Where voltage exceeds 600V provide permanent signage indicating "DANGER - HIGH VOLTAGE - KEEP OUT". Provide signage at each electrical room indicating "DANGER - ELECTRICAL ROOM". Utilize adhesive backed, yellow background, block lettering signage at door.
8. Using adhesive backed printed tape label (white background, black lettering) all receptacle and switch coverplates, power poles, etc. listing panel designation and circuit number. Tape shall be attached to outside of receptacle or switch coverplates.

J. Spare Parts:

1. Deliver to Owner and obtain receipt for spare parts including key switches, fuses, etc.

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3.2 TESTS

- A. Branch circuits shall be tested during installation for continuity and identification and shall pass operational tests to determine that all circuits perform the function for which they are designed. For all feeder and exterior branch circuit wiring rated 600 volts or less, provide 1,000 volt "Megger" insulation test prior to energizing feeders. Use a 1,000-volt motor driven megger for all tests. Test voltage shall be applied until readings reach a constant value, and until three (3) equal readings, each one (1) minute apart, are obtained. Minimum megger reading shall be 45 megohms for feeder conductors. Document test results and submit for approval prior to energizing conductors.

END OF SECTION

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SECTION 260526 - GROUNDING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Provide grounding system equal to or exceeding the requirements of NEC and as indicated in the contract documents. Raceway system which includes metal conduit, wireways, pullboxes, junction boxes, busway, wire ways, cable trays, enclosures, motor frames, etc., shall be made to form a continuous, conducting permanent ground circuit of the lowest practical impedance to enhance the safe conduction of ground fault currents and to prevent objectionable differences in voltage between metal nonload current carrying parts of the electrical system.
- B. Provide solid grounding of building structures and electrical and communications systems and equipment. It includes basic requirements for grounding for protection of life, equipment, circuits and systems. Types of grounding systems include the following:
 - 1. Electrical Equipment Grounding.

1.2 QUALITY ASSURANCE

- A. All methods of construction, details of workmanship, that are not specifically described or indicated in the contract documents, shall be subject to the control and approval of the Owner's Representative. Equipment and materials shall be of the quality and manufacture indicated in their respective sections of the specifications. The equipment specified is based upon the acceptable manufacturers listed. Equipment types, device ratings, dimensions, etc., correspond to the nomenclature dictated by those manufacturers. Where "or equal" is stated, equipment shall be equivalent in every way to that of the equipment specified and subject to approval. All equipment shall be tested at the factory. Unless specified elsewhere, standard factory inspection and operational tests will be acceptable.
- B. Electrical Components, Devices and Accessories: Listed and labeled as defined in the NEC by Nationally Recognized Testing Laboratory (NRTL) and marked for intended use.
- C. Comply with UL 467 for grounding and bonding materials and equipment.

1.3 REQUIREMENTS

- A. Grounding conductors, bonding conductors, jumpers, grounded conductors, etc. shall be sized in accordance with the NEC.

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- B. Equipment and materials shall be installed in accordance with the manufacturer's recommendations.

1.4 SUBMITTALS

- A. Provide submittals for the following:
 - 1. Ground rods and connectors.
 - 2. Ground bars.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Conductors:
 - 1. Exposed grounding components such as bars, straps, cables, flexible jumpers, braids, shunts, etc., shall be bare copper unless otherwise indicated.
 - 2. Grounding conductors in raceway with 600V circuiting shall be insulated to match the circuit conductors with green color.
 - 3. Grounding conductors used with system voltage greater than 1000V shall be bare unless otherwise indicated.
 - 4. Grounding conductor size shall be as indicated or as required by the NEC whichever is larger, stranded, soft drawn or soft annealed copper, unless otherwise indicated. Sizing shall take into account circuit voltage drop.
 - 5. Acceptable Manufacturers:
 - a. Same make as for 600 volt conductors.
- B. Connectors, Clamps and Terminals:
 - 1. Mechanical connectors and clamps shall be made of copper alloy or silicon bronze. Solderless compression terminals shall be copper, long-barrel, NEMA two bolt. Bolts and washers (Belleville) shall be of comparable material or stainless steel.
 - a. Acceptable Manufacturers:
 - 1) Burndy
 - 2) Hubbell Anderson Corp.
 - 3) Thomas & Betts

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- 4) Approved equal
 - 2. Pipe Clamp:
 - a. Pipe clamp for bonding to pipe type electrode (water pipe, etc.) shall be a suitably sized copper alloy clamp.
 - b. Acceptable Manufacturers:
 - 1) Burndy GAR-BU
 - 2) O-Z Gedney Type CG
 - 3) Burndy "Durium"
 - 4) AFL Global "Everdur"
 - 5) Approved equal
 - 3. Flexible Strap:
 - a. Flexible grounding straps shall be of braided high conductivity copper with two hole connector. Strap shall have equal to or greater than ampacity of the system it is bonding to. Strap shall provide flexibility in all directions when installed properly.
 - b. Acceptable Manufacturers:
 - 1) Burndy
 - 2) OZ Gedney
 - 3) Approved equal
- C. Ground Bars
 - 1. Provide ground bars where indicated. Ground bars shall be:
 - a. 98% conductive copper, minimum.
 - b. 4 in. x 1/4 in. thick minimum with length as indicated with minimum 36 in. for electric room/MDF and all other minimum of 24 in.
 - c. Standard NEMA bolt hole patterns with maximum quantity of lug locations. Spacing of 1-1/8 in. apart.
 - 2. Bar shall be mounted to an accessible wall location with galvanized steel hardware and 2000V rated insulators. Mounting shall be suitable for full complement of cabling.
 - 3. Unit shall conform to EIA/TIA standards.

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4. Acceptable Manufacturers:
 - a. Erico
 - b. Newton Instrument
 - c. Burndy
 - d. Harger

PART 3 - EXECUTION

3.1 INSTALLATION

A. Grounding Conductors:

1. Provide grounding conductor(s) with all power circuits. Conductor shall be sized as indicated or as required by the NEC as a minimum and shall be terminated on the equipment, device, enclosure, etc. grounding terminal. Conductor size shall be for the entire length unless approved by the Engineer where oversized for voltage drop.
2. Conductors above grade to ground electrodes (water piping, structural column, etc.) and to equipment (service entrance, ground bars, ground halos, etc.) shall be installed in metallic conduit with ends bonded to the conduit.
3. Grounding conductors shall be installed to have a minimum radius of 3 in.
4. Grounding conductors in a raceway system shall be terminated/bonded to each box, cabinet, enclosure, etc. through which it passes or terminates.
5. Grounding conductors routed with underground circuits shall be bonded to each ground electrode and metallic cable support system within the raceway system including pull and access locations.
6. Stranded conductors penetrating vapor barriers, foundations, slab on grade and water stop membranes shall have the interstitial spaces between strands filled with solder 4 in. beyond the membrane each side. The conductor shall be sealed to the membrane with a manufacturer approved method.

B. Raceway Systems:

1. All metal supports, cable trays, messenger cables, frames, sleeves, brackets, braces, etc. for the raceway system, panels, switches, boxes, starters controls, etc., which are not rigidly secured to and in contact with the raceway system, or which are subject to vibration and loosening, shall be bonded to the raceway system.

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2. Termination of rigid conduit at all boxes, cabinets, and enclosures shall be made up tightly with a double locknut arrangement and a bushing, bushings being of the insulated type. Utilize grounding bushings as specified elsewhere in these specifications.
 3. Conduit which runs to or from boxes, cabinets, or enclosures having concentric or eccentric knockouts which partially perforate the metal around the conduit and hence impair the continuity of system ground circuits shall be provided with bonding jumpers connected between a grounding type bushing/locknut on the conduit and a ground bus or stud inside the box, cabinet, or enclosure and attached thereto.
 4. Conduit expansion joints and telescoping sections of metal raceways shall be provided with bonding jumpers sized in accordance with the NEC.
- C. Connectors Clamps and Terminals:
1. Connectors utilized above grade in dry accessible locations shall be mechanical or exothermic type.
 2. Connectors in damp locations, below grade or if not indicated shall be exothermic type.
 3. Clean the area near the connecting surfaces prior to any connection to ensure effective contact. Cleaning shall be to the bare metal. Wire brush area if needed to remove rust scale paint, dirt, etc. to expose bare metal.
 4. Exothermic connections shall be installed in accordance with the manufacturer's recommendations and tested with heavy blow of a five pound sledge.
- D. Flexible Strap:
1. Flexible straps shall be used when bonding vibrating/moveable equipment, with expansion fittings and where recommended by the manufacturer.
 2. Sufficient slack shall be provided to compensate for the anticipated vibration, movement and expansion.
- E. Secondary Electrical Systems:
1. The neutral (grounded) conductor of each low voltage, single and/or polyphase system or distribution system, except special isolated double insulated systems, shall be solidly connected to ground at the transformer neutral bushing, or at the main secondary switchgear to the system

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ground, and shall be sized for current carrying capacity, not to be less than as required by the NEC. Ground connection shall be to the building grounding system, building steel, building water service, building concrete reinforcement and as indicated.

2. Provide equipment grounding conductor, green colored insulation, with phase conductors, to primary side of all transformers rated 600 volts or less circuited to the enclosure and secondary neutral bushing, to all electrical utilization and distribution equipment; insulation shall be same type as phase conductors. Transformer enclosures shall be bonded to the primary and secondary circuit grounding conductor.
3. Equipment grounding conductors shall extend from the point of termination back to the ground bus of the source panelboard, switchboard, transformer, or switchgear.

F. Equipment Grounding:

1. Poles Supporting Outdoor Lighting Fixtures: Install grounding electrode and a separate insulated equipment grounding conductor in addition to grounding conductor installed with branch circuit conductors.
2. Surge Protection Device (SPD) Ground Conductor Installations: Extend SPD dissipation ground conductors to local equipment ground bus and to common grounding electrode conductors. Size conductors per SPD manufacturer recommendations and the NEC.

G. Grounding and Bonding for Piping:

1. Metal Water Service Pipe: Install insulated copper grounding conductors in conduit from building's main service equipment or grounding bus to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes using a bolted clamp connector or by bolting a lug-type connector to a pipe flange using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor or sleeve to conductor at each end.
2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.

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3.2 GROUND TERMINAL BUS INSTALLATION

- A. Install ground terminal bar in rooms where shown on the drawings. Mount bar 18 in. above finished floor by anchors and bolts using 1-1/2 in. long insulated spacer between bar and wall. Use a minimum of two (2) supports 18 in. on center. Connect all grounding electrode system conductors, system enclosure ground bus, and other indicated electrode systems to the terminal bar.
- B. Label grounding conductors terminated to bus for equipment, location, electrode, etc. served.

3.3 TESTS

- A. Test the building ground system before backfilling to ensure continuity and determine system resistance value.
- B. Testing procedure shall be a fall of potential type with a moving auxiliary electrode in accordance with IEEE Standard 142 and reviewed/approved by the Engineer. Sufficient test points shall be taken for accurate resistance value.
- C. Make resistance measurements in dry weather, no earlier than 48 hours after rainfall. Provide tabulated test results indicating distance between rods and resistance readings on a plotted graph.
- D. Test each ground electrode system separately prior to connection to the system or main building ground bar. Test each system ground electrode system a second time after backfilling has occurred and all final connections (building steel, water service, etc.) have been made.
- E. Soil type, date, time, meter manufacturer/model number, person performing the test, test witnesses and most recent rainfall shall be noted in test submittal.

END OF SECTION

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SECTION 26 20 00 - ELECTRIC DISTRIBUTION

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Provide a complete distribution system as indicated on the Contract Documents and as specified herein.

1.2 QUALITY ASSURANCE

- A. All methods of construction, details of workmanship, that are not specifically described or indicated in the contract documents, shall be subject to the control and approval of the Owner's Representative. Equipment and materials shall be of the quality and manufacture indicated in their respective sections of the specifications. The equipment specified is based upon the acceptable manufacturers listed. Equipment types, device ratings, dimensions, etc., correspond to the nomenclature dictated by those manufacturers. Where "or equal" is stated, equipment shall be equivalent in every way to that of the equipment specified and subject to approval. All equipment shall be tested at the factory. Unless specified elsewhere, standard factory inspection and operational tests will be acceptable.
- B. Installation shall be in accordance with NFPA-70 (National Electrical Code), National Electrical Safety Code (NESC), state codes, local codes, and requirements of authority having jurisdiction.
- C. Equipment shall be designed, manufactured, assembled, and tested in accordance with the latest revisions of applicable published ANSI, NEMA, UL and IEEE Standards.

1.3 SUBMITTALS

- A. Submit the following product data/information:
 - 1. Manufacturer and equipment type.
 - 2. Standard catalog information sheet.
 - 3. Detailed shop drawings indicating plan, elevation, end and isometric views. Top and bottom conduit areas shall be clearly shown and dimensioned on the drawings.
 - 4. Single-line diagram.
 - 5. Complete Bill of Materials.

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6. All relevant ratings including, but not limited to, voltage, current, interrupting and withstand.
 7. Overcurrent Device Information. Model number, available settings, setting ranges, capabilities, etc.
 8. Submit available and final settings, programming and adjustments.
- B. Submit product data and information for the following equipment, materials, products, etc.:
1. Switchboards.
 2. Dry type transformer(s) including shielded and linear load transformer(s).
 3. Distribution and branch circuit panelboards.
 4. Enclosed circuit breakers.
 5. Disconnect switches.
 6. Meter Centers.
 7. Surge Protective Devices.

1.4 WARRANTY

- A. Provide full system warranty (labor, travel, equipment, etc.) in accordance with Division 1 and a minimum of one (1) year from acceptance.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Branch Circuit Panelboards (480Y/277 volt, 208Y/120 volt, 240/120 volts):
1. Provide branch circuit panelboard as indicated in the "Panelboard Schedule" and as located on the drawings. Panelboards shall be equipped with quick make/quick break thermal-magnetic, molded case circuit breakers as scheduled.
 2. Panelboard bussing and lugs shall be copper. Provide grounding bus in each panelboard, securely bonded to the box. Panelboard bus structure and main lugs or main circuit breaker shall have current ratings as indicated. Such ratings shall be established by heat rise tests, conducted in accordance with UL Standard 67.

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3. Provisions for additional circuit breakers shall be such that field addition of connectors or mounting hardware will not be required to add circuit breakers to the panelboard. Bus connections shall be bolt-on.
 4. Each panelboard, as a complete unit, shall have a short circuit current rating equal to or greater than the rating shown on the Panelboard Schedule or on the plans. All panelboards shall be fully rated. "Series Ratings" are NOT acceptable. Reducing breaker ratings on the basis of series rating is not acceptable.
 5. The panelboard bus assembly shall be enclosed in a steel cabinet. The rigidity and gauge of steel to be specified in UL Standard 50 cabinets. Wiring gutter space shall be in accordance with UL Standard 67 for panelboards. Each front shall include a door and have a flush, stainless steel, cylinder type lock with catch and spring-loaded door pull. All panelboard locks shall be keyed alike. Doors shall be mounted by completely concealed steel hinges. A circuit directory frame and card with a clear plastic covering shall be provided on the inside of the door. Fronts shall be of code gauge, full-finished steel with rust inhibiting iron phosphate sealer and baked enamel finish. Minimum box width shall be 20 in. Provide door-in-door construction. Panelboard to be keyed to match the Owner's existing system. Provide full length piano-hinged trim allowing access to wiring gutters without removal of trim.
 6. Panelboards with main circuit breaker shall have inherent and listed coordination of the main and branch circuit breakers.
 7. Ratings shall be as indicated on the Panelboard Schedule.
 8. Manufacturers: Subject to compliance with Contract Documents, the following manufacturers are acceptable:
 - a. 208Y/120 Volt and 240/120 Volt:
 - 1) Square D "NQ" - Design Make.
 - 2) Eaton Corporation "PRL1"
 - 3) General Electric by ABB ReliaGear "RQ"
 - 4) Siemens
- B. Circuit Breakers:
1. Circuit breakers below 400 amp frame shall be molded case with inverse time and instantaneous tripping functions, unless indicated otherwise in contract documents.

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2. Listed combination of coordinated circuit breakers shall be verified by the equipment manufacturer utilizing published data sheets. Confirm listings shall be submitted.
 3. Lugs shall be mechanical, rated for 60/75° AL/Cu.
 4. Branch circuit breakers shall be quick-make, quick-break, thermal-magnetic and trip indicating, and multipole breakers shall have common trip. Single pole 15 and 20 ampere circuit breakers shall be UL listed as "Switching Breakers" at 120V ac or 277 V ac and carry the SWD marking.
 5. Ratings shall be as indicated in the Contract Documents.
- C. Disconnect Switches:
1. Shall be heavy-duty type three-pole, with "Quick Make/Quick Break" operating handle mechanically interlocked with the cover, horsepower and voltage rated to match equipment served. Where indicated switches shall be provided with dual-element, time delay, rejection type fuses. Switches shall be installed in NEMA 1 for indoor use, NEMA 4[X] for outdoor use. Provide provisions for padlocking in the "off" position. Provide neutral bar in single phase or three phase, four wire circuits, and ground bar in all switches. Provide auxiliary contacts where called for.
 2. All disconnects connected downstream of ASD's shall have a normally open and normally closed auxiliary contacts which shall be wired to the ASD to indicate disconnect is open.
 3. Manufacturers: Subject to compliance with Contract Documents, the following manufacturers are acceptable:
 - a. Square-D - Design Make.
 - b. Cutler Hammer
 - c. General Electric
 - d. Siemens
- D. Fuses:
1. All fuses rated 600 volts and below shall be rejection type dual-element, time-delay type. Provide two (2) complete sets of fuses for all fusible devices. Deliver spare fuses to the Owner and obtain receipt.
 2. Manufacturers: Subject to compliance with Contract Documents, the following manufacturers are acceptable:
 - a. Fuses 600 Amperes and Below: Bussman Type FRS-R (600 volts), Bussman Type FRN-R (300 volts) or equivalent.

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- b. Fuses Rated Above 600 Amperes: Bussman Type KRP-C or equivalent.

2.2 SHORT CIRCUIT LEVELS AND COORDINATION STUDY

- A. The Contractor shall adjust and program all overcurrent devices. The Engineer will provide the settings/ratings of relays and circuit breaker trip units to the Contractor.
- B. The Contractor shall submit the following information, as a minimum:
 - 1. Each overcurrent device: Device name (load served), manufacturer, model number/type, trip unit model number, time current curve (TCC) with TCC number, and available settings and parameters.
 - 2. Equipment manufacturer letter of verification that all specific project non-adjustable trip circuit breakers are inherently selectively coordinated based on testing results.
 - 3. Equipment manufacturer verification that all panelboard fused (main and branch) are inherently selectively coordinated based on testing results.
 - 4. Length, size and raceway material for each feeder circuit.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. All equipment shall be grounded per the NEC.
- B. Electrical distribution equipment shall have lugs/terminations suitable for the indicated conductor size. Where conductors have been oversized for voltage drop and where approved by the Engineer it shall be allowed to reduce the conductor size using hydraulically crimped splice in a box next to the distribution equipment to allow for standard lug termination.
- C. Install dry-type transformers with adequate clearances for proper ventilation. Bolt floor mounted transformer to pad.
- D. Distribution switchboards, motor control centers and floor mounted dry-type transformers shall be mounted on 4 in. high concrete pads which shall extend 3 in. on all sides. Securely bolt the unit to the pads for proper horizontal and vertical alignment.
- E. Coordinate transformer pad dimensions with transformer manufacturer's requirements. Coordinate transformer pad locations, dimensions and details with General Contractor.

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- F. Provide pad lockable branch circuit breaker device to hold circuit breaker in the closed position, but not prevent overcurrent protection, for all branch circuits serving fire alarm controls panels, emergency lighting and life safety branch circuits.
- G. Identification:
 - 1. Identify all items of equipment as described in Section 260501-3.1, Identification. Identification shall be provided for switchboards, panelboards, transformers, ASD's, motor starters, disconnect switches, enclosed circuit breakers, switchboard main/distribution breakers, MCC's automatic transfer switches, UPS's, generators, surge suppression devices, control panels, switchgear, etc.
 - 2. Switchboards, panelboards, MCC's, switchgear, etc. shall have a label indicating name/tag ID, feeder source, conductor color convention and for service entrance locations the available short circuit current.

3.2 ELECTRICAL LOAD TEST

- A. Conduct a load test prior to request for final payment and comply with the following:
 - 1. Energize maximum normal light and power load for a period of two hours when scheduled.
 - 2. Record voltage at service and at each panel.
 - 3. Measure current in each phase of all feeders.
 - 4. Adjust transformer taps as directed by engineer after review of report.
 - 5. Provide and install all necessary metering equipment.
 - 6. Owner's Representative or Site Representative shall witness the test.
 - 7. Before final acceptance specified test shall be completed to the satisfaction of the Owner's Representative who shall be sole judge of the acceptability of such tests and who may direct the performance of such additional tests as deemed necessary in order to determine the acceptability of the systems, equipment, material and workmanship. Additional tests required by the Owner's Representative shall be provided at no additional cost. Protective equipment shall be actuated in a manner that clearly demonstrated their workability and operation.

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3.3 CLEANING

- A. At the completion of the project, while equipment is de-energized, it shall be thoroughly cleaned to a shipped condition using methods in accordance with the manufacturer's recommendations. Utilize vacuum for cleaning and not compressed gas.

3.4 SPARE PARTS

- A. Deliver loose equipment to the Owner and obtain receipt for fuses, keys to panelboards, etc.

3.5 DISCONNECT DEVICES

- A. All disconnect devices downstream of ASD's: Provide wiring, conduit and connections between ASD and disconnect auxiliary switch to ASD.

END OF SECTION

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SECTION 26 50 00 - LIGHTING

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 DESCRIPTION

- A. Provide interior and exterior lighting systems, including luminaires, hangers, supports, fittings, lamps, wiring, connections and controls, as indicated in the Contract Documents for complete and operational systems. Luminaires, in general, have been specified for the particular type of ceiling in which they are to be installed. Verify the ceiling construction details and provide luminaires suitable for the respective ceiling types and room finish schedule.

1.3 REFERENCES

- A. The following standards, criteria, codes, etc. shall be followed in the manufacture and installation of the lighting systems.
 - 1. NFPA
 - 2. NEC
 - 3. IESNA
 - 4. NEMA
 - 5. ANSI
 - 6. UL

1.4 QUALITY ASSURANCE

- A. Luminaires shall be as specified in the "Luminaire Schedule". Luminaire types, appearance, characteristics, photometrics, finishes, etc., correspond to the specified manufacturer and associated series or catalog number listed in the "Luminaire Schedule". Products of other listed acceptable manufacturers shall be equivalent in every way to that of the luminaire specified. The Engineer reserves the right to disapprove any luminaire type submitted which they feel is not equal in quality, appearance or performance to the luminaire specified.
- B. Manufacturer's luminaire series or catalog numbers listed in the "Luminaire Schedule" indicate quality, type, and style, but may not cover required special design details. Provide luminaires having such special details as noted in the "Luminaire Schedule", as indicated by the specified luminaire model number and as required for proper installation.

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- C. All luminaires shall be new and bear a Nationally Recognized Testing Laboratories (NRTL) label for the service intended.
- D. Luminaires shall be products of manufacturers regularly engaged in the manufacture of the type of luminaires specified and shall be the manufacturer's latest standard design that complies with specification requirements.
- E. Verify the availability of all luminaires proposed to be used in the execution of the work prior to submitting same for approval. The discontinuance of production of any luminaire after such approval has been granted shall not relieve the Contractor from furnishing an approved luminaire of comparable quality and design at no additional cost.
- F. Photometric and operational data shall be provided only by qualified and certified organizations. Certification documentation shall be submitted with the luminaire information.
- G. Should there be any difference between drawings and schedules, secure from Architect/Engineer such information as necessary prior to providing proposal. When finishes are not definitely specified, they shall be as selected by the Architect and not be limited to standard finishes.
- H. Locations indicated for luminaires are approximate. Field coordinate exact locations as near as possible to the location indicated. Coordinate with the Engineer for any major location changes.

1.5 SUBMITTALS

- A. Product Data: For each luminaire type, include in a single submittal, in order of luminaire designation, the catalog "cut" sheet with complete manufacturer and model number. Product data should include the following:
 - 1. Manufacturer and Catalog Number.
 - 2. Features, accessories, materials and finishes.
 - 3. Physical description and dimensions of luminaires.
 - 4. Life, power input, output (lumens, distribution, CCT, and CRI) and energy-efficiency data.
 - 5. Photometric data and adjustment factors based on laboratory tests (space to mounting height ratio, coefficient of utilization complete values, IES distribution, candlepower distribution by angle and luminaire efficiency). Format shall be in accordance with IES TM-27.

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6. Power, signal, and control wiring diagrams between luminaires and controllers.
 7. Lens/Louver Type.
 8. Driver/ballast with each type luminaire as applicable (type, sound rating, overload protection, voltage, input/fixture wattage, ballast factor, power factor, etc.).
 9. Emergency lighting units, including batteries and chargers.
 10. Certification of IES LM-79, IES LM-80 and TM-21 testing for LED luminaires. Luminaires shall be tested in accordance with IES LM and TM standards.
 11. Warranty.
- B. Coordination Drawings: Provide coordination drawings in accordance with Section 260500. Reflected ceiling plan(s) and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
1. Luminaires.
 2. Suspended ceiling components.
 3. Partitions and millwork that penetrate the ceiling or extend to within 12 inches of the plane of the luminaires.
 4. Structure members to which equipment and or luminaires will be attached.
 5. Initial access modules for acoustical tile, including size and locations.
 6. Items penetrating finished ceiling, including other luminaires, air outlets and inlets, speakers, sprinklers, access panels, ceiling mounted projectors, etc.
- C. Color Chips: Provide color chips of available finishes for luminaires upon request of Architect/Engineer.
- 1.6 DELIVERY, STORAGE AND HANDLING
- A. Luminaires and equipment shall be delivered with NRTL and manufacturer's labels intact and legible. Broken, cracked and damaged materials and equipment shall be removed from the site immediately and be replaced with new materials and equipment. Luminaires and accessories shall be stored in protected dry locations in their original unbroken package or container. Luminaires shall be protected from dust and dampness both before and after installation. Luminaires shall be protected from paint and cleaning solvents during all phases of construction.

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PART 2 - PRODUCTS

2.1 LUMINAIRE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. NRTL Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division hazard by a NRTL.
- C. UL Compliance: Comply with UL 1598 and UL 8750.
- D. Recessed Luminaires: Comply with NEMA LE 4.

2.2 LIGHT-EMITTING DIODE (LED) LUMINAIRES

- A. Luminaires shall be identical in construction features, options and appearance to the luminaires specified in the Luminaire Schedule. LED luminaires include white and RGBW systems as indicated on the luminaire schedule.
- B. Luminaires shall be provided with all cables, controllers, power supplies, drivers, connectors, terminators and accessories required for a complete installation. LED system shall utilize pulse width modulation, non-linear scaling techniques and reverse polarity protection.
- C. Provide dimming down to 10% as a minimum, or to percentage indicated or called for on the drawings. Unless otherwise indicated, the dimming control shall be a 0-10VDC signal
- D. RGBW LED systems where indicated shall be capable of at least 8-bit control of red, green, blue and white module. RGBW LED system shall be capable of setting each module with a unique and individual address. Each address shall be controlled independently by DMX or alternate method protocol. All RGB LED fixtures shall undergo a minimum of eight-hour burn-in testing during manufacturing.
- E. LED luminaires shall be high brightness and binned for forward voltage, luminous flux and wavelength.
- F. LED luminaires shall be tested in accordance with IESNA LM-79 (luminous output, power input, luminaire efficacy (lumens/watt), color temperature and color rendering index), IESNA LM-80 (L70, output luminous maintenance, 10,000 hour minimum test, calculation method is not acceptable) and IESNA TM-21/28. Luminaire output shall be a minimum of 100 lumens/watt. Rated life shall be a minimum of 50,000 hours at 70% output. Testing shall be performed by a US Department of Energy (DOE) accredited laboratory.

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- G. Drivers shall be solid state Class 1 power supply/driver with universal input (120-277V). The system shall have a minimum 90% power factor, 3.5 maximum crest factor, minimum efficiency of 90%, a maximum of 20% THD and overload protection. Adequate heat sink capability shall be provided to ensure the rated life. Unit shall meet FCC rules and regulations.
- H. Where indicated luminaires shall have color tuning capability and control. System to have separate dimming (5-100%) and color (3000K to 5000K, or as indicated on drawings) adjustability. Control shall be Dali or DMX512 for controllability as indicated. The system shall utilize the most recent settings when energized.
- I. The luminaire (to include LED sources and drivers) shall have a full five (5) year minimum warranty for replacement and labor.
 - 1. Acceptable LED Node Manufacturers:
 - a. Philips
 - b. Osram
 - c. Cree
 - d. Nichea
 - e. Lumiled

2.3 EXIT LUMINAIRES:

- A. Electrical Characteristics:
 - 1. LED type for 120/277 volt supply.
 - 2. Meet or exceed illumination requirements of NFPA 101, and all of the requirements of UL924.
 - 3. Maximum input power of 5 watts per illuminated face.
 - 4. Provide fully automatic internal emergency power pack including a premium grade battery, three-stage charger (constant current, equalize and float charge), relay, low voltage battery disconnect and brownout protection circuits. Battery shall provide sufficient capacity to operate the lamps for 1-1/2 hours to an end voltage of 87-1/2% of nominal battery voltage.
 - 5. Provide self-diagnostic circuitry to warn at malfunction of battery, charger, transfer circuit or emergency lamps by means of separate LED indicator lights. Also provide automatic programming which will include five minute discharge/diagnostic cycling every 28 ± days to exercise the unit's battery and check emergency operation.

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2.4 EMERGENCY BATTERY PACK LUMINAIRES:

- A. Completely self-contained in compact, low profile injection molded UL 94V-0 flame rated thermoplastic housing, damp location rated with universal mounting plate.
- B. Premium grade, pure lead maintenance free battery with sufficient capacity to operate the light sources for 90 minute to an end voltage of 87-1/2% of nominal battery voltage. Three stage charger (constant current, equalize and float charge), relay, low voltage battery disconnect and brownout protection circuits.
- C. Glare-free LED type lighting source. Test switch and charge rate indicator.
- D. Universal 120/277 volt supply.
- E. Photometric output: for a location with 8' unit mounting height, 9' ceiling, 8' wide corridor and 80/50/20% reflectance, multiple unit spacing shall be:
 - 1. Standard unit - 30' on center.
 - 2. High output (HO) unit - 60' on center.
- F. Provide self-diagnostic circuitry to warn malfunction of battery, charger, transfer circuit of emergency lamps by means of separate LED indicator lights. Also provide automatic programming which will include five minute discharge/diagnostic cycling every $28 \pm$ days to exercise the unit's battery and check emergency operation.

2.5 LUMINAIRE CONSTRUCTION

- A. Metal Parts:
 - 1. Free of burrs and sharp corners and edges.
 - 2. Sheet metal components shall be steel unless otherwise indicated.
 - 3. Form and support to prevent warping and sagging.
- B. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

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C. Lenses:

1. Shall be listed materials tested in accordance with ASTM D-635, "Rate of Burning and/or Extent and Time of Burning of Self-Supporting Plastics in a Horizontal Position" and burns less than 2/5 inches per minute.
2. The products shall have a smoke density of less than 75 when tested in accordance with ASTM D-2843, standard test method for "Density of Smoke from the Burning or Decomposition of Plastics".
3. The flame spread rating shall not exceed 0-25 and smoke developed rating shall not exceed 450 in accordance with ASTM E-84, standard test method for "Surface Burning Characteristics of Building Materials".
4. Self-ignition shall not occur below 600°F, in accordance with ASTM D-1929, standard test method for "Ignition Properties of Plastics".
5. Materials shall remain in place 15 minutes at 175°F and fall from frame at 200° below ignition temperature in accordance with ASTM D-648, "Deflection Temperature of Plastics Under Flexural Load".

2.6 LUMINAIRE SCHEDULE

- A. Luminaire schedule is found on the contract drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of Work.
- B. Examine roughing-in for luminaire to verify actual locations of luminaire and electrical connections before luminaire installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 GENERAL INSTALLATION

- A. Comply with NECA 1.
- B. All luminaires shall be installed as per manufacturer furnished installation instructions.
- C. Provide for every luminaire as shown on the plans, or as scheduled on the drawings.

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- D. Location of all ceiling and wall mounted luminaires shall be as indicated on the Architectural and Electrical drawings. The contractor shall verify ceiling type, construction, and material prior to ordering.
- E. Provide luminaires with an IC rating for luminaires installed in direct contact with insulation.
- F. Provide plaster frames for plaster ceilings and flanged frames for drywall ceilings.
- G. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.
- H. Luminaires shall be suitable and as recommended by the manufacturer for the actual intended mounting method and materials.
- I. Supports:
 - 1. Sized and rated for luminaire weight.
 - 2. Able to maintain luminaire position after cleaning and relamping.
 - 3. Provide support for luminaire without causing deflection of ceiling or wall.
 - 4. Luminaire-mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and a vertical force of 400 percent of luminaire weight.
- J. Flush-Mounted Luminaires:
 - 1. Secured to outlet box.
 - 2. Attached to ceiling structural members at four points equally spaced around circumference of luminaire.
 - 3. Trim ring flush with finished surface.
- K. Wall-Mounted Luminaires:
 - 1. Attached to structural members in walls, to a minimum 20 gauge backing plate attached to wall structural members, or using through bolts and backing plates on either side of wall.
 - 2. Do not attach luminaires directly to gypsum board.
- L. Suspended Luminaires:
 - 1. Pendant and Rods:

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- a. Pendant mount luminaires from 1/4 in. threaded rods of required length.
 - b. Sleeve threaded rods with 1/2 in. EMT painted with color as directed by Architect/Engineer.
 - c. Brace pendants and rods longer than 48 inches to limit swinging.
 - 2. Aircraft Cable:
 - a. Cables shall be 1/16 in. aircraft cable with end safety fittings. Cable shall be provided with 2 in. diameter mini-canopy and threaded coupler for attachment to a 1/4 in.-20 threaded stud extending 3/4 in. below ceiling.
 - b. Cable assembly shall include a spring-loaded adjustment device mounted in the fixture.
 - c. The Contractor shall be responsible for providing required supports for cable attachment.
 - d. For cord feed to the luminaire provide continuous cord clip of matching color to attach the cord to the cable.
 - e. Support per manufacturer's recommendations.
 - 3. Support stem mounted, single unit luminaires with approved outlet box and accessories that hold tem and provide damping of luminaire oscillations. Support outlet box vertically to building structure using approved devices.
 - 4. Use tubing or stem for wiring at one point of continuous rows of luminaires and tubing, rod, or wire support for suspension for each unit of length of luminaire chassis, including one at each end.
- M. Ceiling-Grid-Mounted Luminaires:
- 1. Secure to any required outlet box.
 - 2. Use approved devices and support components to connect luminaire to building structure in a minimum of four locations, spaced near corners of luminaire. Utilize #10 steel wire; similar to that used to support the ceiling grid.
 - 3. Provide UL listed seismic hold-down clips and fasten to luminaires and to ceiling grid members at or near each luminaire corner.

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4. Install luminaires of sizes less than ceiling grid as indicated on reflected ceiling plans or center in acoustical panel and support luminaire independently with at least two metal channels spanning and secured to ceiling tees.
- N. Cove Lighting:
1. Installed so as to produce a continuous and unbroken band of light with no shadows or light gaps.
- O. In-Grade Luminaires:
1. Provide a minimum of 6 in. peat gravel at the bottom of luminaire to allow for drainage. When installed in a concrete walkway, secure luminaire to rebar to prevent luminaire from "floating" when concrete is poured.
 2. Seal conduit entry into luminaire to prevent moisture penetration into luminaire from conduit system.
 3. Secure faceplate of in-grade luminaires in accordance with manufacturer directions to compress gasket evenly to form a waterproof seal. The use of power tools to secure faceplate is not permitted.
- P. Provide all necessary accessories for "end-to-end" mounting where continuous rows of luminaires are indicated. All luminaire assemblies shall be grounded.
- Q. Luminaires installed in continuous rows may be fed by a single outlet if luminaires are UL approved and suitable for through wiring in luminaire raceway.
- R. New luminaires may be provided to replace existing luminaires indicated to remain or be reused, subject to shop drawing approval.
- 3.3 GROUNDING
- A. Ground all non-current carrying parts of all lighting luminaires.
- B. All grounding shall be accomplished with NRTL tested grounding connectors suitable for this purpose.
- 3.4 FINAL CLEANING
- A. Immediately prior to acceptance, damp clean diffusers, glassware, luminaire trim, reflectors, lamps, louvers, lens and similar objects of all luminaires. Remove all dirt, corrosion, foreign material, finger marks, and blemishes. Replace all burned out lamps and failed components.

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3.5 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 - 1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
 - 2. Test of Emergency Lighting: Under supervision of Engineer, interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery power and retransfer to normal.
- B. Luminaire will be considered defective if it does not pass operation tests and inspections.
- C. Prepare test and inspection reports.
- D. Replace luminaires damaged during shipment, construction, or installation.

3.6 STARTUP SERVICE

- A. Comply with requirements for startup specified in Section 260936 "Lighting Controls."

3.7 ADJUSTING

- A. Provide adjusting the direction of aim of luminaires to suit occupied conditions. Adjustment may be required during hours of darkness.
- B. Final distribution shall be acceptable to the Owner and may take several attempts.

3.8 REMOVAL OF BALLASTS IN EXISTING LUMINAIRES

- A. Assume ballasts contain PCB material unless labeled otherwise or test samples show materials are not PCB; submit a test report. Remove all ballasts from existing luminaires indicated on contract documents. Dispose of all ballasts which do not have non PCB labels in PCB containers and pay all costs to have containers taken to EPA approved incinerators and disposed of all EPA regulations. Follow all EPA regulations for transporting material. If ballast has leaked in existing luminaires, remove material deposited in luminaire and dispose of those materials as indicated above. Provide documentation verifying disposal of PCB contaminated ballasts.

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3.9 REMOVAL OF LAMPS IN EXISTING LUMINAIRES

- A. The Contractor shall employ the service of a certified disposal/recycling service company to dispose of all removed fluorescent and/or HID lamps. All disposal procedures shall be performed in accordance with EPA Requirements and Subtitle C for the disposal of mercury contaminated lamps.

END OF SECTION

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SECTION 265500 - LIGHTING CONTROL

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Provide a complete lighting control system as indicated on the Contract Documents and as specified herein.

1.2 RELATED DOCUMENTS

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

1.3 QUALITY ASSURANCE

- A. Equipment and materials shall be of the quality and manufacture indicated in their respective sections of the specifications. The equipment specified is based upon the acceptable manufacturers listed. Equipment types, device ratings, dimensions, etc. correspond to the nomenclature dictated by those manufacturers.
- B. Installation shall be accordance with NFPA 70 (National Electrical Code), energy conservation codes, state codes, local codes, and requirements of authority having jurisdiction.
- C. Equipment shall be designed, manufactured, assembled, and tested in accordance with the latest revisions of applicable published ANSI, NEMA and IEEE Standards.
- D. All equipment shall NRTL tested.
- E. All components and assemblies are to be factory pretested.
- F. The controls provider must:
 - 1. Provide equipment from manufacturers for which they maintain a contract, distributorship, are an agent, or other formal arrangement for which documentation can be produced showing authority to sell and service the equipment in this territory.
 - 2. Demonstrate that they have successfully installed similar systems, utilizing their standard products, for a minimum period of five (5) years.
 - 3. Employ service technicians who are trained in accordance with the systems manufacturer's recommendations.

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4. Own and demonstrate proficiency in the use of the required test equipment, tools, etc. for the proper installation, set-up, testing and maintenance of the system. If requested, must provide a listing of tools and/or equipment and where appropriate, certifications in the proper training and use of the tools and/or equipment.

1.4 SUBMITTALS

- A. Submit the following equipment, materials, and products including all components and accessories:
 1. General Equipment
 2. Vacancy/occupancy Sensors
 3. Digital Lighting Control System
 4. Lighting Control Panels
 5. Emergency Lighting Control Devices
 6. Wiring diagrams
 7. Commissioning Plan
- B. Submit the shop drawings and the product data specified below at the same time as a single submittal package.
- C. Product Data: Provide equipment data sheets, specifications, wiring diagrams and installation instructions for all required system components.
- D. Shop drawings shall include the following at a minimum:
 1. Composite custom wiring and/or schematic diagram of each control circuit as proposed to be installed (standard diagrams will not be accepted). Wiring diagrams shall include all system components, including but not limited to: room controllers, digital switches, vacancy/occupancy sensors, photocells, isolated relays, digital I/O interfaces to conference room A/V systems, network interfaces, lighting control panels and associated components.
 2. All system devices shall be located per the system manufacturers recommendations. All devices shall be suitable for the building configuration and intended operation.

1.5 SYSTEM DESCRIPTION

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- A. The lighting control system and/or components, as specified and indicated on the drawings to provide the intended and required control of the lighting systems.

PART 2 - PRODUCTS

2.1 GENERAL EQUIPMENT

A. Switches

1. Toggle/Snap

- a. Unit shall be quiet operation, quick make/quick break, rated for 20A/120-277V/1hp at 120/277V, side/back wired with nylon/polycarbonate toggle, self grounding mounting screw clip plate (not staple), ground terminal and silver alloy contacts. Units shall meet latest Federal Specification WS-896, NEMA WD-1 and UL Test 20.
- b. Acceptable Manufacturers (for single pole units, provide two pole, three way, four way, illuminated handle, keyed, etc. type of the same quality and model).
 - 1) Hubbell HBL1221
 - 2) P&S 20AC1
 - 3) Leviton 1221-2

2. Low Voltage

- a. Unit shall be button type switch that is configurable from one button to eight buttons using point-to-point low voltage wiring for control of single or multiple loads. Each button shall provide a momentary contact and all share a common return. The switch shall be totally passive and contain no active electronics or power supply. Operation is dependent upon a Class 2 connection to a compatible relay panel or other device that can react to a momentary contact signal.
- b. Each button shall have an LED indicator light that can serve as a status indicator or as a locator light. The LED indicators shall be powered by a 24VDC source originating from the lighting control panel or other device. The button quantities shall be as indicated on the plan views.
- c. Acceptable Manufacturer

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- 1) Wattstopper LVSW series (Design Make)
 - 2) Acuity Brands
 - 3) Hubbell
 - 4) Approved Equal.
 3. All device colors shall match the surrounding devices and shall be selected by the Architect.
- B. Lighting Dimmers
1. Provide lighting dimmer where indicated suitable for the type of luminaire for even continuous control. Unit shall be rated for the indicated connected load plus 25% minimum (even when ganged). Review luminaire schedule and plans for type and loading. Provide for three-way control as indicated.
 2. Low voltage dimming shall be as recommended by the luminaire manufacturer for magnetic or solid state.
 3. LED dimmers shall be as recommended by the luminaire manufacturer and be listed for use with the associated driver.
 4. Device color shall match the other project devices.
 5. Acceptable Manufacturers:
 - a. Lutron (Design Make)
 - b. Crestron
 - c. Acuity Brands
 - d. Leviton
 - e. Approved equal
- C. Photoelectric Controls:
1. Heavy Duty, 1/2 in. Conduit Mounting:
 - a. 120 volt, SPST, 2000 watt: Tork Model 2101.
 - b. 277 volt, SPST, 2000 watt: Tork Model 2104.

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2. Combination Photoelectric Control and Contactor:
 - a. 120 volt, DPST, 3000 watt per pole: Tork Model 5403.
 - b. 277 volt, DPST, 3000 watt per pole: Tork Model 5404-3.
 - c. 208 volt, DPST, 3000 watt per pole: Tork Model 5404.

2.2 VACANCY/OCCUPANCY SENSORS

A. Vacancy/occupancy Sensors:

1. Vacancy/occupancy sensors shall comply with the following as a minimum:
 - a. Zero crossing switching operation (switch on/off only where sine wave is at zero volts) suitable for linear, non-linear and electronic/magnetic fluorescent ballasts for the loads indicated. Where the load to be controlled exceeds the sensor load rating provide a separate relay of adequate rating.
 - b. Failure of the unit shall be to the on/closed position or manual operation.
 - c. Motion sensitivity adjustment (dip switch or dial) and time delay adjustment (5 to 30 minutes minimum, dip switch or dial).
 - d. Line voltage input and switching. Field selectable for 120 or 277 VAC, 60 Hz.
 - e. UL listed and have a five (5) year manufacturer full replacement warranty.
 - f. Test mode feature to override the set time delay to allow adjusting of the sensitivity.
 - g. Sensor locations shall be adjusted during construction and at occupancy as recommended by the manufacturer for optimal sensing and operation.
 - h. Operation shall be field selectable with vacancy sensor being manual "on" with close switch/contact upon motion sensing and open after the set amount of time delay without motion or occupancy sensor being automatic on upon motion sensing.
 - i. Adjustable controls/settings shall only be accessible when the front cover is removed or from the back of the unit.

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- j. Unit color shall match the project devices except for the ceiling-mounted units which shall match the ceiling color. All color selections shall be by the Architect.
 - k. Ultrasonic sensing shall not be affected by air movement and shall operate at 32 kHz minimum (shall not interfere with hearing aids or other equipment).
 - l. Provide components as needed for the indicated control.
 - m. A factory-authorized representative shall coordinate and instruct the startup services of the sensors providing placement recommendations, connection guidance and startup supervision and adjustment.
2. Wall Mounted - Dual Technology:
- a. Unit shall fit into a standard single gang electrical box, have an On/Off button, and utilize PIR and ultrasonic technology motion sensing. Both types of sensing are needed for contact closure but only one (1) is needed to keep it closed.
 - b. Minimum Switching Capacity: 120 V - 800 W, 277 V - 1200 W.
 - c. The sensing shall be 180 degrees and the sensitivity area to be a minimum of:
 - 1) Major Motion (Walking/Arm Wave): 35 ft. x 30 ft.
 - 2) Minor Motion (Small Motion at Desk): 20 ft. x 15 ft.
 - d. Ambient light level sensing (adjustable 20-300 fc) to prevent "On" operation when the ambient light level is greater than the setpoint level.
 - e. High impact resistant sensor lens.
 - f. Acceptable Manufacturers:
 - 1) Wattstopper DW-100 (Design Make)
 - 2) Hubbell
 - 3) Eaton
 - 4) Acuity Brands

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3. Wall Mounted - Dual Technology - Dual Switching:
 - a. Unit shall fit into a standard single gang electrical box, have two (2) On/Off buttons, and utilize PIR and ultrasonic technology motion sensing. Both types of sensing are needed for contact closure but only one (1) is needed to keep it closed. To have two (2) contacts each fully rated, electrically separate and be commonly controlled.
 - b. Minimum Switching Capacity: 120 V - 800 W, 277 V - 1200 W.
 - c. The sensing shall be 180 degrees and the sensitivity area to be a minimum of:
 - 1) Major Motion (Walking/Arm Wave): 35 ft. x 30 ft.
 - 2) Minor Motion (Small Motion at Desk): 20 ft. x 15 ft.
 - d. Ambient light level sensing (adjustable 20-300fc) to prevent "On" operation when the ambient light level is greater than the setpoint level.
 - e. High impact resistant sensor lens.
 - f. Acceptable Manufacturers:
 - 1) Wattstopper DW-200 (Design Make)
 - 2) Hubbell
 - 3) Eaton
 - 4) Acuity Brands
4. Wall Mounted - Dual Technology - Dimmer Switch:
 - a. Unit shall fit into a standard single gang electrical box, have an on/off button and utilize dual technology (PIR and Ultrasonic) motion sensing. Both types of sensing are needed for contact closure, but only one is needed to keep it closed. Selectable manual or automatic on mode. Provide with 0-10 VDC dimming control with raise and lower buttons.
 - b. Minimum Switching Capacity: 120 V - 1000 W, 277 V - 1200 W.
 - c. The sensing shall be 180° and the sensitivity area to be a minimum of:

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- 1) Major Motion (Walking/Arm Wave): 35ft. x 30 ft.
 - 2) Minor Motion (Small Motion at Desk): 20 ft. x 15 ft.
- d. Ambient light level sensing (adjustable 20-300 fc) to prevent "on" operation when the ambient light level is greater than the set point level.
- e. High impact resistant sensor lens.
- f. Dimming Control Signal: 0-10 VDC, with minimum sink current of 50mA. Raise/lower buttons to allow manual dimming of the space luminaires.
- g. Acceptable Manufacturers:
 - 1) Wattstopper DW-311 (Design Make)
 - 2) Hubbell
 - 3) Eaton
 - 4) Acuity Brands
5. Ceiling Mounted - Ultrasonic (Subscript "U"):
 - a. Unit shall mount to standard octagonal box, have auxiliary contact (Form C, 0.5A at 24 VDC), and utilize ultrasonic sensing.
 - b. Shall have self-contained rated contacts or control a separate switch pack. If a self-contained unit, then the ratings and function shall meet or exceed the switch pack specifications.
 - c. Sensing shall be 360 degrees with a minimum operating area of:
 - 1) Major Motion (Walking/Arm Wave): 50 ft. x 30 ft.
 - 2) Minor Motion (Small Motion at Desk): 40 ft. x 20 ft.
 - d. Corridor (Major Motion): 50 ft. x 16 ft.
 - e. Units shall be suitable for overlap of motion detection areas without reduction in spacing and false operation.
 - f. Sensing shall be suitable for a ceiling/mounting height of up to 12 ft. minimum.

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- g. Ambient light level sensing (adjustable 20-300 fc) to prevent "On" operation when the ambient light level is greater than the setpoint level.
 - h. The maximum depth shall be 1.5 in. below the ceiling/box.
 - i. Acceptable Manufacturers:
 - 1) Wattstopper WT Series (Design Make)
 - 2) Hubbell
 - 3) Eaton
 - 4) Acuity Brands
- 6. Ceiling Mounted - Dual Technology (No Subscript):
 - a. Unit shall mount to standard octagonal box, have auxiliary contact (Form C, 0.5A at 24 VDC), and utilize PIR and ultrasonic technology motion sensing. Both types of sensing are needed for contact closure but only one (1) is needed to keep it closed.
 - b. Shall have self-contained rated contacts or control a separate switch pack. If a self-contained unit, then the ratings and function shall meet or exceed the switch pack specifications.
 - c. Sensing shall be 360 degrees with a minimum operating area of:
 - 1) Major Motion (Walking/Arm Wave): 50 ft. x 30 ft.
 - 2) Minor Motion (Small Motion at Desk): 40 ft. x 20 ft.
 - d. Units shall be suitable for overlap of motion detection areas without reduction in spacing and false operation.
 - e. Sensing shall be suitable for a ceiling/mounting height of up to 12 ft. minimum.
 - f. Ambient light level sensing (adjustable 20-300 fc) to prevent "On" operation when the ambient light level is greater than the setpoint level.
 - g. The maximum depth shall be 1.5 in. below the ceiling/box.
 - h. Acceptable Manufacturers:

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- 1) Wattstopper DT-300 (Design Make)
- 2) Hubbell
- 3) Eaton
- 4) Acuity Brands

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Provide all required system components, interconnection wiring and branch circuit power connections as required by the lighting control system manufacturer to meet the intended sequence of operation and system performance requirements. All system wiring shall be in accordance with the system manufacturer's requirements at a minimum.
- B. All line voltage wiring shall be installed in conduit. Terminations shall be done above accessible ceilings or within utility rooms and within a 4"x4" back box and have a suitable cover provided. Digital network devices (room controllers, isolated relays, plug load controllers, etc.) shall be mounted to a junction box and connected as recommended by the system manufacturer.

3.2 SYSTEM PROGRAMMING

- A. Upon completion of the installation, the system shall be programmed by the manufacturer's factory authorized representative who shall verify a complete fully functional system.
- B. The system manufacturer shall include separate individual site visits scheduled to complete the system programming and perform the following functions:
 1. Initial system startup/programming (time shall be suitable to setup all system devices). A minimum of two days shall be accounted for the system initial setup.
 2. Coordination with the owner to develop preferred lighting control scenes, scene illumination levels, button operation and coordinate day lighting requirements prior to final system programming. Once verified with the owner all system components shall be fully programmed and setup.
 3. Verification of the system operation (time shall be suitable to test and verify day lighting functions are operating properly). The manufacturer shall provide light meters for verification; time shall be as required for proper testing of the system.

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4. The lighting control system manufacturer shall coordinate all room names and scheduling with the owner prior to final setup.
5. The presence of the system manufacturer's service technicians to assist the installing electrician in all of the above is a requirement of this project and proof of time expended shall be provided to the Owner's Representative.

3.3 SYSTEM COMMISSIONING

- A. The electrical contractor shall provide both the Owner and the electrical engineer with a minimum of ten working days written notice of the system startup and configuration date.
- B. Refer to the lighting control details that are part of the Construction Drawings for sequence of operation and commissioning requirements of the project lighting control scenarios.
- C. All lighting control systems and components shall be commissioned to verify sensor location, time delay/sensitivity is properly set, auto-on/manual-on, override times, controls, day-lighting control, communications between control panels, and timeclock controls are operating as intended.
- D. Calibrate all sensor time delays, sensitivity settings and properly aim to guarantee proper detection of occupants and energy savings.
 1. Adjust time delay so that controlled area remains lighted for 15 minutes after occupant leaves area.
- E. Exterior photocells shall be aimed per the manufacturer's installation instructions. Locate and aim to be facing to the north and avoid being blocked by the building architectural features.
- F. Provide written or computer-generated documentation on the commissioning of the system including room by room description including:
 1. Sensor parameters, time delays, sensitivities, and daylighting set points.
 2. Sequence of operation, (e.g. manual ON, Auto OFF. etc.)
 3. Load Parameters (e.g. blink warning, etc.)

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3.4 SYSTEM TRAINING

- A. The Contractor shall provide instruction to the Owner's Representative with regard to use and operation of the system. Obtain signed receipt from Owner's Representative that instruction has been given.
- B. The lighting control system's manufacturer shall supply at least one (1) service technician after all systems have been tested and in full operation as described above to assist the installing electrician to demonstrate and instruct the Owner's Representative on the operation, programming and any uniqueness of the control system. Minimum time required for Owner instruction of the system is one (1) eight (8) hour session. Provide additional instruction and training to the owner to as required to verify the owner is comfortable with the system operation. Time of demonstration and instruction to be at Owner's convenience during normal working hours and shall be scheduled a minimum of ten working days prior.

3.5 WARRANTY

- A. Provide a five year complete manufacturer's warranty on all products to be free of manufacturers' defects.

3.6 MAINTENANCE

- A. Spare Parts:
 - 1. Provide the following spare parts/components to be used for the owner's maintenance. The spare parts shall be fully tested for proper operation and turned over to the owner in the original boxes:
 - a. Digital Light Control System
 - 1) (3) Ceiling mounted occupancy/vacancy sensors
 - 2) (1) Digital daylight sensor
 - 3) (2) Isolated relay interfaces
 - 4) (3) Room controllers
 - 5) (2) Digital switches
 - 6) (2) Digital dimmers
 - 7) (1) Scene Control Switch
 - 8) 500' of spare cabling that meets the manufacturers wiring requirements.

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END OF SECTION

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SECTION 283102 - ANALOG ADDRESSABLE FIRE ALARM SYSTEM

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Provide labor, materials, equipment and services to perform operations required for the complete installation of a fully operational analog addressable fire alarm system and related Work as described in the Contract Documents.
- B. Provide system as approved by local Fire Marshal and the Authority Having Jurisdiction (AHJ). System materials and installation shall be in accordance with the manufacturer's recommendations.

1.2 QUALITY ASSURANCE

- A. All methods of construction, details of workmanship that are not specifically described or indicated in the contract documents, shall be subject to the control and approval of the Owner's Representative. Equipment and materials shall be of the quality and manufacture indicated in their respective sections of the specifications. The equipment specified is based upon the acceptable manufacturers listed. Equipment types, device ratings, dimensions, etc. correspond to the nomenclature dictated by those manufacturers. All equipment shall be tested at the factory. Unless specified elsewhere, standard factory inspection and operational tests will be acceptable.
- B. Installation shall be in accordance with NFPA-70 (National Electrical Code), NFPA-72 (National Fire Alarm Code), AHJ, state codes, local codes, requirements of authority having jurisdiction and the contract documents. Installer shall be certified in the State of New York for fire alarm installation.
- C. Equipment shall be designed, manufactured, assembled, and tested in accordance with the latest revisions of applicable published UL, NFPA, ANSI, NEMA and IEEE Standards. All system equipment shall be compatible and of the same manufacturer.
- D. Each item of the fire alarm system shall be listed as a product of a single fire alarm system manufacturer and shall bear the UL Label.
- E. System installation shall be under the supervision of an accredited factory representative. Final connections to the FACP, annunciator panel and any other panels shall be by the factory representative.
- F. The system provider must:
 - 1. Provide equipment from a single manufacturer for which they maintain a contract, distributorship, are an agent, or other formal arrangement for

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which documentation can be produced showing authority to sell and service the equipment in this territory.

2. Demonstrate that they have successfully installed these systems, utilizing their standard products, for a period of five (5) years minimum.
3. Maintain a service organization to provide both normal and emergency service. Emergency service must be available 24 hours per day, 365 days per year and staff must be adequate to respond within 2 hours of an emergency call.
4. Have a service location not more than 50 miles from the project location.
5. Maintain adequate spare parts inventory to provide both normal and emergency service.
6. Employ service technicians who are trained in accordance with the systems manufacturer's recommendations.
7. Own and demonstrate proficiency in the use of the required test equipment, tools, etc. for the proper installation, set-up, testing and maintenance of the system. If requested, provide a listing of tools and/or equipment and where appropriate, certifications in the proper training and use of the tools and/or equipment.
8. Provide all system programming to deliver a customized system to the Owner ready for use.
9. All system programming is to be completed to the satisfaction of the Owner. If after preliminary use of the system, and/or training, the increased understanding of the system's features and capabilities necessitates reprogramming to any extent, it is to be performed at no additional cost.
10. Provide a minimum of two system inspections/tests each year during the warranty period as described in NFPA 72. Needed and requested system programming changes shall be provided at these times.
11. Warranty period shall be as described elsewhere with two years being minimum. Provide a service contract for the Owner review for two years beyond the warranty period. Warranty shall include all parts, materials, labor, transportation, etc.
12. Any system being extended or connected to an existing system shall be tested for full functionality prior to beginning work. System shall be signed off by Owner/Engineer as fully functional prior to any new work.

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1.3 SYSTEM DESCRIPTION

- A. The system shall constantly monitor all initiation devices and notification circuits for any abnormalities or alarm conditions. System shall sample/poll each addressable device no less than every 10 seconds.
- B. The system operation subsequent to the alarm activation by any initiating device (manual station, automatic detector, sensor, sprinkler flow switch, etc.) shall be as follows:
 - 1. All audible alarm notification appliances within corresponding building or designated area shall provide a common audible fire alarm signal until the System Reset Key or the Signal Silence Key is depressed.
 - 2. All visual alarm notification appliances shall flash continuously and synchronized until the system is reset or silenced.
 - 3. Shutdown of the corresponding HVAC system equipment shall occur with a supervisory alarm until the system is reset. All fans over 2000 cfm shall be shut down.
 - 4. Activation of all programmed outputs assigned to the initiating device shall occur until the system is reset or the silence key is depressed.
 - 5. The alarm shall be displayed at the local Fire Alarm Control Panel (FACP) and the fire alarm annunciator panel. A printout shall be produced at the FACP.
 - 6. The system alarm LED shall flash on the control panel and the fire alarm annunciator panel until the alarm has been acknowledged/reset. Once acknowledged, this same LED shall latch on. A subsequent alarm received shall flash the system alarm LED on the control panel and annunciator. The LCD display shall show the new alarm information.
 - 7. A pulsing audible alarm tone shall occur within the local building control panel and, where applicable, the fire alarm annunciator panel until the event has been acknowledged.
 - 8. Alarms shall be entered into the system event log history.
 - 9. Refer to Appendix A for operational/sequence matrix.
- C. Any subsequent alarm shall follow the operation described above.
- D. The activation by any system smoke detector or sensor shall initiate an alarm verification operation whereby the panel will reset the activated detector and wait for a second alarm activation. If, within a preset time after resetting, a second

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alarm is reported from the same or any other smoke detector, the system shall process the alarm as described previously. If no second alarm occurs within the prescribed time, the system shall resume normal operation. The alarm verification shall operate only on smoke detector alarms. Other activated initiating devices shall be processed immediately. The alarm verification operation shall be selectable by device.

- E. A manual evacuation (drill) switch shall be provided to operate the alarm notification appliances without causing other control circuits to be activated. However, should an actual alarm occur, all alarm functions shall occur as described previously.
- F. The system shall have a password(s) to allow the operator to display all alarms, troubles, and supervisory service conditions log history including the time of each occurrence. This shall be able to be viewed from the front of the control panel, annunciator panel or from a computer connected to the FACP.
- G. The actuation of the "walk test" program at the control panel shall activate the "Walk Test" mode of the system which shall cause the following to occur:
 - 1. The remote central monitoring station connection shall be bypassed.
 - 2. Only audible and visual appliances shall be operated. Other alarm functions (elevator recall, HVAC shutdown, etc.) shall not be affected.
 - 3. Walk test shall be selectable by circuit or circuits.
 - 4. Actual alarms received during a "Walk Test" shall cause the control panel to go into alarm and override the walk test mode.
 - 5. The control panel shall show trouble conditions.
 - 6. The walk test activation of any initiation device shall cause the audible signals to activate for two seconds or a distinguishable audible.
 - 7. The panel shall automatically reset itself after signaling is complete.
 - 8. The control panel shall automatically return to normal condition if there is no activity on a walk test circuit for a period of 30 minutes.
- H. Any momentary opening of an initiating or notification appliance circuit wiring shall cause an audible signal to sound at the Fire Alarm Control Panel and, where applicable, the annunciator panel for four seconds indicating a trouble condition.

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- I. Elevator Operation:
 - 1. Provide the following equipment as a minimum and as indicated on the drawings:
 - a. Smoke detection in the elevator equipment room.
 - b. Smoke detection at each elevator lobby.
 - c. Smoke detection in the elevator shaft if a smoke hatch.
 - d. Heat detection in the equipment room and shaft (high and low) if a sprinkler system is in the area. Detectors shall be within 2 ft. of the individual sprinkler heads.
 - e. Flow and tamper switches if the sprinkler system has a separate zone for the elevator(s).
 - f. Detection devices located in elevator lobbies, elevator hoistways and elevator machine rooms shall be used for elevator recall. Hoistway and equipment room heat detection shall initiate power shut down prior to water flow. Power shut down shall have a time delay suitable for the elevator car to return to the main landing. Separate elevator sprinkler zone flow switch shall initiate power shut down without time delay. Operation shall be in accordance with ASME A17.1, Safety Code for Elevators and Escalators. Signals shall be provided to the elevator controls for main level lobby alarm, any lobby alarm, elevator equipment room alarm and elevator hoistway alarm as a minimum. Provide addressable control modules for the signals to the elevator controls.
- J. Duct mounted smoke detectors associated with duct dampers shall have an addressable control module to operate the duct damper. In the event of an alarm initiation by the duct mounted smoke detector or the associated air handling unit/fan shut down the duct damper shall be closed. Control wiring shall be provided to shut the damper(s) when the associated air handling unit is not operational. Provide power supplies, wiring and accessories as needed for this operation.

1.4 SUPERVISION

- A. The system shall utilize independently supervised initiation device circuits. The alarm activation of any initiation device shall not prevent the subsequent alarm operation of any other initiation device.
- B. Notification appliance circuits shall be supervised to indicate an open or short circuit condition.

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- C. The incoming power to the system shall be supervised so that any power failure must be audible and visually indicated at the control panel and the remote annunciator. A green "power on" LED shall be displayed continuously while incoming power is present. This shall be a trouble alarm.
- D. The system batteries shall be supervised so that a low battery condition or disconnection of the battery shall be audibly and visually indicated at the control panel and the remote annunciator. This shall be a trouble alarm.
- E. The system shall have provisions for disabling and enabling all circuits individually for maintenance or testing purposes.

1.5 SUBMITTALS

- A. Provide a complete system submittal prior to ordering of equipment and installation including but not limited to:
 - 1. Complete equipment list.
 - 2. Catalog descriptive literature for all equipment. This shall include a description of the unit, ratings, functions, capability, materials and compatibility with other components.
 - 3. Riser Wiring Diagram showing all equipment, devices, device addresses, connections, control connections, remote notification connection(s), wire quantities and sizes.
 - 4. Typical Terminal Wiring Diagram for each type of device.
 - 5. Terminal wiring Diagram for all Fire Alarm equipment.
 - 6. Calculations including:
 - a. Battery sizing calculations indicating total number of power devices, load associated with each type device, backup period and recommended battery capacity (AH).
 - b. Voltage drop calculations with actual equipment loads used to derive battery back-up ampere-hour rating and individual circuit voltage drop (indicate the wire size to be used and the associated voltage drop with the allowed voltage drop) for each circuit.
 - 7. Complete console enclosure and equipment configuration.
- B. Submittal package, calculations and system wiring shall be performed/collected/signed by a NICET Level III technician.

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- C. If required by the Authority Having Jurisdiction (AHJ) provide a submission of all requested information for review and comment by the AHJ. All AHJ comments shall be incorporated and resubmitted until approved.
- D. Test reports at the completion of the project. Testing shall be of all system devices, equipment, circuits, features and functions.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. The project fire alarm system shall comply with and be in accordance with the drawings and specifications. All system equipment and materials shall be of the same manufacturer unless otherwise indicated. System and component acceptable manufacturers include the following unless otherwise indicated:
 - 1. Simplex - JCI (Basis of Design)
 - 2. Notifier
 - 3. Siemens - Cerberus
 - 4. EST - GE

2.2 FIRE ALARM SYSTEM

- A. The fire alarm system shall be comprised of the components specified as a minimum and also include components not indicated but required for a complete and operable system as described herein.
- B. The system and all its components shall be UL listed and in accordance with NFPA 72, local and state codes.
- C. The system shall have 25% spare capacity. This shall include all individual notification circuits, initiation circuits, initiating modules, alarm modules, power supplies, batteries, central processing unit memory and printed circuit card space. System initiation device and control device capacity shall be a minimum of the indicated percentage over the shown quantity or 250 whichever is greater.
- D. Each initiating device shall have an individual address for system communication. The system addresses shall not exceed seven digits. Each address, initiation circuit, notification circuit and control point shall have an individual identification description.

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2.3 VENTILATION FAN SHUTDOWN CONTROL

- A. Provide supervised normally closed relays and contactors for connection into the fan motor control circuits ahead of all automatic devices.
- B. Sequence fan shutdown for every air distribution system over 2000 cfm. Provide duct detectors in return of systems over 2,000 cfm and in return at each floor of systems over 15,000 cfm.
- C. Provide drill bypass feature, locate switch on Fire Alarm Control Panel and label "DRILL-FAN SHUTDOWN BYPASS". Buzzer shall sound continuously while in bypass mode.
- D. Provide fan reset feature, locate switch on Fire Alarm Control Panel and label "FAN RESET".

2.4 INITIATION DEVICES

- A. General:
 - 1. Provide analog addressable smoke and thermal sensors as shown. All detectors, control modules, monitor modules and all other initiation devices shall communicate with twisted pair cable and have an individual address. Peripheral devices shall be of the same manufacturer as the FACP.
 - 2. Spot type detectors shall utilize the same interchangeable bases.
 - 3. If a device is removed or taken out of service a trouble signal shall be initiated.
- B. Photo-Obscuration Type Smoke Detector:
 - 1. The photo-obscuration detector shall operate on the photo electronic principle and provide an analog signal to the system indicating the amount of smoke. Detector shall be an analog addressable type.
 - 2. The detector shall incorporate a built in type identification so the system can identify the type of detector. The sensor shall be continually monitored to measure any change in their sensitivity because of the environment (dirt, smoke, temperature, humidity, etc.). Unit shall not be affected by exterior light or EMF.
 - 3. The detector shall be designed and arranged to prevent interference from exterior electromagnetic fields and light.

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4. The detector shall provide advance indication of the analog value of the products of combustion to the FACP indicating that maintenance is required in order to insure normal operation. The detector sensitivity shall be adjustable per device (within UL limits) and be set at the FACP for continuous or variable based on time of day. There shall be a minimum of six (6) selectable sensitivity levels. The individual detector sensitivity setting shall be adjusted to meet the building/space characteristics and operation. The detector shall monitor the obscuration continuously and raise the obscuration level to compensate for a dirty sensor to maintain the set sensitivity.
5. Detectors shall be designed for twistlock mounting to a separate base assembly. Provide manufacturer's recommended back box suitable for surface mounting where required.
6. The detector base shall have terminals for making all connections; no soldering shall be required. It shall be possible to secure the detector to the base with a concealed socket headscrew to prevent unauthorized tampering.
7. Smoke detectors shall be UL 268 listed and FM approved.
8. All smoke detectors shall be field checked and set to meet the prevailing conditions of the premise and any Owner requests. All such work shall be performed by an authorized representative of the manufacturer trained in such procedures.
9. Photo-obscuration type smoke detection shall be used for smoke detection unless indicated otherwise indicated.

C. Heat Detector:

1. The heat detector shall be a thermal sensor and shall constantly monitor the space temperature and constantly report this to the system. The unit shall be analog addressable.
2. The sensor shall use dual solid state thermistors and shall monitor the ambient temperature from 32 degrees F, to 155 degrees F and provide a fast response to rapid increase in temperature. The sensor shall send data to the FACP representing the analog value of the ambient temperature. The FACP shall be suitable to monitor for set temperature (selectable by detector for 135 or 155 degrees F) and rate of rise (selectable by detector for 15 or 20 degrees F per minute). Individual detector thermal settings shall be adjusted for the building/space characteristics and operation but shall initially be set to 135 degrees F set temperature and 15 degrees F per minute rate of rise.

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3. Detectors shall be designed for twistlock mounting to a separate base assembly. Provide back box suitable for surface mounting where required.
 4. The detector base shall have terminals for making all connections; no soldering shall be required. It shall be possible to secure the detector in the base with a concealed socket headscrew to prevent unauthorized tampering.
 5. Smoke detectors shall be UL 268 listed and FM approved.
 6. All thermal sensors shall be field checked and set to meet the prevailing conditions of the premise. All such work shall be performed by an authorized representative of the manufacturer trained in such procedures.
- D. Combination Smoke And Heat Detector:
1. Single detector shall have both heat and smoke sensing capability as described in the photoelectric smoke detector and heat detector paragraphs above. Unit shall provide two individual analog sensing levels to the FACP including one for smoke and one for heat.
 2. Detector shall utilize the same base unit as the smoke and heat detectors.
- E. Addressable Initiation Module:
1. The addressable initiation module shall be used to connect supervised conventional initiating device or zone of supervised conventional initiating devices (water flow switches, tamper switches, manual pull stations, (4) wire smoke detectors, conventional (4) wire duct detectors, fire pump alarms, dry chemical fire extinguisher control panels, etc.) to one of the system's addressable circuits.
 2. The module shall provide address setting means using rotary decimal switches and also store an internal identifying code which the control panel shall use to identify the type of device.
 3. The module shall contain an integral LED that flashes each time the unit is polled.
- F. Manual Pull Stations:
1. Noncoded pull-down type, double action (push then pull down) manual addressable units with front keyed test/reset. Units shall be semi-flush where installed in construction with hollow or block walls. Where construction does not allow semi-flush mounting then unit shall be surface

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mounted utilizing the manufacturers back box. Each unit shall have a distinct address. Units shall be key reset.

2. Units installed outdoors or in potentially wet locations shall be rated for such conditions.
3. Bright red finish with white lettering "FIRE ALARM".

G. Duct-Type Smoke Detector:

1. Detector shall be a photoelectric type that shall be activated by the presence of combustion products.
2. The detector head shall be a plug-in unit. The unit shall contain no moving parts. One chamber shall be for fire detection and the second chamber shall function as a reference, to stabilize the detector for changes in environmental temperature, humidity and pressure. It shall be possible to electrically check detectors sensitivity, using a sensitivity test set, or equivalent, and readjust the detectors sensitivity as required.
3. Housing shall have ports for testing and a clear cover panel.
4. The detector base shall have terminals for making all connections; no soldering shall be required. It shall be possible to secure the detector in the base with a concealed socket-head screw to prevent unauthorized tampering.
5. Smoke detectors shall be listed by Underwriter's Laboratories, Inc. and approved by Factory Mutual Insurance Company.
6. Provide complete with sampling tubes. Size sampling tubes for 80% of the width of the duct. Locate in ductwork for the indicated system and in accordance with the manufacturer's recommendations. Unit shall be rated for air velocities of 300 to 4000 fpm as a minimum.
7. Provide addressable control module and 120V power for smoke damper operation.
8. Provide a remote indicating light/key test switch for each duct detector and mount directly below each duct detector on the underside of the ceiling where the detector is concealed.
9. Provide addressable base.

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H. Sampling Smoke Detection System:

1. Sampling smoke detection shall consist of a photoelectric based smoke detector, air drawing fan, controls, aspirator and filter. It shall have programmable threshold alarm level and time delay and have a minimum of seven (7) configurable relay outputs. Each system shall cover a minimum of 20,000 sq. ft.
2. A pipe network shall transport air to the detector, pipe shall be sized in accordance with the manufacturer's recommendations. System shall be suitable for 650 ft. of sample pipe, minimum. Provide 24VDC from fire alarm system to power each air sampling detector. Provide two (2) Addressable Control Modules at each air sampling detector. Air sampling detection system shall output an alarm signal and a trouble signal to these addressable control modules for monitoring by the fire alarm system.
3. Control unit shall be mounted where accessible and protected.
4. System piping shall be painted to match the surrounding with labels 20 ft. on center and sampling holes as directed by the manufacturer. All burrs shall be removed and pipe cleaned of all loose/unwanted material. Pipe support shall match the specified conduit supports and be a maximum of 5 ft. on center. A "tee" with valves shall be provided for each section of pipe for connection to compressed air source or pressure testing. Each end of the piping shall have a test port for pressurization testing.
5. System modeling for the space and intended area shall be performed by the system manufacturer and the layout modified as needed at no additional cost. Final system layout shall be included in the project coordination drawings.
6. Acceptable Manufacturers:
 - a. Design Make: Vesda LaserPlus.
 - b. Orr Protection Systems.
 - c. Approved equal.

I. Carbon Monoxide (CO) Detector:

1. Detector shall sense the level of CO concentration within a space and provide analog addressable signal to the system and be UL 2075 listed. Unit shall have a minimum life span of 10 years without replacement/recalibration.

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2. Provide with audible notification base unit for local unique notification. Alarm and notification initiation shall be from the control panel.
 3. Detector shall connect to the system addressable circuiting.
 4. Alarm level shall be adjusted at the control panel. Upon an alarm the local notification shall sound and a trouble alarm initiated.
- J. Single Station Carbon Monoxide (CO) Detector:
1. Detector shall sense the level of CO concentration within a space, provide local notification and be UL 2034 listed. Unit shall have a minimum life span of 10 years without replacement/recalibration.
 2. Provide with audible notification base unit for local unique notification. Audible shall be 85dB minimum output at 10 ft.
 3. Unit shall be 120V with 9V battery backup.

2.5 NOTIFICATION APPLIANCES

- A. Horns:
1. 24 volts DC.
 2. Basic grille type with powder coated red finish paint.
 3. Horn shall be rated 94 dBA (anechoic chamber) at 10 feet. Output shall be selectable steady tone or coded. Provide dampening devices to reduce unit output by 5dBA for a minimum of 40% of the system horn units and install as needed to meet the Owner's needs.
 4. Units shall be semi-flush where installed in construction with hollow or block walls. Where construction does not allow semi-flush mounting then unit shall be surface mounted utilizing the manufacturers back box.
 5. Units installed outdoors or in potentially wet locations shall be rated for such conditions.
 6. Provide directional projector where noted on the Drawings.
 7. Provide backbox and grille for fully recessed installations; 4 in. deep box maximum.
 8. Horn for carbon monoxide alarm notification shall meet the requirements above but have a white finish color, have the word "ALERT" imprinted on the device and have a temporal Code 4 alarm.

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B. Strobe Unit:

1. 24 volts DC with built-in Xenon Flasher; two watts maximum. Pulse duration shall be 0.2 seconds with maximum duty cycle of 40%. Illumination intensity shall be field selectable for 15/30/75/110 candela or 135/177/185 candela as applicable for the location. Output setting shall be 15 candela in corridors, 75 candela in general areas, 177 candela in sleeping areas or as indicated. Flash rate minimum 1 Hz, maximum 2 Hz. Units within building shall flash in synchronization.
2. Protruding pyramid shaped lexan lens with reflector and the word "FIRE" imprinted on the lens.
3. Rated life shall be a minimum of 500 hours of continuous operation.
4. Units installed outdoors or in potentially wet locations shall be rated for such conditions.
5. Units shall be semi-flush where installed in construction with hollow or block walls. Where construction does not allow semi-flush mounting then unit shall be surface mounted utilizing the manufacturers back box. Wall or ceiling mounted as noted on the Drawings.
6. Provide surface backbox for surface installation; 4 in. deep maximum.
7. Strobe for carbon monoxide alarm notification shall meet the requirements above but have a white finish color and have the word "ALERT" imprinted on the device.

C. Combination Horn-Strobe Units:

1. Unit shall be a combination of the horn and strobe units specified above in a single manufactured unit.

2.6 ADDRESSABLE CONTROL MODULE

- A. The addressable control module shall have an individual system address, be supervised and control an output dry contact from indication from the FACP. This can be used to control or have an input to elevator controls, notification appliances, door holder circuits, fans systems, etc. as indicated. Modules shall be connected to the addressable loop(s).
- B. The unit shall control an output relay (dry contact form C). The module shall mount in a 4 in. square, 2-1/8 in. deep electrical box.
- C. The module shall contain an integral LED that shall flash each time the module is polled.

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- D. The module shall provide address setting means using rotary decimal switches and also store an internal identifying code which the control panel shall use to identify the type of device. Each unit shall have a separate address and be connected to the system addressable signaling circuit.

2.7 REMOTE ANNUNCIATOR

- A. Wall mount within a flush box. Maximum depth of 4 in., stainless steel trim. Nominal dimensions of 4 in. x 12 in.
- B. Annunciation shall be by two line by 40 character LCD display to provide system information and alarm/trouble description.
- C. Unit power and control shall be from the FACP. Unit circuiting shall be supervised.
- D. Provide trouble signal with audible buzzer, silencing switch and system reset. All pushbuttons shall be inoperable without keyswitch activated. Pushbuttons for alarm acknowledge, silence and alarm reset shall be standard on the front with a description. Shall include a minimum of four auxiliary switches/pushbuttons to be programmed as coordinated with the owner (possible options are door holder release override, manual alarm initiation, elevator capture bypass, etc.).
- E. Tamper-resistant front panel screws.

2.8 AUTOMATIC DIALER

- A. Provide automatic tie to telephone line upon activation of the fire alarm system and transmission of prerecorded message. Provide two telephone lines from the building service individually routed to the FACP and terminated.
- B. Ten minute digitally stored message capacity.
- C. Provide automatic line seizure.
- D. Provide automatic telephone dialing to a prearranged telephone line. System shall have standard pre-recorded message stored in the memory. Record and store custom message as indicated by the Owner or call station.

2.9 DIGITAL COMMUNICATOR

- A. The digital fire communicator shall be installed in the FACP or mounted in a separate enclosure. The communicator shall be powered by 24 VDC from the FACP and shall report four (4) conditions - (2) alarm, (1) trouble and (1) supervisory. The unit shall have a built in auxiliary relay output which is programmable for alarm or trouble conditions, and shall be capable of sending a distinctive AC power failure report.

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- B. Install all wiring in accordance with manufacturer's recommendations. All wiring shall be completely tested as directed by the manufacturer, and a written test report submitted to them for approval. Their approval shall be obtained before connecting any devices. The system manufacturer, by their approval of the test report, shall assume all responsibility for all installed wiring.
- C. The communicator shall have the following features: visual and audible trouble indications; supervised or unsupervised input channels, dual phone line interface with line seizure; local and remote programming and automatic 24-hour test.
- D. The communicator shall be UL 864 listed and meet the requirements of NFPA 72 Chapter 4 for supervising station fire alarm systems.

2.10 NOTIFICATION APPLIANCE CIRCUIT EXTENDER (NAC)

- A. Unit shall provide additional notification appliance circuit capability for new or existing system and be utilized for horns and strobe units.
- B. Connections to the unit shall include power, notification appliance circuit output circuits and addressable control input or notification circuit input. The power circuit shall be from an emergency source if available in the building.
- C. Notification appliance circuit capability shall be four Class B or Class A, 2A, 24VDC minimum. Selectable for synchronized or not.
- D. Power supply shall be rated for 8A minimum at 24VDC for circuit power use and battery charging. Battery and charger shall be as specified within this section.
- E. Unit shall provide output circuit/operation/battery/power/status monitoring and trouble signal to FACP as needed.
- F. Provide with battery and charger. Battery to be sized for backup as indicated for FACP.
- G. Operation: upon a signal through the addressable control input or the notification appliance circuit indicating a system alarm.
- H. Use: Units can be utilized where indicated or where building is greater than 60,000square feet or over six stories in height. There shall be a minimum of one unit for each floor.

2.11 WIRE GUARDS

- A. Where specified herein or shown on the drawings provided a suitable wire guard for protection of indicated devices/equipment. Units shall be custom as needed for the application.

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- B. Wire guard shall be a minimum #6 wire gage of zinc plated steel, overall clear coating and welded at joints. For any unit needing access it shall have an integral hinge and locking means.
- C. As a minimum provide a wire guard for equipment where indicated and in gymnasiums.
- D. Wires shall have 2 inch maximum spacing.
- E. Acceptable Manufacturers:
 - 1. Design Make: American Time and Signal.
 - 2. Simplex.
 - 3. Approved equal.

2.12 PULL STATION ALARM COVER

- A. Provide a protective alarm cover over manual pull stations in public places where indicated. Unit shall allow easy access to the manual pull station and also provide an audible alarm when operated.
- B. Unit shall provide a 95dB alarm at 1 foot and be powered from a 9VDC battery.
- C. Unit shall be suitable for use in the intended location and pull station.
- D. Acceptable manufacturer:
 - 1. System manufacturer.
 - 2. STI Stopper II.

PART 3 - EXECUTION

3.1 INSTALLATION, EQUIPMENT

- A. All installations shall be accomplished in a professional manner by qualified personnel regularly engaged in and experienced in this type of Work. Fire alarm installation shall be directed by a person who possesses a state license for installation of fire alarm systems. All equipment and components shall be installed in accordance with the manufacturer's recommendations.
- B. System junction boxes and surface mounted device boxes shall be painted red.
- C. All notification circuits shall originate from the FACP. Signal expander units shall not be used.

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- D. Provide all wiring to sprinkler flow switches, pressure switches, and alarm check valves, installed by others. Maintain supervisory circuitry to the switches. Use liquidtight conduit for the last 2 ft. - 0 in. of raceway at the switch.
- E. Provide all wiring to post indicator valves, OS&Y valves and dry pipe sprinkler system maintenance air pressure switches, provided by others. Wire into the supervisory alarm portion of the fire alarm system.
- F. Provide all wiring to the smoke dampers installed by others. Provide an addressable control module for each. Wire to the damper junction box with flexible conduit and wire; provide box or boxes as required. Install according to NEC. Smoke dampers shall close when its associated smoke duct detector is in alarm, upon direction from the FACP or if the associated fan unit is not operating.
- G. Provide all wiring to duct smoke detectors. Duct smoke detectors shall be mounted on the ventilating ductwork by others. All mounting arrangements, holes cut into ductwork, sealing of openings along with ceiling and access doors for the duct type detectors shall be provided by others. Provide duct detectors along with sampling tubes with end caps. Sequence smoke damper operation thirty seconds after its associated fan has been shut down.
- H. Provide all wiring required for fan shutdown. Wire from the addressable control module for each fan to be shut down and provide wiring from the module to the fan control unit (starter, adjustable speed drive, etc.) Dry contact shall be wired ahead of all control functions for starters. Provide intermediate relay for control circuits beyond the rating of the control module.
- I. Install all door holders in accordance with installation detail on the drawings and coordinate with the General Construction trade. A maximum of fifty (50) door holders shall be wired to each power circuit. Connect door holders to nearest 120 volt corridor receptacle circuit.
- J. Provide all elevator capture control wiring. Installation shall be in accordance with manufacturer's recommendations.
- K. Elevator machine room and shaft heat detectors shall be mounted within two feet of the sprinkler head where applicable.
- L. Detection and initiating equipment shall be listed by NRTL and approved by FM.
- M. All surface mounted devices shall be mounted on a special box furnished by fire alarm equipment manufacturer. Total assembly shall be secure, smooth contour and have no protrusions.
- N. Where detectors are installed on wood or masonry surfaces, attach brackets directly to the surface with tamperproof fasteners. Where detectors are installed on suspended ceilings, provide additional supports in the ceiling, such as

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channel support system, angle iron or additional runner bars. Fasten the additional supports rigidly to the ceiling runner bar system. Attach bracket to the supports with tamperproof fasteners. Install metal spacers between the bracket and supports so that the ceiling tiles will not be a part of the support system.

- O. Install wall mounted audio/visual signal devices at 80 in. AFF to center line. Where ceiling types are called for, verify ceiling type and mounting height in the field. Provide pendant-mounted devices as required for specified mounting height.
- P. An auxiliary fire alarm relay used to control an emergency control device that provides control functions described in this specification shall be located within 3 ft. of the emergency control device and all wiring shall be supervised.
- Q. All smoke detectors shall be field checked and set to meet the prevailing conditions of the premise. All such Work shall be performed by an authorized representative of the manufacturer trained in such procedures.
- R. Provide circuiting from all indicated motor controls for indication if not operational and close any associated smoke dampers.

3.2 SYSTEM CIRCUITING

- A. All wiring shall conform to the NEC and to NFPA-72, National Fire Alarm Code.
- B. Install all wiring in accordance with manufacturer's recommendations taking into account loading, intended location, circuit length, spare capacity and voltage drop.
- C. All wiring shall be copper and installed in a dedicated/segregated EMT conduit system.
- D. Power circuits:
 - 1. Provide the required quantity of 20 ampere, 120 volt circuits to the system with a minimum of one (1) for the FACP, one (1) for door release, one (1) for each notification circuit extender.
 - 2. Circuit breakers serving fire alarm system equipment shall have a red handle lock to prevent from manual off operation. Directory shall be marked for the specific equipment served.
- E. Provide minimum #18 AWG twisted shielded pair for addressable signal line circuits. Notification appliance circuits shall be #14 AWG minimum. Conductor size shall meet or exceed the manufacturer recommendation and be within the voltage drop calculations.

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- F. Addressable signal line circuits shall be NFPA 72 - 2010 Class A (redundant, single open operation).
- G. Notification appliance circuits shall be NFPA 72 - 2010 Class A (redundant, single open operation).
- H. Notification circuits shall be segregated as indicated on the drawings and by individual floors as a minimum. Circuits shall also be dedicated to audible or visual appliances but not both.

3.3 PROGRAMMING

- A. Include in bid the cost to cover all system programming, including items particular to this project (such as custom zone descriptions, time delay settings, sensitivity settings, etc.) such that entire system is 100% complete and operating to the Owner's satisfaction. Coordinate all system programming with the Owner. Also, provide programming of the system a minimum of once during the warranty period to provide changes requested by the Owner.

3.4 SPARE EQUIPMENT

- A. Provide the following spare equipment to the Owner. Deliver the equipment to the Owner designated location on the project site in original packaging.
- B. Equipment to include:
 - 1. Smoke detectors: 5% of each type used with a minimum of five (5).
 - 2. Heat detectors: 5% of each type used with a minimum of five (5).
 - 3. Addressable control modules: 2% of each type used with a minimum of two (2).

3.5 BUILDING RADIO SIGNAL SITE SURVEY

- A. The contractor shall have a third party entity perform a radio signal site survey to determine the fire department radio signal strength throughout the project area. This shall be conducted at the end of construction and by a sub-contracted firm with methods acceptable to the local jurisdiction.
- B. The survey shall be coordinated and in conjunction with the local fire department.
- C. The survey shall meet the requirements of the Fire Code of New York State. Provide a report describing the survey methods used, pertinent requirements, measurements taken, areas where the signal strength is acceptable and recommendations for amplification/building antennas for areas where the signal strength is no suitable.

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3.6 TESTING AND INSTRUCTION

- A. The fire alarm system shall be fully tested after the installation is complete. Testing shall include all devices, FACP, annunciator panel, other panels, features and functions. Testing shall be witnessed by the owners representative and be in accordance with the NFPA and herein. Provide a testing report to the authority having jurisdiction and the Engineer as a submittal.
- B. Provide a minimum of four (4) hours of instruction to the operating personnel designated by the Owner's Representative with regard to use and operation of the system. Provide up to three programming modifications.
- C. Provide three (3) sets of keys to all panels, manual stations, etc., to the Owner's Representative.
- D. Provide a copy of the system programming to the Owner on a CD/DVD disk or flash drive.
- E. Provide to the Owner system Operation Manuals as specified, that shall include as a minimum:
 - 1. Bill of Material.
 - 2. Catalog descriptive literature for all equipment. This shall include a description of the unit, ratings, functions, capability, materials and compatibility with other components.
 - 3. Riser Wiring Diagram showing all equipment, devices, device addresses, connections, control connections, remote notification connection(s), wire quantities and sizes.
 - 4. Floor plan indicating equipment and device locations, addresses, power circuit information with power panel location, notification circuiting, initiation circuiting and control circuiting. Contact the Engineer for a copy of the project floor plans.
 - 5. Typical Terminal Wiring Diagram for each type of device.
 - 6. Terminal wiring Diagram for all Fire Alarm equipment.
 - 7. Calculations including:
 - a. Battery sizing calculations indicating total number of power devices, load associated with each type device and recommended battery capacity (AH).

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- b. Voltage drop calculations with actual equipment loads used to derive battery back-up ampere-hour rating and individual circuit voltage drop (indicate the wire size to be used and the associated voltage drop with the allowed voltage drop) for each circuit.
- 8. Instruction report starting when instruction was given and who was in attendance, signed by Owner's Representative.
- 9. A written test report from an authorized representative of the equipment manufacturer that each device and overall system operation has been 100% tested and approved.
- 10. Certificate of Completion as described in NFPA-72.
- 11. A five (5) year warranty in accordance with the Basic Requirements of these Specifications shall be provided for this system.

3.7 CO DETECTOR SIGNAGE

- A. Coordinate with the Owner, install a permanent 8-1/2 in. and 11 in., two (2) color lamicoid sign at eye level in the vicinity of every CO alarm notification device indicating specific instructions to be followed, ex. "Do not enter room if an alarm is sounding".

END OF SECTION

APPENDIX A
FIRE ALARM SYSTEM OPERATION/SEQUENCE MATRIX

System Outputs

System Inputs	Actuate Common Alarm Signal	Actuate Audible Alarm Signal	Actuate Common Supervisory Signal Indicator	Actuate Audible Supervisory Signal	Actuate Common Trouble Signal Indicator	Actuate Audible Trouble Signal	Indicate Zone or Device Description	Activate Notification	Display Change of Status on All Annunciators/Print	Transmit Alarm Signal to Central Station	Transmit Supervisory Signal to Central Station	Transmit Trouble Signal to Central Station	Release Magnetically Held Recall Floor	Actuate Warning to Elevator	Actuate Warning to Elevator Cabs	Activate Elevators Shunt Trip	Close All Related Smoke Dampers	Unlock All Exits and Control Doors	Shutdown Respective Air Handling Units	Activate Floor Pressurization (High Rise Only)	Activate Stairwell Pressurization (High Rise Only)	Active Smoke Exhaust (High Rise Only)	Open Associated Smoke Hatch	Local Notification
Fire Alarm System AC Power Failure					X	X						X												
Fire Alarm System Low Battery					X	X						X												
Open Circuit					X	X						X												
Ground Fault					X	X						X												
Circuit Short					X	X						X												
Manual Pull Station Actuation	X	X					X	X	X	X			X					X						
Area Smoke Detectors	X	X					X	X	X	X			X	X			X	X		X	X	X		
HVAC Air Duct Smoke Detector	X	X					X		X	X							X		X					
Area Heat Detectors	X	X					X	X	X	X			X	X			X	X		X	X	X		
Fire Suppression System Alarm	X	X					X	X	X	X			X	X			X	X						
Sprinkler Tamper Switch			X	X			X				X													
Sprinkler Water Flow in Building	X	X					X			X			X	X			X	X						
Sprinkler Water Flow in Elevator Equipment Room or Shaft	X	X					X	X	X	X				X	X	X	X							
Elevator Shaft Smoke Detector	X	X					X	X	X	X													X	
Elevator Equipment Room Area Smoke Detector	X	X					X	X	X	X			X	X		X	X							
Elevator Shaft and Equipment Room Heat Detectors	X	X	X	X			X	X	X	X			X	X		X	X	X						
Elevator Pit Sprinkler Flow	X	X					X			X			X	X	X	X								
Elevator Pit Heat Detector	X	X					X	X		X			X	X	X	X								
Elevator Lobby Smoke Detectors	X	X					X	X	X	X			X	X			X	X		X	X	X		
Elevator Lobby Recall Floor	X	X					X	X	X	X			X	X			X	X		X	X	X		
Fire Pump Power Failure/Phase Reversal			X	X			X		X	X	X	X												
Fire Pump Low Fuel			X	X			X		X	X	X		X	X			X	X						

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FIRE ALARM SYSTEM OPERATION/SEQUENCE MATRIX

System Inputs	Actuate Common Alarm Signal	Actuate Audible Alarm Signal	Actuate Common Supervisory Signal Indicator	Activate Audible Supervisory Signal	Actuate Common Trouble Signal Indicator	Activate Audible Trouble Signal	Indicate Zone or Device Description	Activate Notification	Display Change of Status on All Annunciators/Print	Transmit Alarm Signal to Central Station	Transmit Supervisory Signal to Central Station	Transmit Trouble Signal to Central Station	Release Magnetically Held	Recall Elevator to Recall Floor	Actuate Warning to Elevator	Actuate Warning to Elevator Cabs	Activate Elevators Shunt Trip	Close All Related Smoke Dampers	Unlock All Exits and Control Doors	Shutdown Respective Air Handling Units	Activate Floor Pressurization (High Rise Only)	Activate Stairwell Pressurization (High Rise Only)	Active Smoke Exhaust (High Rise Only)	Open Associated Smoke Hatch	Local Notification
Fire Pump Running	X	X					X		X	X			X	X				X	X						
Jockey Pump Running			X	X			X		X		X														
Fire Pump not in Automatic Mode	X	X					X			X															
Area of Refuge Two-Way Communication Status	X	X					X			X															
Smoke Detector Adjacent to Smoke Hatch	X	X					X	X	X	X			X	X					X					X	
AHU Off, Any Reason																		X							
CO Detection			X	X			X		X		X														X