

Garfield County
 Building & Planning Department
 108 8th Street Suite 401
 Glenwood Springs, CO 81601-
 Phone: (970)945-8212 Fax: (970)384-3470

Permit NO: **BLCO-11-09-1350**
 Permit Type: **Commercial Building**
 Work Classification: **Remodel**
 Permit Status: **Approved**

Permit

Issue Date: **Not Issued** Expires: **01/01/2999**

Project Address	Parcel No.	Subdivision	Section	Township	Range
3799 HWY 82 GLENWOOD SPRINGS, CO 81601-	218527100060		27	6	89

Owner Information	Address	Phone	Cell
Holy Cross Energy	PO Box 2150 Glenwood Springs CO 81602	970-945-5491	

Contractor(s)	Phone	Primary Contractor
FCI Contractors	(970)434-9093	Yes

Required Inspections:
 For Inspections call: **1(970)384-5003**

Proposed Construction / Details

Warehouse & Vehicle storage interior remodel.

Valuation:	\$ 417,750.00
Total Sq Feet:	42281

Inspection IVR

See Permit Record

FEES DUE

Fee	Amount
Commercial Building Fee	\$3,509.25
Plan Check Fee	\$2,281.01
Total:	\$5,790.26

FEES PAID

Inv Total	Paytype	Amt Paid	Amt Due
Inv # BLCO-11-09-19865			
\$ 5,790.26	Check # 129068	\$5,790.26	
			\$ 0.00

**Building Department
Copy**

GARFIELD COUNTY BUILDING PERMIT APPLICATION
 108 8th Street, Suite 401, Glenwood Springs, Co 81601
 Phone: 970-945-8212 / Fax: 970-384-3470 / Inspection Line: 970-384-5003
 www.garfield-county.com

A-5

1	Parcel No: (this information is available at the assessors office 970-945-9134) 2185-271-00-060		
2	Job Address: (if an address has not been assigned, please provide Cr, Hwy or Street Name & City) or and legal description 3799 Hwy 82 Glenwood Springs CO 81601		
3	Lot No:	Block No:	Subd./ Exemption:
4	Owner: (property owner) Holy Cross Energy	Mailing Address: PO Box 2150 Glenwood Springs CO 81601	Ph: 970-945-5477 Alt Ph: 970-947-5525
5	Contractor: FCT Constructors	Mailing Address: PO Box 1767 Grand Jct. CO 81502	Ph: 970-434-9043 Alt Ph: 970-9384
6	Architect/ Engineer: DPA Architectural Group	Mailing Address: 406 Hyland Park Dr. GWS CO 81601	Ph: 970-945-4040 Alt Ph: DNV
7	Sq. Ft. of Building: 42281	Sq. Ft. or Acres of Lot: 9AC (+/-)	Height: 24' No. of Floors: 1
8	Use of Building: Warehouse & Vehicle Storage		
9	Describe Work: Interior Remodel of existing Building		
10	Class of Work: <input type="checkbox"/> New <input checked="" type="checkbox"/> Alteration <input type="checkbox"/> Addition		
11	Garage: <input type="checkbox"/> Attached <input type="checkbox"/> Detached	Septic: <input type="checkbox"/> ISDS <input type="checkbox"/> Community	
12	Driveway Permit:	Owners valuation of Work: \$	557,000

NOTICE

Authority. This application for a Building Permit must be signed by the Owner of the property, described above, or an authorized agent. If the signature below is not that of the Owner, a separate letter of authority, signed by the Owner, must be provided with this Application.

Legal Access. A Building Permit cannot be issued without proof of legal and adequate access to the property for purposes of inspections by the Building Department.

Other Permits. Multiple separate permits may be required: (1) State Electrical Permit, (2) County ISDS Permit, (3) another permit required for use on the property identified above, e.g. State or County Highway/ Road Access or a State Wastewater Discharge Permit.

Void Permit. A Building Permit becomes null and void if the work authorized is not commenced within 180 days of the date of issuance and if work is suspended or abandoned for a period of 180 days after commencement.

CERTIFICATION

I hereby certify that I have read this Application and that the information contained above is true and correct. I understand that the Building Department accepts the Application, along with the plans and specifications and other data submitted by me or on my behalf (submittals), based upon my certification as to accuracy. Assuming completeness of the submittals and approval of this Application, a Building Permit will be issued granting permission to me, as Owner, to construct the structure(s) and facilities detailed on the submittals reviewed by the Building Department.

In consideration of the issuance of the Building Permit, I agree that I and my agents will comply with provisions of any federal, state or local law regulating the work and the Garfield County Building Code, ISDS regulations and applicable land use regulations (County Regulation(s)). I acknowledge that the Building Permit may be suspended or revoked, upon notice from the County, if the location, construction or use of the structure(s) and facility(ies), described above, are not in compliance with County Regulation(s) or any other applicable law.

I hereby grant permission to the Building Department to enter the property, described above, to inspect the work. I further acknowledge that the issuance of the Building Permit does not prevent the Building Official from: (1) requiring the correction of errors in the submittals, if any, discovered after issuance; or (2) stopping construction or use of the structure(s) or facility(ies) if such is in violation of County Regulation(s) or any other applicable law.

Review of this Application, including submittals, and inspections of the work by the Building Department do not constitute an acceptance of responsibility or liability by the County of errors, omissions or discrepancies. As the Owner, I acknowledge that responsibility for compliance with federal, state and local laws and County Regulations rest with me and my authorized agents, including without limitation my architect designer, engineer and/ or builder.

I HEREBY ACKNOWLEDGE THAT I HAVE READ AND UNDERSTAND THE NOTICE & CERTIFICATION ABOVE:

A. Montoya 11-2-09
OWNERS SIGNATURE **DATE**

STAFF USE ONLY

Special Conditions: <i>CE will file for partial refund of \$1212.25 for overpayment.</i>				
Adjusted Valuation: 417750.00	Plan Check Fee: 1803.96 776.10	Permit Fee: 2774.55 2769.55	Manu home Fee:	Misc Fees:
ISDS Fee: NONE	Total Fees: 4578.01	Fees Paid: 5790.26	Balance Due: <1212.25>	BP No & Issue Date: 1111-107 -1350 ISDS No & Issued Date: NONE
Setbacks:	OCC Group: 52/51	Const Type: V-B	Zoning: C/L	
BLDG DEPT: <i>[Signature]</i>	PLNG DEPT: <i>[Signature]</i>			
APPROVAL	DATE 11/5/09	APPROVAL	DATE 11/5/09	

The following items are required by Garfield County for a final Inspection:

- 1) A final Electrical Inspection from the Colorado State Electrical Inspector.
- 2) Permanent address assigned by Garfield County Building Department and posted at the structure and where readily visible from access road.
- 3) A finished roof; a lockable building; completed exterior siding; exterior doors and windows installed; a complete kitchen with cabinets, sink with hot & cold running water, non-absorbent kitchen floor covering, counter tops and finished walls, ready for stove and refrigerator; all necessary plumbing.
- 4) All bathrooms must be complete, with washbowl, tub or shower, toilet, hot and cold running water, non-absorbent floors, walls finished, and privacy door.
- 5) Steps over three (3) risers, outside or inside must be must have handrails. Balconies and decks over 30" high must be constructed to all IBC and IRC requirements including guardrails.
- 6) Outside grading completed so that water slopes away from the building;
- 7) Exceptions to the outside steps, decks, grading may be made upon the demonstration of extenuating circumstances., i.e. weather. Under such circumstances A Certificate of Occupancy may be issued conditionally.
- 8) A final inspection sign off by the Garfield County Road & Bridge Department for driveway installation, where applicable; as well as any final sign off by the Fire District, and/or State Agencies where applicable.

A CERTIFICATE OF OCCUPANCY (C.O.) WILL NOT BE ISSUED UNTIL ALL THE ABOVE ITEMS HAVE BEEN COMPLETED.

A C.O. MAY TAKE UP TO 5 BUSINESS DAYS TO BE PROCESSED AND ISSUED.

OWNER CANNOT OCCUPY OR USE DWELLING UNTIL A C.O. IS ISSUED. OCCUPANCY OR USE OF DWELLING WITHOUT A C.O. WILL BE CONSIDERED AN ILLEGAL OCCUPANCY AND MAY BE GROUNDS FOR VACATING PREMISES UNTIL ABOVE CONDITIONS ARE MET.

I understand and agree to abide by the above conditions for occupancy, use and the issuance of a C.O. for the building identified in the Building Permit.


OWNERS SIGNATURE
Bapplicationdecember2007

11-2-09
DATE

GARFIELD COUNTY BUILDING AND PLANNING
970-945-8212

**MINIMUM APPLICATION REQUIREMENTS
FOR
CONSTRUCTION OF
COMMERCIAL OR MULTI-FAMILY RESIDENTIAL BUILDINGS**
Including
**NEW CONSTRUCTION
ADDITIONS
ALTERATIONS**
And
MOVED BUILDINGS

In order to understand the scope of the work intended under a permit application and expedite the issuance of a permit it is important that complete information be provided. When reviewing a plan and it's discovered that required information has not been provided by the applicant, this will result in the delay of the permit issuance and in proceeding with building construction. The owner or contractor shall be required to provide this information before the plan review can proceed. Other plans that are in line for review may be given attention before the new information may be reviewed after it has been provided to the Building Department.

Please review this document to determine if you have enough information to design your project and provide adequate information to facilitate a plan review. Also, please consider using a design professional for assistance in your design and a construction professional for construction of your project. Any project with more than ten (10) occupants requires the plans to be sealed by a Colorado Registered Design Professional.

To provide for a more understandable plan and in order to determine compliance with the building, plumbing and mechanical codes, applicants are requested to review the following checklist prior to and during design.

TWO (2) SETS OF CONSTRUCTION DRAWINGS & TWO (2) SITE PLANS MUST BE SUBMITTED FOR ALL APPLICATIONS.

Plans to be included for a Building Permit must be on draft paper at least 18"x 24"" and drawn to scale.

Plans must include a floor plan, a concrete footing and foundation plan, elevations all sides with decks, balcony steps, hand rails and guard rails, windows and doors, including the finish grade and original grade line. A section showing in detail, from the bottom of the footing to the top of the roof, including re-bar,

anchor bolts, pressure treated plates, floor joists, wall studs and spacing, insulation, sheeting, house-rop, (which is required), siding or any approved building material. Engineered foundations may be required. Check with the Building Department.

A window schedule. A door schedule. A floor framing plan, a roofing framing plan, roof must be designed to withstand a 40 pound per square foot up to 7,000 feet in elevation, a 90 M.P.H. windspeed, wind exposure B or C, and a 36 inch frost depth.

All sheets need to be identified by number and indexed. All of the above requirements must be met or your plans will be returned.

All plans submitted must be in compliance with the 2003 IBC, IPC, IMC, IFGC, and IFC, 2006 IECC.

Applicants are required to indicate appropriately and to submit completed checklist at time of application for a permit:

1. Is a site plan included that identifies the location of the proposed structure, additions or other buildings, setback easements, and utility easements showing distances to the property lines from each corner of the proposed structure prepared by a licensed surveyor and has the surveyors signature and professional stamp on the drawing? Slopes of 30% or more on properties must be show on site plan. **(NOTE: Section 106.2)** Any site plan for the placement of any portion of a structure within 50 ft. of a property line and not within a previously surveyed building envelope on a subdivision final plat shall be prepared by a licensed surveyor and have the surveyors signature and professional stamp on the drawing. Any structure to be built within a building envelope of a lot shown on a recorded subdivision plat, shall include a copy of the building envelope as it is shown on the final plat with the proposed structure located within the envelope.
Yes

2. Does the site plan when applicable include the location of the I.S.D.S. (Individual Sewage Disposal System) and distances to the property lines, wells (on subject property and adjacent properties), streams or water courses? This information must be certified by a licensed surveyor with their signature and professional stamp on the design.
Yes _____ Not necessary for this project

3. Does the site plan indicate the location and direction of the State, County or private road accessing the property?
Yes

4. Have you provided any **RESOLUTIONS** and/ or **LAND USE PERMIT(S)** associated with this property?
Yes _____ if Yes please provide a COPY. No

5. Is the I.S.D.S. (Individual Sewage Disposal System) designed, stamped and signed by a Colorado Registered Engineer?
Yes _____ Not necessary for this project

6. Are the plans submitted for application review **construction drawings** and not drawings that are stamped or marked identifying them as "Not for construction, for permit issuance only", "Approval drawings only", "For permit issuance only" or similar language?

Yes _____ Not necessary for this project

7. Do the plans include a foundation plan indicating the size, location and spacing of all reinforcing steel in accordance with the building code or per stamped engineered design?

Yes Not necessary for this project _____

8. If the building is a pre-engineered structure, is there a stamped, signed engineered foundation plan for this building?

Yes _____ Not necessary for this project

9. Do the plans indicate the location and size of ventilation openings for under floor crawl spaces and the clearances required between wood and earth?

Yes _____ Not necessary for project

10. Do the plans indicate the size and location of the ventilation openings for the attic, roof joist spaces and soffits?

Yes _____ Not necessary for this project

11. Do the plans include design loads as required under the IBC or IRC for roof snowloads, (a minimum of 40 pounds per square foot in Garfield County)?

Yes _____ Not necessary for this project

12. Do the plans include design loads as required for floor loads under the IBC or IRC?

Yes _____ Not necessary for this project

13. Does the plan include a building section drawing indicating foundation, wall, floor, and roof construction?

Yes Not necessary for this project

14. Is the wind speed and exposure design included in the plan?

Yes _____ Not necessary for this project

15. Does the building section drawing include size and spacing of floor joists, wall studs, ceiling joists, roof rafters or joists or trusses?

Yes _____ Not necessary for this project

16. Does the building section drawing or other detail include the method of positive connection of all columns and beams?

Yes _____ Not necessary for this project

17. Does the elevation plan indicate the height of the building or proposed addition from the **undisturbed grade** to the midpoint between the ridge and eave of a gable or shed roof or the top of a flat roof?
(Check applicable zone district for building height maximum)
Yes _____ Not necessary for this project
18. Does the plan include any stove or zero clearance fireplace planned for installation including make and model and Colorado Phase II certifications or Phase II EPA certification?
Yes _____ Not necessary for this project
19. Does the plan include a masonry fireplace including a fireplace section indicating design to comply with the IBC or IRC?
Yes _____ Not necessary for this project
20. Does the plan include a window schedule or other verification that egress/rescue windows from sleeping rooms and/or basements comply with the requirements of the IBC or IRC?
Yes _____ Not necessary for this project
21. Does the plan include a window schedule or other verification that windows provide natural light and ventilation for all habitable rooms?
Yes _____ Not necessary for this project
22. Do the plans indicate the location of glazing subject to human impact such as glass doors, glazing immediately adjacent to such doors; glazing adjacent to any surface normally used as a walking surface; sliding glass doors; fixed glass panels; shower doors and tub enclosures and specify safety glazing for these areas?
Yes _____ Not necessary for this project
23. Do the plans include a complete design for all mechanical systems planned for installation in this building?
Yes No _____ Not necessary for this project _____
24. Have all areas in the building been accurately identified for the intended use? (Occupancy as identified in the IBC Chapter 3)
Yes Not necessary for this project _____
25. Does the plan indicate the quantity, form, use and storage of any hazardous materials that may be in use in this building?
Yes _____ Not necessary for this project
26. Is the location of all natural and liquid petroleum gas furnaces, boilers and water heaters indicated on the plan?

Yes _____ Not necessary for this project

27. Do the plans indicate the location and dimension of restroom facilities and if more than four employees and both sexes are employed, facilities for both sexes?

Yes Not necessary for this project _____

28. Do the plans indicate that restrooms and access to the building are handicapped accessible?

Yes Not necessary for this project _____

29. Have two (2) complete sets of construction drawings been submitted with the application?

Yes

30. Have you designed or had this plan designed while considering building and other construction code requirements?

Yes

31. Does the plan accurately indicate what you intend to construct and what will receive a final inspection by the Garfield County Building Department?

Yes

32. Do your plans comply with all zoning rules and regulations in the County related to your zone district? For corner lots see supplemental section 5.05.03 in the Garfield County Zoning Resolution for setbacks.

Yes

33. Do you understand that approval for design and/or construction changes are required **prior** to the implementation of these changes?

Yes

34. Do you understand that the Building Department will collect a "Plan Review" fee from you at the time of application and that you will be required to pay the "Permit" fee as well as any "Septic System" or "Road Impact" fees required, at the time you pick up your building permit?

Yes

35. Are you aware that you are required to call for all inspections required under the IBC including approval on a final inspection **prior** to receiving a Certificate of Occupancy and occupancy of the building?

Yes

36. Are you aware that the Permit Application must be signed by the Owner or a written authority be given for an Agent and that the party responsible for the project must comply with the Uniform Codes?

Yes

37. Are you aware that you must call in for an inspection by 3:30 the business day before the requested inspection in order to receive it the following business day? Inspections will be made between 7:30 a.m. and 3:30 p.m. Monday through Friday. Inspections are to be called in to 384-5003.
Yes
38. Are you aware that requesting inspections on work that is **not ready** or **not accessible** will result in a \$50.00 re-inspection fee?
Yes
39. Are you aware that prior to submittal of a building permit application you are required to show proof of a legal and adequate access to the site? This may include (but is not limited to) proof of your right to use a private easement/right of way; a County Road and Bridge permit; a Colorado Dept. of Highway Permit including a Notice to Proceed; a permit from the federal government or any combination. You can contact the Road & Bridge Department at 625-8601. See Phone book for other agencies
Yes
40. Do you understand that you will be required to hire a State of Colorado Licensed Electrician and Plumber to perform installations and hookups? The license number will be required at time of inspection.
Yes
41. Are you aware, that on the front of the building permit application you will need to fill in the Parcel/Schedule Number for the lot you are applying for this permit on prior to submittal of the building permit application? Your attention in this is appreciated.
Yes
42. Do you know that the local fire district may require you to submit plans for their review of fire safety issues?
Yes (Please check with the building department about this requirement)
43. Do you understand that if you are planning on doing any excavating or grading to the property **prior** to issuance of a building permit that you will be required to obtain a grading permit?
Yes _____ Not necessary for this project
44. Did an Architect seal the plans for your commercial project? State Law requires any commercial project with occupancy of more than 10 persons as per Section 1004 of the IBC to prepare the plans and specifications for the project.
Yes Not Necessary for this project _____

45. If you anticipate obtaining a water tap from the City of Rifle, please provide a letter indicating that the City will provide water service. No building permit application will be accepted without such a letter.

Yes _____

I hereby acknowledge that I have read, understand, and answered these questions to the best of my ability.



Signature

Date

Phone: 947-5525 (days); 379-9384 (evenings)

Project Name: Electrician Operations Center Remodel

Project Address: 3799 Hwy 82

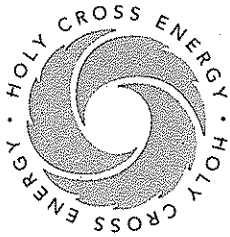
Note:

On any of these questions you may be required to provide this information. If required information is not supplied, delays in issuing the permit are to be expected. Work may not proceed without the issuance of the permit.

*If you have answered "Not necessary for this project" on any of the questions and it is determined by the Building Official that the information is necessary to review the application and plans to determine minimum compliance with the adopted codes, please expect the following:

- A. The application may be placed behind more recent applications for building permits in the review process and not reviewed until required information has been provided and the application rotates again to first position for review.
- B. Delay in issuance of the permit.
- C. Delay in proceeding with construction.

bpmnrepcommMar2009



3799 HIGHWAY 82 • P.O. BOX 2150
GLENWOOD SPRINGS, COLORADO 81602
(970) 945-5491 • FAX (970) 945-4081

September 15, 2008

To Whom It May Concern:

Please be advised that Andy Montoya, d/b/a Professional Construction Services, has been retained by Holy Cross Energy as Owner's Representative/Construction Manager for Phase 1 of Holy Cross's Glenwood Springs campus expansion. As such, Andy has the authority to sign various required permit applications for the construction of the project for Holy Cross.

Sincerely,
HOLY CROSS ENERGY

Tim Charlton,
General Manager of Support Services

TC:vw

Montoya

BUILDING PERMIT

GARFIELD COUNTY, COLORADO

INSPECTION WILL NOT BE MADE UNLESS
THIS CARD IS POSTED ON THE JOB

Date Issued 11/10/2009 Permit No. -1350

AGREEMENT

In consideration of the issuance of the permit, the applicant hereby agrees to comply with all laws and regulations related to the zoning, location; construction and erection of the proposed structure for which this permit is granted, and further agrees that if the above said regulations are not fully complied with in the zoning, location, erection and construction of the above described structure, the permit may then be revoked by notice from the County Building department and IMMEDIATELY BECOME NULL AND VOID.

Use Interior remodel - warehouse vehicle storage.
Address or Legal Description Hwy 82 G.S.
Owner Holy Cross Energy Contractor FCI Constructors
Building Permit Type Commercial

This Card Must Be Posted So It Is Plainly Visible From The Street Until Final Inspection

INSPECTION RECORD

Footing	Driveway
Foundation / Grouting	Insulation <u>na</u>
Underground Plumbing <u>WOMENS BATH RM. NORTH FLOOR 3-10-10TW</u>	Drywall
Rough Plumbing <u>3-26-10 J.W.</u>	Electric Final (by State Inspector) <u>OK By BF 5/20/10</u> (Prior to Final)
Rough Mechanical	Septic Final <u>na</u>
Gas Piping <u>3-9-10 J.W. N.FL. P1-1 REST OF GAS LINE 3-18-10 J.W.</u>	FINAL <u>Five Alarm Approved 6/11/10 Ronald L. Biggs (GSW)</u> <u>6/11/10 DM</u> (You Must Call For Final Inspection)
Electric Rough (by State Inspector) <u>OK Per State BF 4-7-10</u> (Prior to Framing)	Notes
Framing <u>4-14-10 DM</u> (to include Roof in place & Windows & Doors installed & Firestopping in place)	

THIS PERMIT IS NOT TRANSFERABLE

For Inspection Call 970-384-5003 Office 970-945-8212
108 8th Street, Suite 401 Glenwood Springs, Colorado 81601

DO NOT DESTROY THIS CARD

APPROVED Date 11/10/2009 By 79 by CE

PROTECT PERMIT FROM WEATHER DAMAGE
(DO NOT LAMINATE)

**COLORADO STATE ELECTRICAL BOARD
INSPECTION REPORT / CORRECTION NOTICE**

Date Received: 20-MAY-10

Permit Number: 681550

Contractor/HomeOwner: R & A ENTERPRISES OF WESTERN COLO INC
Address: 3799 Highway 82
Type of Inspection: Complete Final
Action: Accepted

Comments or Corrections:

Inspectors Name: Robert Fuller
Phone Number: 970-947-8902 **Date:** 20-MAY-10

COLORADO STATE ELECTRICAL BOARD
DEPARTMENT OF REGULATORY AGENCIES
1580 Logan St. Suite 550
Denver, Colorado 80203-1941
Phone: (303) 894-2985

Andy Schwaller

From: Doug Porterfield [dpadoug@qwestoffice.net]
Sent: Friday, May 28, 2010 11:32 AM
To: Andy Schwaller
Cc: 'Ralph Mitchell'; 'Andy Montoya'; 'JoeNiewohner'
Subject: Holy Cross Energy phase 3A Entry Lobby

Andy

Thank you for your time this morning in discussing some of the permit/code questions on the Holy Cross Energy Administrative Addition project. As requested, please consider this follow-up on the issue of the two story lobby not being designed as an atrium per section 404 of the 2003 IBC. This requirement was waived by Ken Smith of the Garfield County Building Department during design based on conversations that the renovation of the existing two story lobby did not create a less safe situation but created a higher level of life safety protection since the lobby would be equipped with automatic fire sprinklers based on the logic of Section 3410 Compliance Alternatives in the 2003 IBC. Additionally, there is no change in occupancy or existing egress patterns of the existing building.

Please let me know if you have any additional questions or comments.

Doug Porterfield
DPA Architectural Group
and
DPA Global Design
406 South Hyland Park Drive
Suite C
Glenwood Springs, CO 81601
970-945-4040
dpadoug@qwestoffice.net

ADDENDUM #1

Date: October 5, 2009

Project: Holy Cross Energy: Phase 2B, Electrical Operations Center Remodel

Project Number: 2009.01

Architect: DPA Architectural Group
406 South Hyland Park Drive
Suite C
Glenwood Springs, CO , 81601

This addendum form is a part of the Contract Documents and modifies the original Contract Documents, dated September 8,, 2009 as noted below. Acknowledge receipt of this addendum in the space provided on the Bid Form. Failure to do so may subject the bidder to disqualification.

Architectural

- 1. Added/Revised
 - 1.1 See attached specification section 08 70 00 Door Hardware.
 - 1.2 See attached drawing: Location and dimension of exterior column.
 - 1.3 See attached drawing: Location and annotation of existing columns to remain.
 - 1.4 See attached drawing: Revise countertop/sink at Women’s Restroom, plan and interior elevation.
 - 1.5 See attached drawing: Room Finish Schedule
 - 1.6 Material Note 05 50 00.65 Trench Grating to be:

1. Manufacturer:
Ohio Gratings, Inc.
5297 S. Southway S.W.
Canton, Ohio 216-477-6760

2. Product: Aluminum dovetail ADT series - 19 ADT ADA Compliant, plain surface with slip-not safety surface. Provide all clips, clamps and anchors as recommended by manufacturer.

Or McNichols 1-800-237-3820 – Equal product as specified above.

- 1.7 Delete all references to Soils report or Geotechnical report.

APPROVED

SUBJECT TO NOTED
EXCEPTIONS & INSPECTIONS
GARFIELD COUNTY
BUILDING DEPARTMENT

Date 11/5/09 By KHS

FIELD COPY

NO INSPECTION WITHOUT
THESE PLANS ON SITE

page of

- 1.8 See attached drawing: Revised elevation and detail reference.
- 1.9 See attached drawing: Detail 4/A2.3.
- 1.10 See attached drawing: Construction Phasing drawing

Structural

- 2. Added/Revised
 - 2.1 See attached drawing: Detail 13/S4.1

Mechanical/Plumbing/Electrical

- 3. Added/Revised
 - 3.1 Added Specification Section 13852, Digital Addressable Fire Alarm System.

End of Addendum

SECTION 08 71 00

FINISH HARDWARE

PART 1 - GENERAL

1.1 SUMMARY:

A. Section Includes: Finish Hardware for door openings, except as otherwise specified herein.

1. Door hardware for steel (hollow metal) doors.
2. Door hardware for aluminum doors.
3. Door hardware for wood doors.
4. Door hardware for other doors indicated.
5. Keyed cylinders as indicated.

B. Intent of Hardware Groups

1. Should items of hardware not definitely specified be required for completion of the Work, furnish such items of type and quality comparable to adjacent hardware and appropriate for service required.
2. Where items of hardware aren't definitely or correctly specified, are required for completion of the Work, a written statement of such omission, error, or other discrepancy to Architect, prior to date specified for receipt of bids for clarification by addendum; or, furnish such items in the type and quality established by this specification, and appropriate to the service intended.

C. Allowances

1. Refer to Division 1 for allowance amount and procedures.

D. Alternates

1. Refer to Division 1 for Alternates and procedures.

1.2 SUBSTITUTIONS:

A. Comply with Division 1.

1.3 SUBMITTALS:

A. Comply with Division 1.

B. Special Submittal Requirements: Combine submittals of this Section with Sections listed below to ensure the "design intent" of the system/assembly is understood and can be reviewed together.

C. Product Data: Manufacturer's specifications and technical data including the following:

1. Detailed specification of construction and fabrication.
2. Manufacturer's installation instructions.
3. Wiring diagrams for each electric product specified. Coordinate voltage with electrical before submitting.
4. Submit 6 copies of catalog cuts with hardware schedule.

- D. Shop Drawings - Hardware Schedule: Submit 6 complete reproducible copy of detailed hardware schedule in a vertical format.
1. List groups and suffixes in proper sequence.
 2. Completely describe door and list architectural door number.
 3. Manufacturer, product name, and catalog number.
 4. Function, type, and style.
 5. Size and finish of each item.
 6. Mounting heights.
 7. Explanation of abbreviations and symbols used within schedule.
 8. Detailed wiring diagrams, specially developed for each opening, indicating all electric hardware, security equipment and access control equipment, and door and frame rough-ins required for specific opening.
- E. Templates: Submit templates and "reviewed Hardware Schedule" to door and frame supplier and others as applicable to enable proper and accurate sizing and locations of cutouts and reinforcing.
1. Templates, wiring diagrams and "reviewed Hardware Schedule" of electrical terms to electrical for coordination and verification of voltages and locations.
- F. Samples: (If requested by the Architect)
1. 1 sample of Lever and Rose/Escutcheon design, (pair).
 2. 3 samples of metal finishes
- G. Contract Closeout Submittals: Comply with Division 1 including specific requirements indicated.
1. Operating and maintenance manuals: Submit 3 sets containing the following.
 - a. Complete information in care, maintenance, and adjustment, and data on repair and replacement parts, and information on preservation of finishes.
 - b. Catalog pages for each product.
 - c. Name, address, and phone number of local representative for each manufacturer.
 - d. Parts list for each product.
 2. Copy of final hardware schedule, edited to reflect, "As installed".
 3. Copy of final keying schedule
 4. As installed "Wiring Diagrams" for each piece of hardware connected to power, both low voltage and 110 volts.
 5. One set of special tools required for maintenance and adjustment of hardware, including changing of cylinders.

1.4 QUALITY ASSURANCE

- A. Comply with Division 1.
1. Statement of qualification for distributor and installers.
 2. Statement of compliance with regulatory requirements and single source responsibility.
 3. Distributor's Qualifications: Firm with 3 years experience in the distribution of commercial hardware.
 - a. Distributor to employ full time Architectural Hardware Consultants (AHC) for the purpose of scheduling and coordinating hardware and establishing keying schedule.

- b. Hardware Schedule shall be prepared and signed by an AHC.
 - 4. Installer's Qualifications: Firm with 3 years experienced in installation of similar hardware to that required for this Project, including specific requirements indicated.
 - 5. Regulatory Label Requirements: Provide testing agency label or stamp on hardware for labeled openings.
 - a. Provide UL listed hardware for labeled and 20 minute openings in conformance with requirements for class of opening scheduled.
 - b. Underwriters Laboratories requirements have precedence over this specification where conflict exists.
 - 6. Single Source Responsibility: Except where specified in hardware schedule, furnish products of only one manufacturer for each type of hardware.
- B. Review Project for extent of finish hardware required to complete the Work. Where there is a conflict between these Specifications and the existing hardware, notify the Architect in writing and furnish hardware in compliance with the Specification unless otherwise directed in writing by the Architect.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Packing and Shipping: Comply with Division 1.
 - 1. Deliver products in original unopened packaging with legible manufacturer's identification.
 - 2. Package hardware to prevent damage during transit and storage.
 - 3. Mark hardware to correspond with "reviewed hardware schedule".
 - 4. Deliver hardware to door and frame manufacturer upon request.
- B. Storage and Protection: Comply with manufacturer's recommendations.

1.6 PROJECT CONDITIONS:

- A. Coordinate hardware with other work. Furnish hardware items of proper design for use on doors and frames of the thickness, profile, swing, security and similar requirements indicated, as necessary for the proper installation and function, regardless of omissions or conflicts in the information on the Contract Documents.
- B. Review Shop Drawings for doors and entrances to confirm that adequate provisions will be made for the proper installation of hardware.

1.7 WARRANTY:

- A. Refer to Conditions of the Contract
- B. Manufacturer's Warranty:
 - 1. Closers: Ten years
 - 2. Exit Devices: Three Years
 - 3. Locksets & Cylinders: Three years
 - 4. All other Hardware: Two years.

1.8 OWNER'S INSTRUCTION:

- A. Instruct Owner's personnel in operation and maintenance of hardware units.

1.9 MAINTENANCE:

- A. Extra Service Materials: Deliver to Owner extra materials from same production run as products installed. Package products with protective covering and identify with descriptive labels. Comply with Division 1 Closeout Submittals Section.
1. Special Tools: Provide special wrenches and tools applicable to each different or special hardware component.
 2. Maintenance Tools: Provide maintenance tools and accessories supplied by hardware component manufacturer.
 3. Delivery, Storage and Protection: Comply with Owner's requirements for delivery, storage and protection of extra service materials.
- B. Maintenance Service: Submit for Owner's consideration maintenance service agreement for electronic products installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS:

- A. The following manufacturers are approved subject to compliance with requirements of the Contract Documents. Approval of manufacturers other than those listed shall be in accordance with Division 1.

<u>Item:</u>	<u>Manufacturer:</u>	<u>Approved:</u>
Hinges	Stanley	Bommer, Hager
Continuous Hinges	Select	Pemko
Locksets	Best	No Substitution
Cylinders	Best	No Substitution
Exit Devices	Precision	Von Duprin 98, Sargent 80
Power Supply	Precision	Von Duprin, Sargent
Closers	Stanley D-4550	LCN 4041, Norton 7500
Door Position Switch	Sentrol	or approved equal
Push/Pull Plates	Trimco	Hager, Rockwood
Push/Pull Bars	Trimco	Hager, Rockwood
Protection Plates	Trimco	Hager, Rockwood
Overhead Stops	ABH	Glynn Johnson
Door Stops	Trimco	Hager, Rockwood
Flush Bolts	Trimco	Hager, Rockwood
Coordinator & Brackets	Trimco	Hager, Rockwood
Key Cabinet	Telkee	MMF, Lund
Threshold & Gasketing	Pemko	National Guard, Hager

2.2 MATERIALS:

- A. Hinges:
1. Template screw hole locations
 2. Minimum of 2 permanently lubricated non-detachable bearings
 3. Equip with easily seated, non-rising pins
 4. Sufficient size to allow 180-degree swing of door
 5. Furnish hinges with five knuckles and flush bearings
 6. Provide hinge type as listed in schedule.
 7. Furnish 3 hinges per leaf to 7 foot 6 inch height. Add one for each additional 30 inches in height or fraction thereof.

8. Tested and approved by BHMA for all applicable ANSI Standards for type, size, function and finish
 9. UL10B listed for Fire
- B. Geared Continuous Hinges:
1. Tested and approved by BHMA for ANSI A156.26-1996 Grade 1
 2. Anti-spinning through fastener
 3. UL10B listed for 3 hour Fire rating
 4. Non-handed
 5. Lifetime warranty
 6. Provide Fire Pins for 3-hour fire ratings
 7. Sufficient size to permit door to swing 180 degrees
- C. Mortise Type Locks and Latches:
1. Tested and approved by BHMA for ANSI A156.13, Series 1000, Operational Grade 1, Extra-Heavy Duty, Security Grade 2 and be UL10C
 2. Fit ANSI A115.1 door preparation
 3. Functions and design as indicated in the hardware groups
 4. Solid, one-piece, 3/4-inch (19mm) throw, anti-friction latchbolt made of self-lubricating stainless steel
 5. Deadbolt functions shall have 1 inch (25mm) throw bolt made of hardened stainless steel
 6. Latchbolt and Deadbolt are to extend into the case a minimum of 3/8 inch (9.5mm) when fully extended
 7. Auxiliary deadlatch to be made of one piece stainless steel, permanently lubricated
 8. Provide sufficient curved strike lip to protect door trim
 9. Lever handles must be of forged or cast brass, bronze or stainless steel construction and conform to ANSI A117.1. Levers that contain a hollow cavity are not acceptable
 10. Lock shall have self-aligning, thru-bolted trim
 11. Levers to operate a roller bearing spindle hub mechanism
 12. Mortise cylinders of lock shall have a concealed internal setscrew for securing the cylinder to the lockset. The internal setscrew will be accessible only by removing the core, with the control key, from the cylinder body.
 13. Spindle to be designed to prevent forced entry from attacking of lever
 14. Provide locksets with 7-pin removable and interchangeable core cylinders
 15. Each lever to have independent spring mechanism controlling it
 16. Core face must be the same finish as the lockset
- D. Cylindrical Type Locks and Latchsets:
1. Tested and approved by BHMA for ANSI A156.2, Series 4000, Operational Grade 1, Extra-Heavy Duty, and be UL10C listed
 2. Fit modified ANSI A115.2 door preparation
 3. Locksets and cores to be of the same manufacturer to maintain complete lockset warranty
 4. Locksets to have anti-rotational studs that are thru-bolted
 5. Keyed lever shall not have exposed "keeper" hole
 6. Each lever to have independent spring mechanism controlling it
 7. 2-3/4 inch (70 mm) backset
 8. 9/16 inch (14 mm) throw latchbolt
 9. Outside lever sleeve to be seamless, of one-piece construction made of a hardened steel alloy
 10. Keyed lever to be removable only after core is removed, by authorized control key
 11. Provide locksets with 7-pin removable and interchangeable core cylinders

12. Hub, side plate, shrouded rose locking pin to be a one-piece casting with a shrouded locking lug.
 13. Locksets outside locked lever must withstand a minimum 1400 inch pounds of torque. In excess of that, a replaceable part will shear. Key from outside and inside lever will still operate lockset
 14. Core face must be the same finish as the lockset
 15. Functions and design as indicated in the hardware groups
- E. Exit Devices shall:
1. Tested and approved by BHMA for ANSI 156.3, Grade 1
 2. Provide a deadlocking latchbolt
 3. Non-fire rated exit devices shall have cylinder dogging.
 4. Touchpad shall be "T" style
 5. Exposed components shall be of architectural metals and finishes.
 6. Lever design shall match lockset lever design
 7. Provide strikes as required by application.
 8. Fire exit devices to be listed for UL10C
 9. UL listed for Accident Hazard
 10. Provide vandal resistant or breakaway trim
- F. Cylinders:
1. Provide the necessary cylinder housings, collars, rings & springs as recommended by the manufacturer for proper installation.
 2. Provide the proper cylinder cams or tail piece as required to operate all locksets and other keyed hardware items listed in the hardware sets.
 3. Coordinate and provide as required for related sections.
- G. Door Closers shall:
1. Tested and approved by BHMA for ANSI 156.4, Grade 1
 2. UL10C certified
 3. Closer shall have extra-duty arms and knuckles
 4. Conform to ANSI 117.1
 5. Maximum 2 7/16 inch case projection with non-ferrous cover
 6. Separate adjusting valves for closing and latching speed, and backcheck
 7. Provide adapter plates, shim spacers and blade stop spacers as required by frame and door conditions
 8. Full rack and pinion type closer with 1½" minimum bore
 9. Mount closers on non-public side of door, unless otherwise noted in specification
 10. Closers shall be non-handed, non-sized and multi-sized 1 through 6
- H. Door Bolts: Flush bolts for wood or metal doors.
1. Provide a set of Self Latching Automatic bolts BHMA 4.4 Type 25 for hollow metal label doors.
 2. Provide a set of Self Latching Automatic bolts BHMA 4.4 Type 25 at wood label doors.
 3. Provide Dust Proof Strike ANSI/BHMA 156.16 at doors with flush bolts without thresholds.
- I. Coordinator and Brackets: Provide a surface mounted coordinator when automatic bolts are used in the hardware set.
1. Coordinator shall comply with ANSI/BHMA A1156.3 Type 21A full width of the opening.

2. Provide mounting brackets for soffit applied hardware.
 3. Provide hardware preparation (cutouts) for latches as necessary.
- J. Kickplates: Provide with four beveled edges ANSI J102, 10 inches high by width less 2 inches on single doors and 1 inch on pairs of doors. Furnish oval-head countersunk screws to match finish.
- K. Push Plates: Provide with four beveled edges ANSI J301, .050 thickness, size as indicated in hardware set. Furnish oval-head countersunk screws to match finish.
- L. Pulls with plates: Provide with four beveled edges ANSI J301, .050 thickness Plates with ANSI J401 Pull as listed in hardware set. Provide proper fasteners for door construction.
- M. Push Pull Bars: Provide ANSI J504, .1" Dia. Pull and push bar model and series as listed in hardware set. Provide proper fasteners for door construction.
- N. Door Stops: Provide a dome floor or wall stop for every opening as listed in the hardware sets.
1. Wall stop and floor stop shall be wrought bronze, brass or stainless steel.
 2. Provide fastener suitable for wall construction.
 3. Coordinate reinforcement of walls where wall stop is specified.
 4. Provide dome stops where wall stops are not practical. Provide spacers or carpet riser for floor conditions encountered
- O. Seals: All seals shall be finished to match adjacent frame color. Seals shall be furnished as listed in schedule. Material shall be UL listed for labeled openings.
- P. Weatherstripping: Provide at head and jambs only those units where resilient or flexible seal strip is easily replaceable. Where bar-type weatherstrip is used with parallel arm mounted closers install weatherstrip first.
1. Weatherstrip shall be resilient seal of Neoprene, Polyurethane or Silicone
 2. UL10C Positive Pressure rated seal set when required.
- Q. Door Bottoms/Sweeps: Surface mounted or concealed door bottom where listed in the hardware sets.
1. Door seal shall be resilient seal of Sponge Neoprene or Silicone
 2. UL10C Positive Pressure rated seal set when required.
- R. Thresholds: Thresholds shall be aluminum beveled type with maximum height of ½" for conformance with ADA requirements. Furnish as specified and per details. Provide fasteners and screws suitable for floor conditions.
- S. Key Control: Provide one wall mounted key cabinet complete with hooks, index and tags.
- T. Silencers: Furnish silencers on all interior frames, 3 for single doors, 2 for pairs. Omit where any type of seals occur.
- 2.3 FINISH:
- A. Designations used in Schedule of Finish Hardware - 3.05, and elsewhere to indicate hardware finishes are those listed in ANSI/BHMA A156.18 including coordination with traditional U.S. finishes shown by certain manufacturers for their products

- B. Powder coat door closers to match other hardware, unless otherwise noted.
- C. Aluminum items shall be finished to match predominant adjacent material. Seals to coordinate with frame color.

2.4 KEYS AND KEYING:

- A. Provide keyed brass construction cores and keys during the construction period. Construction control and operating keys and core shall not be part of the Owner's permanent keying system or furnished in the same keyway (or key section) as the Owner's permanent keying system. Permanent cores and keys (prepared according to the accepted keying schedule) will be furnished to the Owner.
- B. Cylinders, removable and interchangeable core system: Best Standard 7-pin.
- C. Permanent keys and cores: Stamped with the applicable key mark for identification. These visual key control marks or codes will not include the actual key cuts. Permanent keys will also be stamped "Do Not Duplicate."
- D. Transmit Grand Masterkeys, Masterkeys and other Security keys to Owner by Registered Mail, return receipt requested.
- E. Furnish keys in the following quantities:
 - 1. 1 each Grand Masterkeys
 - 2. 4 each Masterkeys
 - 3. 2 each Change keys each keyed core
 - 4. 15 each Construction masterkeys
 - 5. 1 each Control keys
- F. The Owner, or the Owner's agent, will install permanent cores and return the construction cores to the Hardware Supplier. Construction cores and keys remain the property of the Hardware Supplier.
- G. Keying Schedule: Arrange for a keying meeting, and programming meeting with Architect Owner and hardware supplier, and other involved parties to ensure locksets and locking hardware, are functionally correct and keying and programming complies with project requirements. Furnish 3 typed copies of keying and programming schedule to Architect.
- H. Power Supply: PS160 Use with Electric locks or electric exit device trim a variety of applications including Electric Locking and Exit Alarm The power supply uses 120 VAC at 0.8 amp input. A 230 VAC at 0.3 ampere is available. The power shall be able to control up to (4) Delayed Egress Exit devices. The filtered and regulated output power is field selectable for 12 or 24 VDC at 2 amp.
 - 1. Fire Alarm release that accepts normally closed contact
 - 2. AC input is protected via a manually reset circuit breaker
 - 3. DC output is protected via an auto-reset fuse (PTC)
- I. Power Transfer: Power transfer device shall supplied in the electric hinge or continuous hinge. Secure and inconspicuous channel is to bring power from the frame to the door.
 - 1. Stanley electric hinge option "CE-54 (4 Wire).
 - 2. Select SL11-HD Series Hinge Concealed electric wires CTW (4,8 or 12) with removable transfer Panel "RP".

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verification of conditions: Examine doors, frames, related items and conditions under which Work is to be performed and identify conditions detrimental to proper and or timely completion.
 - 1. Do not proceed until unsatisfactory conditions have been corrected.

3.2 HARDWARE LOCATIONS:

- A. Mount hardware units at heights indicated in the following publications except as specifically indicated or required to comply with the governing regulations.
 - 1. Recommended Locations for Builder's Hardware for Standard Steel Doors and Frames, by the Door and Hardware Institute (DHI).
 - 2. NWWDA Industry Standard I.S.1.7, Hardware Locations for Wood Flush Doors.

3.3 INSTALLATION:

- A. Install each hardware item per manufacturer's instructions and recommendations. Do not install surface mounted items until finishes have been completed on the substrate. Set units level, plumb and true to line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.
- B. Conform to local governing agency security ordinance.
- C. ADA Standard: Conform to ANSI A117.1 for positioning requirements for disabled.
- D. Installed hardware using the manufacturers fasteners provided. Drill and tap all screw holes located in metallic materials. Do not use "Riv-Nuts" or similar products.

3.4 FIELD QUALITY CONTROL AND FINAL ADJUSTMENT

- A. Contractor/Installers, Field Services: After installation is complete, contractor shall inspect completed door openings on site to verify installation of hardware is complete and properly adjusted, in accordance with both the Contract Documents and final shop drawings.
 - 1. Check and adjust closers to ensure proper operation.
 - a. Adjust closer to complete full closing cycle in less than 4 to 6 seconds without abrupt change of speed between "Sweep" and "Latch" speeds.
 - b. Adjust "Backcheck" according to manufacturer's instructions.
 - c. Set exterior doors closers to have 8.5 lbs maximum pressure to open, interior non-rated at 5 lbs, rated openings at 12 lbs
 - 2. Check latchset, lockset, and exit devices are properly installed and adjusted to ensure proper operation.
 - a. Verify levers are free from binding.
 - b. Ensure latchbolts and dead bolts are engaged into strike and hardware is functioning.
 - 3. Report findings, in writing, to architect and hardware supplier outlining corrective actions and recommendations.

3.5 SCHEDULE OF FINISH HARDWARE:

Manufacturer List

<u>Code</u>	<u>Name</u>
BE	Best Access Systems
BY	By Others
PE	Pemko
PR	Precision
SE	Sentrol
ST	Stanley
TK	Telkee
TR	Trimco

Finish List

<u>Code</u>	<u>Description</u>
PC	Prime Coat
600	Primed for Painting
612	Satin Bronze, Clear Coated
BRZ	Powder Coat Bronze
US10	Dull Bronze

Option List

<u>Code</u>	<u>Description</u>
54	CONCEALED WIRES (4)
CD	CYLINDER DOGGING
CE	CONC. WIRES-USE WITH 18,54,56,58 SUFFIX
FL	Fire Exit Hardware
HC	Hurricane Code Device
B4E	BEVELED 4 EDGES
NRP	NON REMOVEABLE PIN HINGE
C-SUNK-KP	COUNTER SINKING OF KICK PLATES

Hardware Sets

SET #1			
2 Hinges	FBB168 4 1/2 X 4 1/2 NRP	US10	ST
1 Elect. Hinge	CE FBB168 4 1/2 X 4 1/2 54	US10	ST
1 Electro-mech Lock	45HW-7TDEU15H STD	612	BE
1 Door Closer	D-4550 CS	BRZ	ST
1 Power Supply	PS160		PR
1 Door Position Switch	1078 CW		SE
1 Weatherstrip	305 DR @ Head and Jambs		PE
1 Door Bottom	315 DN		PE
1 Threshold	171 A		PE
1 Card Reader	By Others		BY

NOTE: Operational Description: Card reader unlocks electric lock.

SET #2

3 Hinges	FBB168 4 1/2 X 4 1/2 NRP	US10	ST
1 Exit Device	HC 2103 X 4903A CD	612	PR
1 Rim Cylinder	1E-72 STD	612	BE
1 Mortise Cylinder	1E-74 STD	612	BE
1 Door Closer	D-4550 CS	BRZ	ST
1 Door Position Switch	1078 CW		SE
1 Weatherstrip	305 DR @ Head and Jambs		PE
1 Door Bottom	315 DN		PE
1 Threshold	171 A		PE

SET #3

3 Hinges	FBB168 4 1/2 X 4 1/2 NRP	US10	ST
1 Exit Device	HC 2103 X 4903A CD	612	PR
1 Rim Cylinder	1E-72 STD	612	BE
1 Mortise Cylinder	1E-74 STD	612	BE
1 Door Closer	D-4550 CS	BRZ	ST
1 Door Position Switch	1078 CW		SE
1 Weatherstrip	305 DR @ Head and Jambs		PE
1 Door Bottom	315 DN		PE
1 Threshold	171 A		PE

SET #100

5 Hinges	FBB179 4 1/2 X 4 1/2 NRP	US10	ST
1 Elect. Hinge	CE FBB179 4 1/2 X 4 1/2 54	US10	ST
1 Set Auto Flush Bolts	3820 X 3810	612	TR
1 Electro-mech Lock	45HW-7DEU15H STD	612	BE
1 Coordinator	3094B Series	PC	TR
2 Door Closer	D-4550 EDA	BRZ	ST
2 Kick Plate	KO050 10" x 1"LDW B4E C-SUNK-KP	612	TR
1 Wall Bumper	1270WV	612	TR
1 Floor Stop	1211	612	TR
2 Mounting Bracket	3095 or 3096 as Req.	PC	TR
1 Dustproof Strike	3910	612	TR
1 Power Supply	PS160		PR
2 Door Position Switch	1078 CW		SE
1 Astragal	Z Ast. By Door Mfg.	600	BY
1 Card Reader	By Others		BY
2 Door Silencers	1229A		TR

NOTE: Operational Description: Card reader unlocks electric lock.

SET #101

3 Hinges	FBB179 4 1/2 X 4 1/2 NRP	US10	ST
1 Lockset	93K-7D15DS3 STD	612	BE
1 Door Closer	D-4550 S	BRZ	ST
1 Smoke Seal	S88 D x Head & Jambs		PE

SET #102

6 Hinges	FBB179 4 1/2 X 4 1/2 NRP	US10	ST
1 Set Auto Flush Bolts	3820 X 3810	612	TR
1 Lockset	93K-7D15DS3 STD	612	BE
1 Coordinator	3094B Series	PC	TR
2 Door Closer	D-4550 EDA	BRZ	ST
2 Kick Plate	KO050 10" x 1"LDW B4E C-SUNK-KP	612	TR
2 Wall Bumper	1270WV	612	TR
2 Mounting Bracket	3095 or 3096 as Req.	PC	TR
1 Dustproof Strike	3910	612	TR
1 Astragal	Z Ast. By Door Mfg.	600	BY
1 Smoke Seal	S88D @ Head & Jambs		PE

SET #103

6 Hinges	FBB168 4 1/2 X 4 1/2 NRP	US10	ST
1 Removable Mullion	FLKR822	600	PR
1 Exit Device	FL 2108 X V4908A	612	PR
1 Exit Device	FL 2101	612	PR
2 Rim Cylinder	1E-72 STD	612	BE
2 Door Closer	D-4550 EDA	BRZ	ST
2 Kick Plate	KO050 10" x 1"LDW B4E C-SUNK-KP	612	TR
2 Floor Stop	1211	612	TR
1 Smoke Seal	S88D @ Head & Jambs		PE
1 Mullion Gasketing	5110 BL		PE

SET #104

1 Door Position Switch	2200 Series Mounting as Req.		SE
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NOTE: Overhead Sectional Door with power operator and hardware by overhead door Mfg.

SET #105

3 Hinges	FBB179 4 1/2 X 4 1/2 NRP	US10	ST
1 Lockset	93K-7D15DS3 STD	612	BE
1 Door Closer	D-4550 EDA	BRZ	ST
1 Wall Bumper	1270WV	612	TR
3 Door Silencers	1229A		TR

SET #106

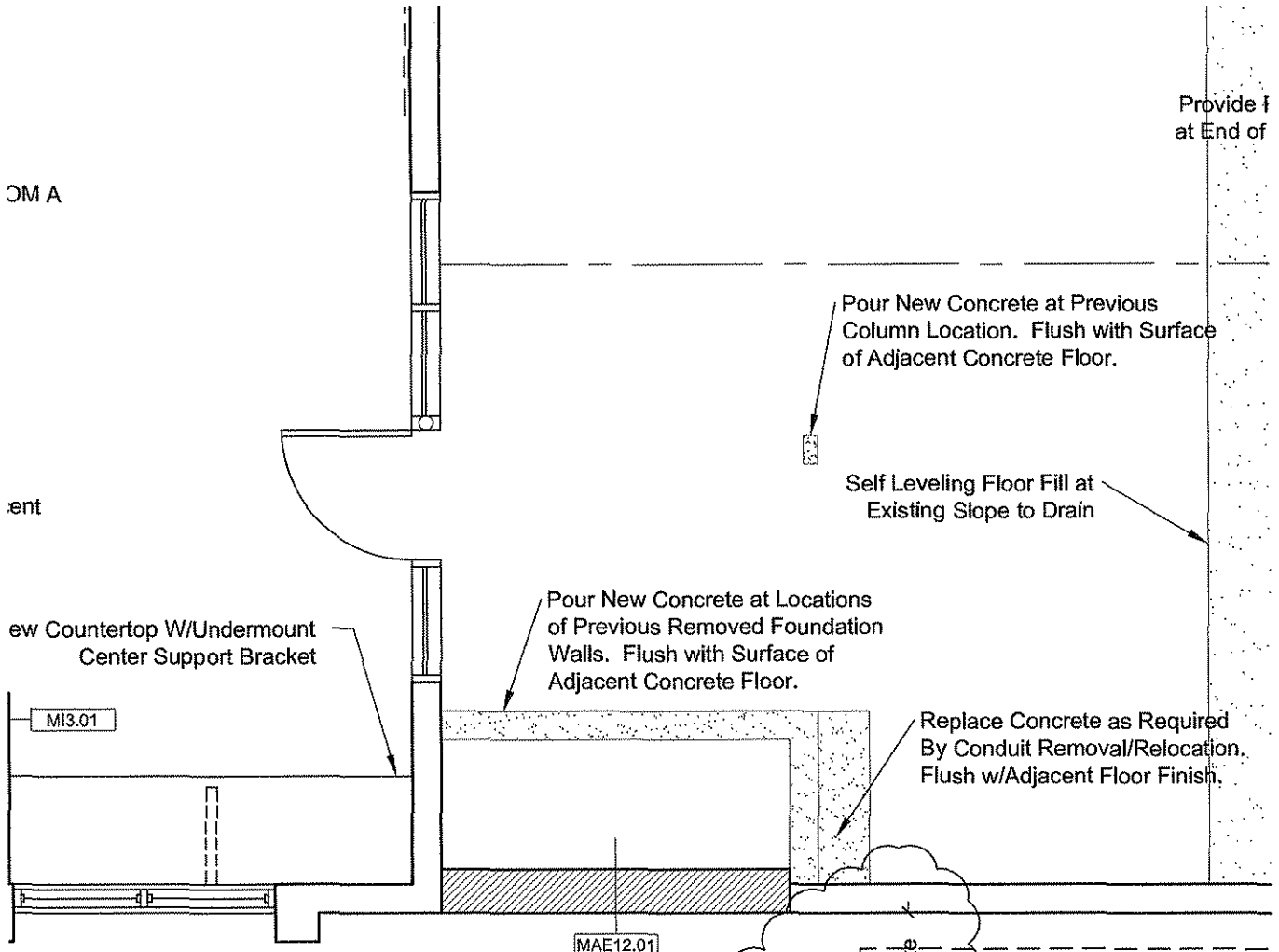
3 Hinges	FBB179 4 1/2 X 4 1/2	US10	ST
1 Pull Plate	1017-3B	612	TR
1 Door Closer	D-4550 STD W/PA BRKT	BRZ	ST
1 Kick Plate	KO050 10" X 2"LDW B4E C-SUNK-KP	612	TR
1 Push Plate	1001-11	612	TR
1 Wall Bumper	1270WV	612	TR
3 Door Silencers	1229A		TR

SET #107

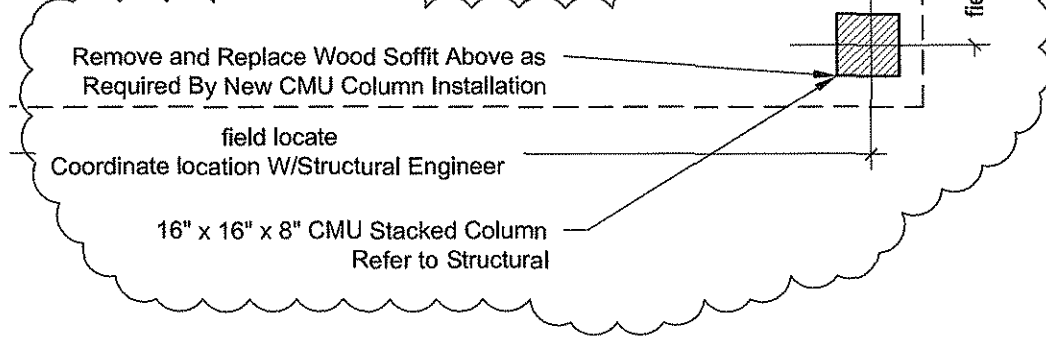
1 Key Cabinet	RWC-75-S		TK
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Opening List


<u>Opening</u>	<u>Hdw Set</u>	<u>Opening Label</u>
100A	100	
105A	101	
106A	105	
107A	106	
108A	105	
109A	106	
110A	2	
110B	104	
110C	104	
110D	104	
111A	102	
113A	3	
113B	103	180
116A	1	
MISC	107	

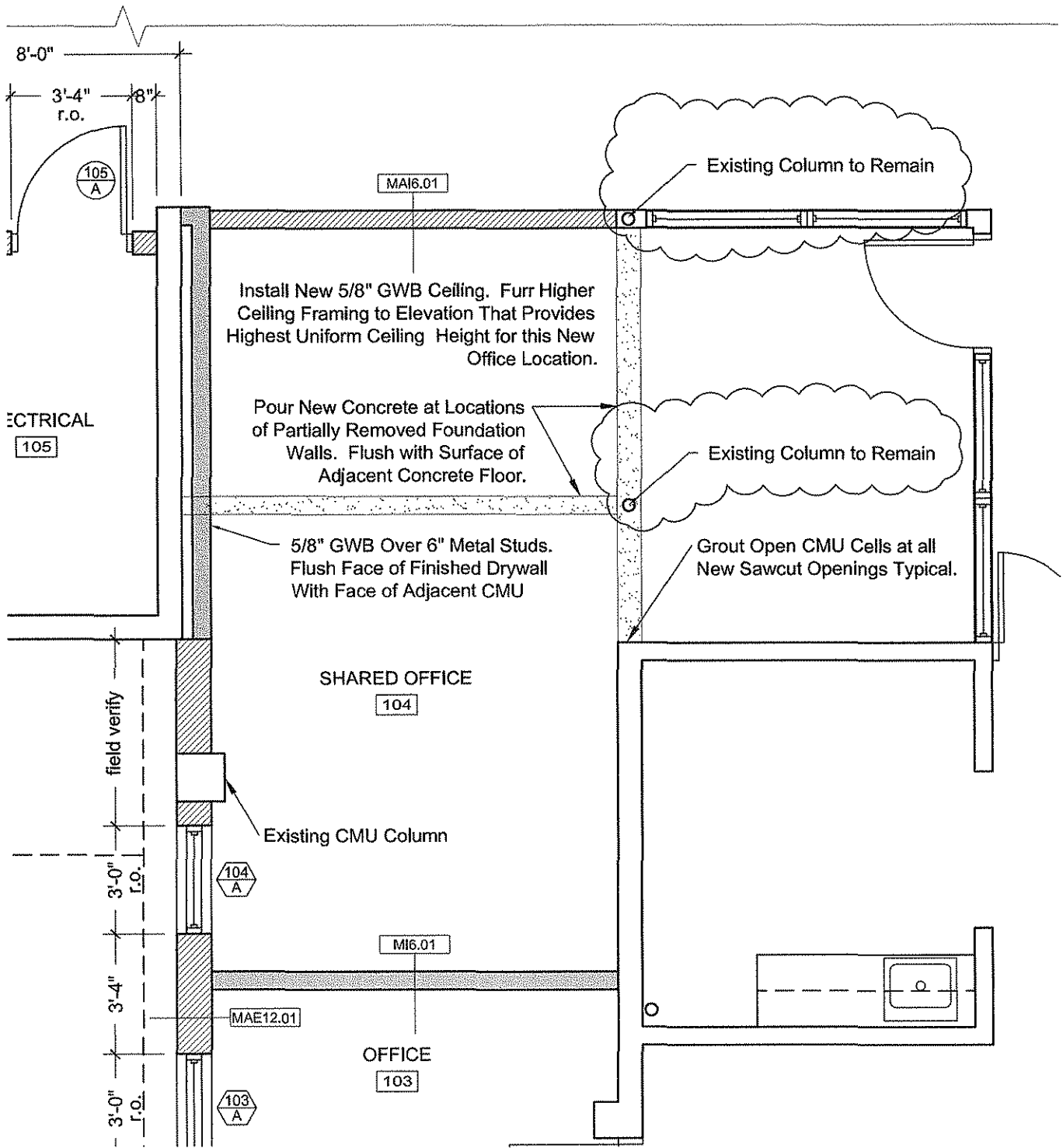


8" Concrete Block
 ing Window R.O.



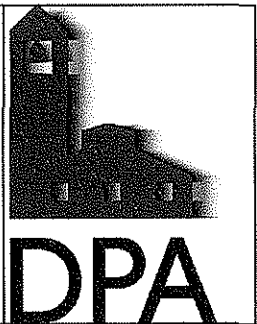
Wall Type Key:
 6", 8" or 12" CMU
 6" Metal Studs

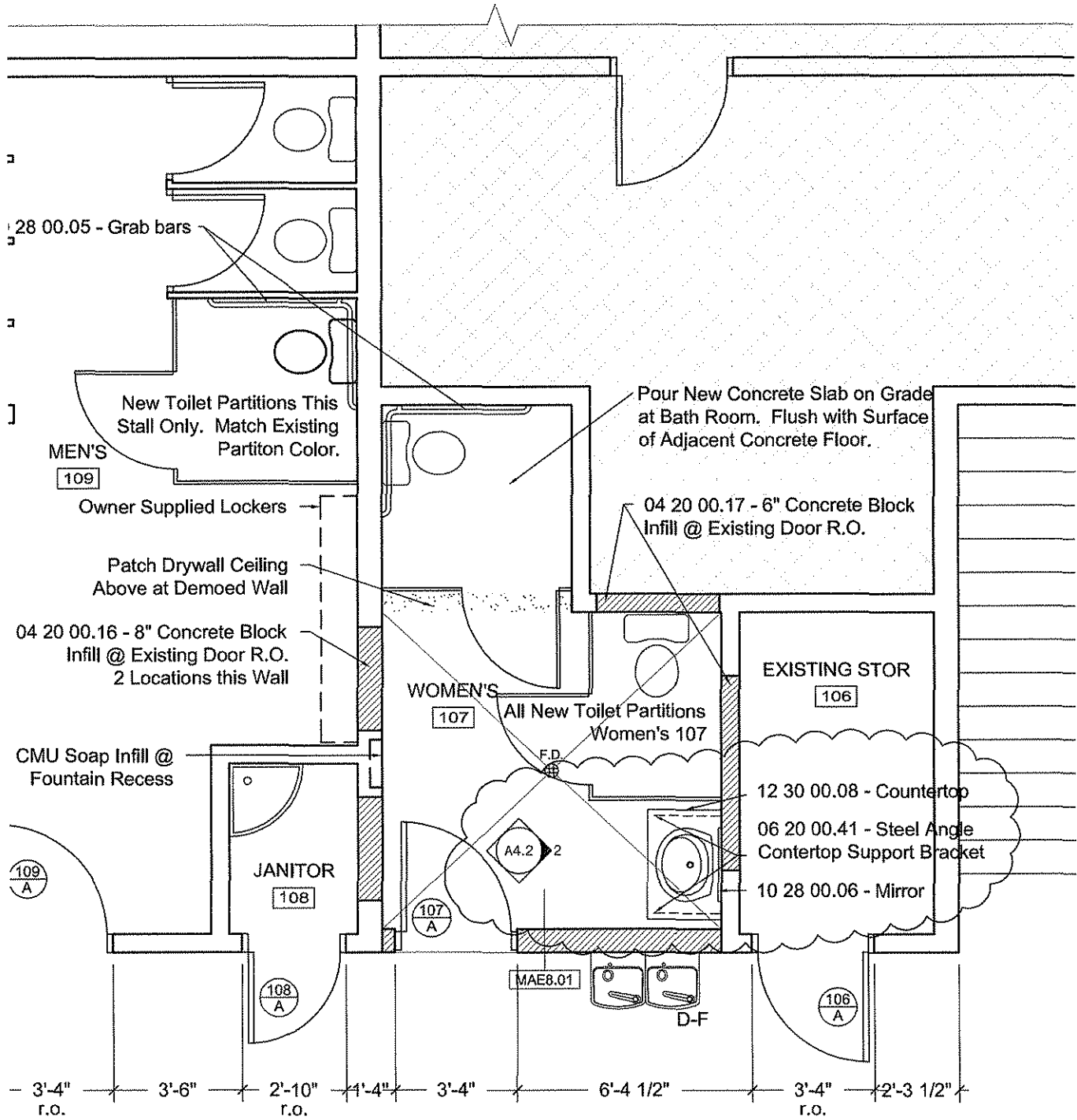
<p>PROJECT: HCE PHASE 2B ELEC. OPS. REMODEL GWS, CO DPA JOB # 2009.04 DESCRIPTION: PORTION OF A1.2 REMODEL PLAN SCALE: 1/4"=1'-0"</p>	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left;">ISSUE</th> <th style="text-align: left;">DATE</th> </tr> </thead> <tbody> <tr> <td>ADDENDUM #1</td> <td>10-05-09</td> </tr> <tr> <td> </td> <td> </td> </tr> <tr> <td> </td> <td> </td> </tr> <tr> <td> </td> <td> </td> </tr> <tr> <td> </td> <td> </td> </tr> <tr> <td> </td> <td> </td> </tr> <tr> <td> </td> <td> </td> </tr> </tbody> </table>	ISSUE	DATE	ADDENDUM #1	10-05-09													
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PROJECT:
HCE PHASE 2B ELEC. OPS. REMODEL
GWS, CO
 DPA JOB # 2009.04
 DESCRIPTION:
PORTION OF A2.2 REMODEL PLAN
 SCALE: 1/4"=1'-0"

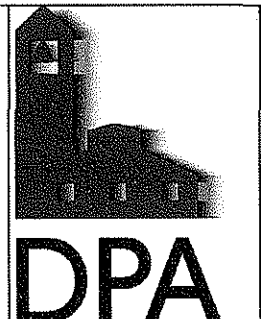
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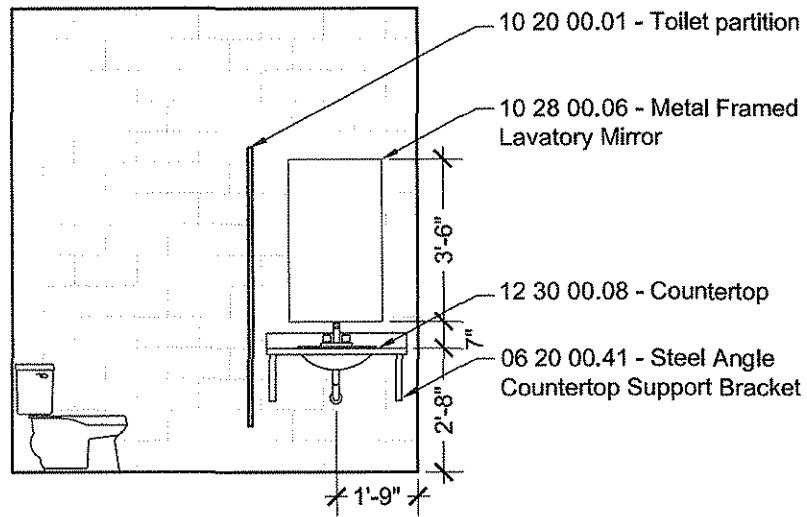





PROJECT:
HCE PHASE 2B ELEC. OPS. REMODEL
GWS, CO
 DPA JOB # 2009.04
 DESCRIPTION:
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SCALE: 1/4"=1'-0"

ISSUE	DATE
ADDENDUM #1	10-05-09

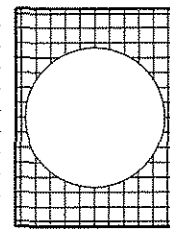




2 **WOMEN'S INTERIOR ELEVATION**
 1/4"=1'-0"

<p>PROJECT : HCE PHASE 2B ELEC. OPS. REMODEL GWS, CO DPA JOB # 2009.04 DESCRIPTION : NEW A4.2 INTERIOR ELEVATION SCALE: 1/4"=1'-0"</p>	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left;">ISSUE</th> <th style="text-align: left;">DATE</th> </tr> </thead> <tbody> <tr> <td>ADDENDUM #1</td> <td>10-05-09</td> </tr> <tr> <td> </td> <td> </td> </tr> <tr> <td> </td> <td> </td> </tr> <tr> <td> </td> <td> </td> </tr> <tr> <td> </td> <td> </td> </tr> <tr> <td> </td> <td> </td> </tr> </tbody> </table>	ISSUE	DATE	ADDENDUM #1	10-05-09											
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File Path: \\laser\redwin\010209.01 Phase 2B - Dispatch-Archie Baker Redwood, Unready\Phase 2B-Detailed Roomwds\2009.01-01-1-Interior-Finish-schedule.dwg
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ROOM FINISH SCHEDULE

ROOM #	ROOM NAME	FLOOR	WALLS								CEILING			BASE	INSULATION ABOVE CEILING	REMARKS
			NORTH		EAST		SOUTH		WEST		MAT.	FIN.	HEIGHT			
			MAT.	FIN.	MAT.	FIN.	MAT.	FIN.	MAT.	FIN.						
100	CREW ROOM A				NEW CMU	P	DW	P	CMU R.O.	P						
100-A	I.T. CLOSET		DW	P			DW	P	DW	P						
101	CREW ROOM B				CMU R.O.	P										
103	OFFICE		DW	P					CMU / DW	P	DW	P				
104	SHARED OFFICE		CMU	P			DW	P	CMU / DW	P	DW	P				
105	ELECTRICAL		CMU	P					CMU	P	DW	P				
106	EXISTING STORAGE				NEW CMU	P		CMU R.O.	P	NEW CMU	P					
107	WOMEN'S REST ROOM	AFC	NEW CMU	P				NEW CMU	P	NEW CMU	P	DW	P			
108	JANITOR				NEW CMU	P		CMU R.O.	P							
109	MEN'S REST ROOM				NEW CMU	P		CMU R.O.	P							
110	VEHICLE STORAGE #2	AFC								NEW CMU	P					
111	STORAGE		NEW CMU	P	CMU	P	CMU	P			STL	P	VARIES			
112	TRAILER STORAGE		CMU	P							STL	P	VARIES			
113	VESTIBULE				NEW CMU	P										
114	FABRICATION BAYS		NEW CMU	P												
115	VEHICLE STORAGE #1						CMU / WD	P								
116	CREW FOREMAN	AFC	CMU	P	CMU	P					LAY	AC	10'-0"	YES	R-30 Minimum	

AFC= ABRASIVE FLOOR COATING	LAY= LAY IN CEILING	S= SEALED MASONRY
ASF= ALUMINUM STORE FRONT	MA= EXPOSED MASONRY	STL= STEEL/RE-STRUCTURAL
AC= ACOUSTIC TILE	MRDW= MOISTURE RESISTANT DRYWALL	VAR= VARIES
CMU= CONCRETE MASONRY UNIT	P= PAINT	VCT= VINYL COMPOSITE TILE
CPT= CARPET W/ PAD	RB= RUBBER BASE	VFA= VINYL FACE ACOUSTIC TILE
DW= DRYWALL	RTF= RESILIENT TILE FLOOR	FF= FACTORY PAINTED FINISH
FRP= FIBER REINF. PANEL	SC= SEALED CONCRETE	WD= PLYWOOD & WOOD FRAMING

Painting General Note:

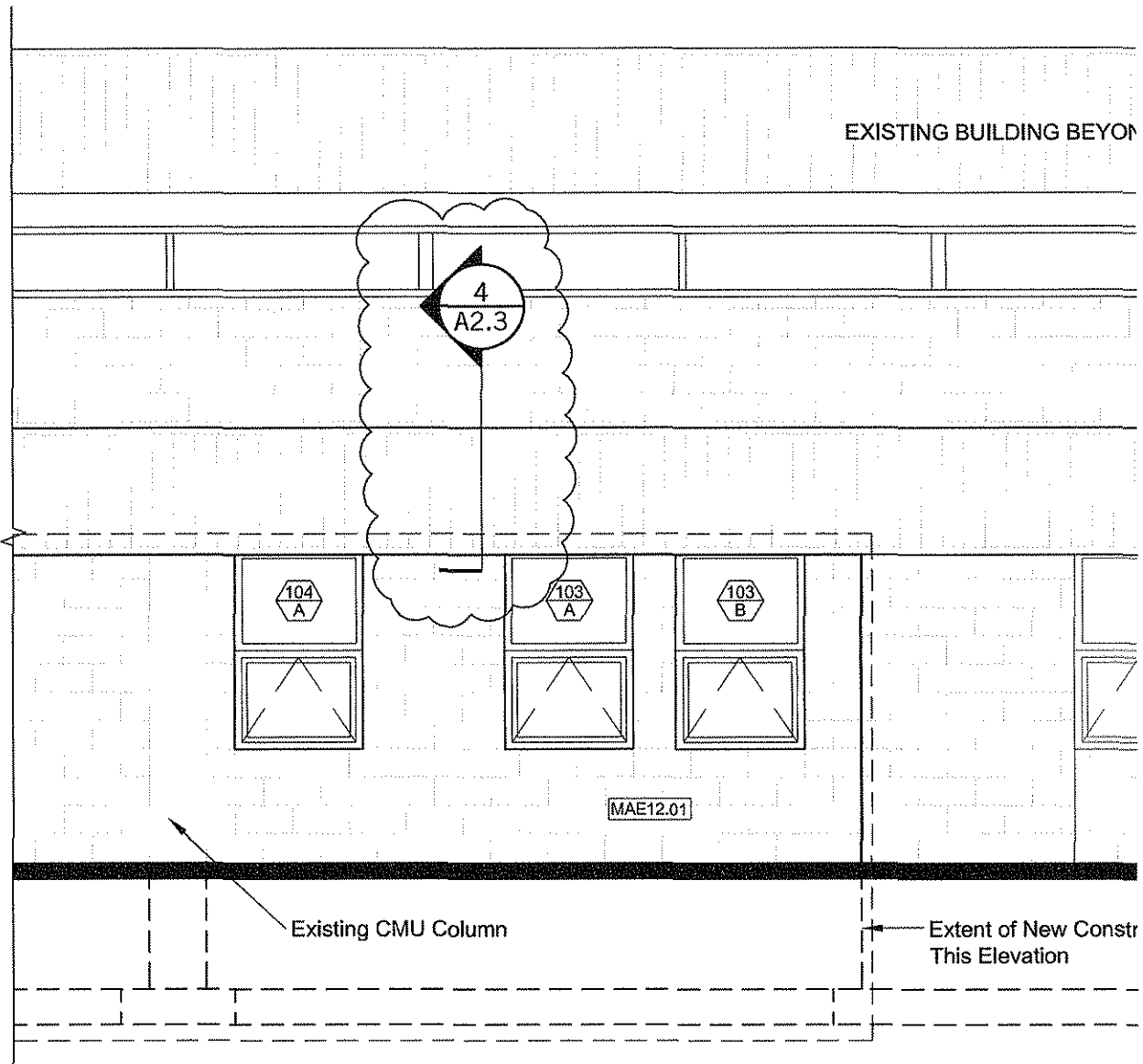
1. New conduit and piping mounted on painted walls to be painted wall color.
2. New conduit and piping mounted on steel roof/ceiling joists or routed through open roof/ceiling assembly to be left unpainted.
3. New concrete sections/patches of interior floor to be finished with Abrasive Floor Coating


1
FINISH SCHEDULE
 NTS

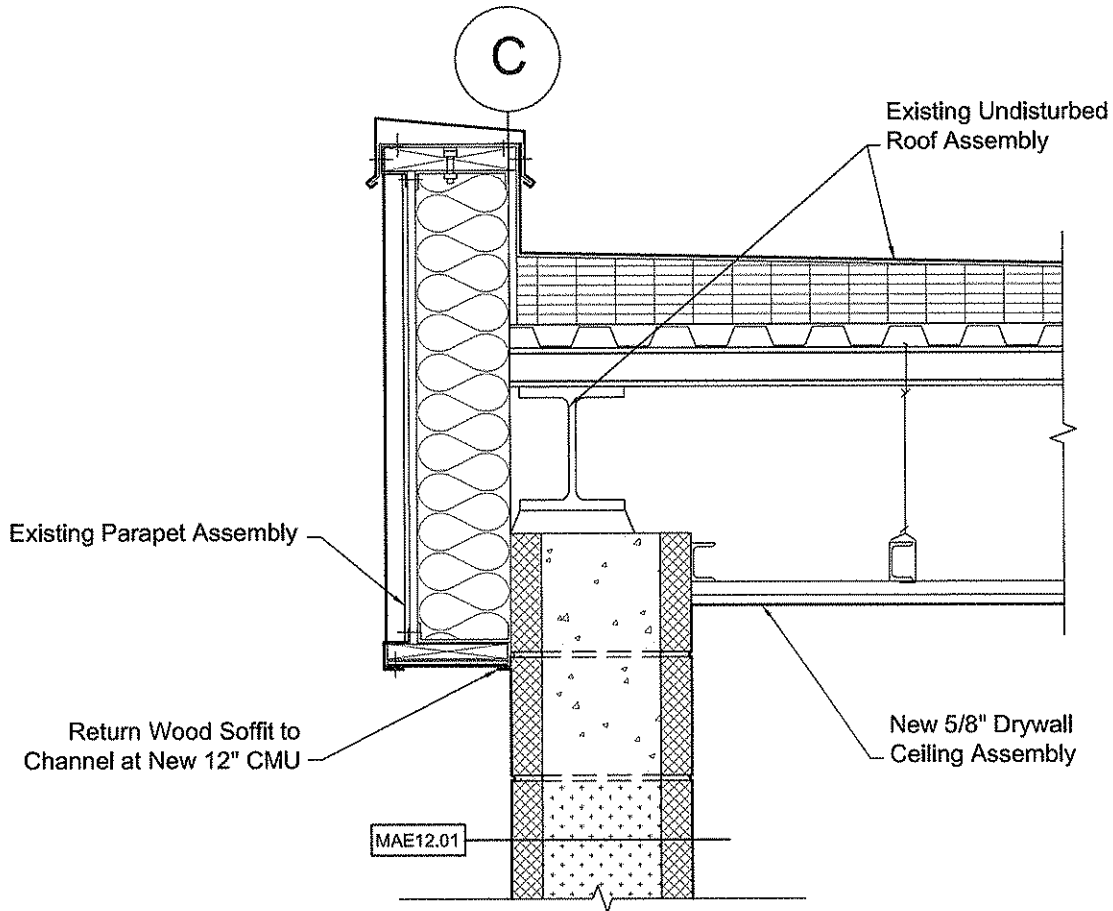
HOLY CROSS ENERGY
 PHASE 2B ELECTRICAL OPERATIONS REMODEL
 Holy Cross Energy
 3799 Highway 82
 Glenwood Springs, Colorado 81601
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Revisions	
Addendum #1	10/11/09

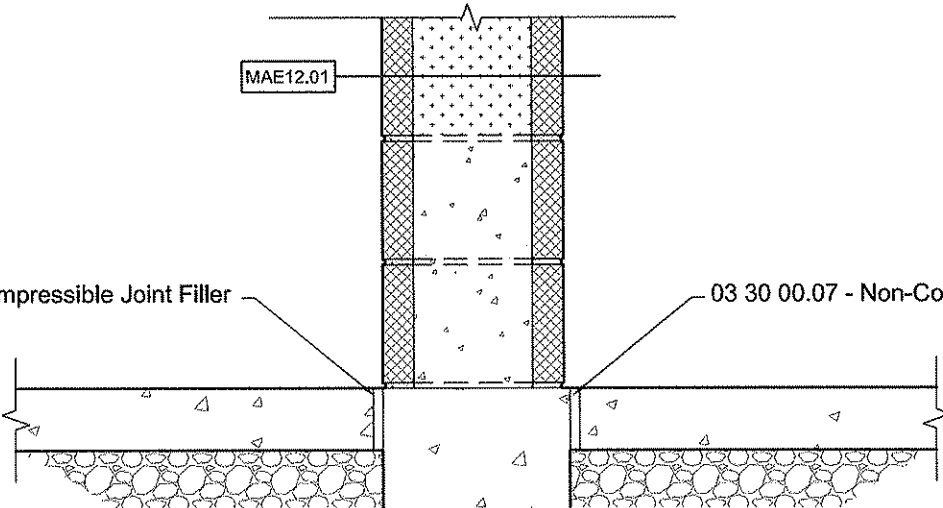
Project Number	2009.01
Date	10/11/09
Drawn By	RAM
Checked By	
Approved By	



<p>PROJECT: HCE PHASE 2B ELEC. OPS. REMODEL GWS, CO DPA JOB # 2009.04 DESCRIPTION: PORTION OF 1/A2.3 SCALE: 1/4"=1'-0"</p>	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left;">ISSUE</th> <th style="text-align: left;">DATE</th> </tr> </thead> <tbody> <tr> <td>ADDENDUM #1</td> <td>10-05-09</td> </tr> <tr> <td> </td> <td> </td> </tr> <tr> <td> </td> <td> </td> </tr> <tr> <td> </td> <td> </td> </tr> <tr> <td> </td> <td> </td> </tr> <tr> <td> </td> <td> </td> </tr> </tbody> </table>	ISSUE	DATE	ADDENDUM #1	10-05-09											
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MAE12.01

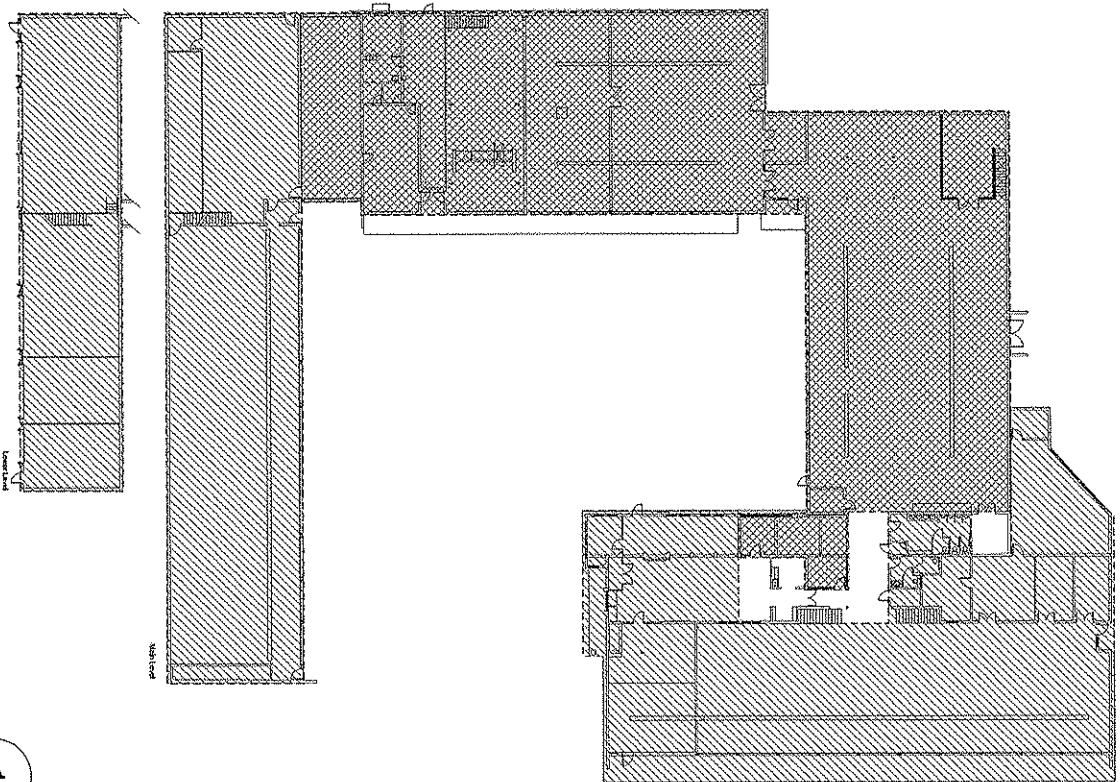


MAE12.01

00.07 - Non-Compressible Joint Filler

03 30 00.07 - Non-Compressible Joint Filler

PROJECT: HCE PHASE 2B ELEC. OPS. REMODEL GWS, CO DPA JOB # 2009.04 DESCRIPTION: 4/A2.3 WALL SECTION SCALE: 1/4"=1'-0"		<table border="1"> <thead> <tr> <th>ISSUE</th> <th>DATE</th> </tr> </thead> <tbody> <tr> <td>ADDENDUM #1</td> <td>10-05-09</td> </tr> <tr> <td> </td> <td> </td> </tr> <tr> <td> </td> <td> </td> </tr> <tr> <td> </td> <td> </td> </tr> <tr> <td> </td> <td> </td> </tr> <tr> <td> </td> <td> </td> </tr> </tbody> </table>	ISSUE	DATE	ADDENDUM #1	10-05-09											
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Fall 2009 Renovation Key
Includes Lighting and Heating Upgrades

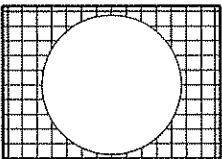


Spring 2010 Renovation key
Includes Lighting and Heating Upgrades

1

CONSTRUCTION PHASING DIAGRAM
NTS

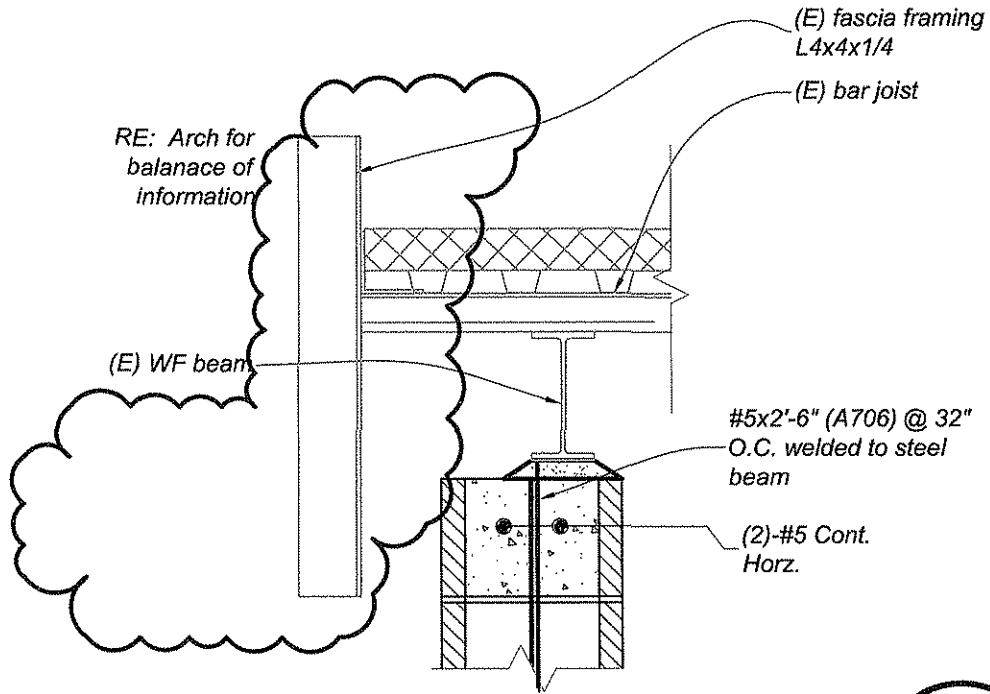
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HOLY CROSS ENERGY
PHASE 2B ELECTRICAL OPERATIONS REMODEL
Holy Cross Energy
3799 Highway 82
Glenwood Springs, Colorado 81601
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DATE: 10/20/09
DRAWING NO: 21-1000-001
PROJECT NO: 09-001

Project Number: 09001
Date: 10/20/09
Designer: RNL
Checker: RNL
Approver: RNL



NEW EXTERIOR INFILL WALL

13

SCALE: 1" = 1'-0"

File: F19

S4.1

**ELECTRICAL OPERATIONS
REMODEL**

HOLY CROSS ENERGY
3799 HIGHWAY 82, GWS, CO

PROJECT NO: 09-266

TITLE: 13/S4.1
Clarify Parapet Location
Addendum 1

SCALE: 1/8"=1'-0"



GREENWOOD Engineers • Constructors
STRUCTURAL 2425 S. Grand, Ste 102,
AND CIVIL INC. GWS, CO 81601
(970) 928-0135
Fax (970) 928-9804

DATE: 09/30/09

SHEET NO: **S-SK01**

SECTION 13852 - DIGITAL, ADDRESSABLE FIRE-ALARM SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Fire-alarm control unit.
2. Manual fire-alarm boxes.
3. System smoke detectors.
4. Heat detectors.
5. Notification appliances.
6. Remote annunciator.
7. Addressable interface device.
8. Digital alarm communicator transmitter.

1.2 SYSTEM DESCRIPTION

- ##### A. Noncoded, network compatible, addressable system, with multiplexed signal transmission, dedicated to fire-alarm service only.

1.3 SUBMITTALS

A. General Submittal Requirements:

1. Submittals shall be approved by authorities having jurisdiction prior to submitting them to Architect.
2. Shop Drawings shall be prepared by persons with the following qualifications:
 - a. Trained and certified by manufacturer in fire-alarm system design.
 - b. NICET-certified fire-alarm technician, Level III minimum.

B. Product Data: For each type of product indicated.

C. Shop Drawings: For fire-alarm system. Include plans, elevations, sections, details, and attachments to other work.

1. Comply with recommendations in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter in NFPA 72.
2. Include voltage drop calculations for notification appliance circuits.
3. Include battery-size calculations.
4. Include performance parameters and installation details for each detector, verifying that each detector is listed for complete range of air velocity, temperature, and humidity possible when air-handling system is operating.

5. Include plans, sections, and elevations of heating, ventilating, and air-conditioning ducts, drawn to scale and coordinating installation of duct smoke detectors and access to them. Show critical dimensions that relate to placement and support of sampling tubes, detector housing, and remote status and alarm indicators. Locate detectors according to manufacturer's written recommendations.
 6. Include floor plans to indicate final outlet locations showing address of each addressable device. Show size and route of cable and conduits.
- D. Delegated-Design Submittal: For smoke and heat detectors indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
1. Drawings showing the location of each smoke and heat detector, ratings of each, and installation details as needed to comply with listing conditions of the detector.
 2. Design Calculations: Calculate requirements for selecting the spacing and sensitivity of detection, complying with NFPA 72.
- E. Qualification Data: For qualified Installer.
- F. Field quality-control reports.
- G. Operation and Maintenance Data: For fire-alarm systems and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 1 Section "Operation and Maintenance Data," deliver copies to authorities having jurisdiction and include the following:
1. Comply with the "Records" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.
 2. Provide "Record of Completion Documents" according to NFPA 72 article "Permanent Records" in the "Records" Section of the "Inspection, Testing and Maintenance" Chapter.
 3. Record copy of site-specific software.
 4. Provide "Maintenance, Inspection and Testing Records" according to NFPA 72 article of the same name and include the following:
 - a. Frequency of testing of installed components.
 - b. Frequency of inspection of installed components.
 - c. Requirements and recommendations related to results of maintenance.
 - d. Manufacturer's user training manuals.
 5. Manufacturer's required maintenance related to system warranty requirements.
 6. Abbreviated operating instructions for mounting at fire-alarm control unit.
 7. Copy of NFPA 25.
- H. Software and Firmware Operational Documentation:
1. Software operating and upgrade manuals.
 2. Program Software Backup: On magnetic media or compact disk, complete with data files.
 3. Device address list.
 4. Printout of software application and graphic screens.

1.4 QUALITY ASSURANCE

- A. System Installer Qualifications: Personnel shall be trained and certified by manufacturer for installation of units required for this Project.
- B. System Installer Qualifications: Installation shall be by personnel certified by NICET as fire-alarm Level II technician.
- C. Source Limitations for Fire-Alarm System and Components: Obtain fire-alarm system from single source from single manufacturer. Components shall be compatible with, and operate as, an extension of existing system.
- D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.5 SOFTWARE SERVICE AGREEMENT

- A. Comply with UL 864.
- B. Technical Support: Beginning with Substantial Completion, provide software support for two years.
- C. Upgrade Service: Update software to latest version at Project completion. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software shall include operating system. Upgrade shall include new or revised licenses for use of software.
 - 1. Provide 30 days' notice to Owner to allow scheduling and access to system and to allow Owner to upgrade computer equipment if necessary.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturer: SimplexGrinnell LP; a Tyco International company..

2.2 SYSTEMS OPERATIONAL DESCRIPTION

- A. Fire-alarm signal initiation shall be by one or more of the following devices:
 - 1. Manual stations.
 - 2. Heat detectors.
 - 3. Smoke detectors.
 - 4. Duct smoke detectors.
 - 5. Automatic sprinkler system water flow.
- B. Fire-alarm signal shall initiate the following actions:

1. Continuously operate alarm-notification appliances.
 2. Identify alarm at the fire-alarm control unit and remote annunciators.
 3. Transmit an alarm signal to the remote alarm receiving station.
 4. Record events in the system memory..
- C. Supervisory signal initiation shall be by one or more of the following devices and actions:
1. Valve supervisory switch.
- D. System trouble signal initiation shall be by one or more of the following devices and actions:
1. Open circuits, shorts, and grounds in designated circuits.
 2. Opening, tampering with, or removing alarm-initiating and supervisory signal-initiating devices.
 3. Loss of primary power at fire-alarm control unit.
 4. Ground or a single break in fire-alarm control unit internal circuits.
 5. Abnormal ac voltage at fire-alarm control unit.
 6. Break in standby battery circuitry.
 7. Failure of battery charging.
 8. Abnormal position of any switch at fire-alarm control unit or annunciator.
- E. System Trouble and Supervisory Signal Actions: Initiate notification appliance and annunciate at fire-alarm control unit and remote annunciators.

2.3 FIRE-ALARM CONTROL UNIT

- A. General Requirements for Fire-Alarm Control Unit:
1. Field-programmable, microprocessor-based, network compatible, modular, power-limited design with electronic modules, complying with UL 864 and listed and labeled by an NRTL.
 - a. System software and programs shall be held in flash electrically erasable programmable read-only memory (EEPROM), retaining the information through failure of primary and secondary power supplies.
 - b. Include a real-time clock for time annotation of events on the event recorder and printer.
 2. Addressable control circuits for operation of mechanical equipment.
- B. Alphanumeric Display and System Controls: Arranged for interface between human operator at fire-alarm control unit and addressable system components including annunciation and supervision. Display alarm, supervisory, and component status messages and the programming and control menu.
1. Annunciator and Display: Liquid-crystal type, 3 lines of 40 characters, minimum.
 2. Keypad: Arranged to permit entry and execution of programming, display, and control commands.
- C. Circuits:

1. Initiating Device, Notification Appliance, and Signaling Line Circuits: NFPA 72, Class B.
 - a. Initiating Device Circuits: Style A.
 - b. Notification Appliance Circuits: Style W.
 - c. Signaling Line Circuits: Style 4.
 - d. Install no more than 50 addressable devices on each signaling line circuit.
- D. Notification Appliance Circuit: Operation shall sound in a standard pattern.
- E. Transmission to Remote Alarm Receiving Station: Automatically transmit alarm, supervisory, and trouble signals to a remote alarm station.
- F. Primary Power: 24-V dc obtained from 120-V ac service and a power-supply module. Initiating devices, notification appliances, signaling lines, trouble signals, supervisory and digital alarm communicator transmitters shall be powered by 24-V dc source.
 1. Alarm current draw of entire fire-alarm system shall not exceed 80 percent of the power-supply module rating.
- G. Secondary Power: 24-V dc supply system with batteries, automatic battery charger, and automatic transfer switch.
 1. Batteries: Sealed lead calcium.
- H. Instructions: Computer printout or typewritten instruction card mounted behind a plastic or glass cover in a stainless-steel or aluminum frame. Include interpretation and describe appropriate response for displays and signals. Briefly describe the functional operation of the system under normal, alarm, and trouble conditions.

2.4 MANUAL FIRE-ALARM BOXES

- A. General Requirements for Manual Fire-Alarm Boxes: Comply with UL 38. Boxes shall be finished in red with molded, raised-letter operating instructions in contrasting color; shall show visible indication of operation; and shall be mounted on recessed outlet box. If indicated as surface mounted, provide manufacturer's surface back box.
 1. Double-action mechanism requiring two actions to initiate an alarm, pull-lever] type; with integral addressable module arranged to communicate manual-station status (normal, alarm, or trouble) to fire-alarm control unit.
 2. Station Reset: Key- or wrench-operated switch.

2.5 SYSTEM SMOKE DETECTORS

- A. General Requirements for System Smoke Detectors:
 1. Comply with UL 268; operating at 24-V dc, nominal.
 2. Detectors shall be four-wire type.
 3. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.

4. Base Mounting: Detector and associated electronic components shall be mounted in a twist-lock module that connects to a fixed base. Provide terminals in the fixed base for connection to building wiring.
 5. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
 6. Integral Visual-Indicating Light: LED type indicating detector has operated and power-on status.
- B. Photoelectric Smoke Detectors:
1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
 2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:
 - a. Primary status.
 - b. Device type.
 - c. Present average value.
 - d. Present sensitivity selected.
 - e. Sensor range (normal, dirty, etc.).
- C. Duct Smoke Detectors: Photoelectric type complying with UL 268A.
1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
 2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:
 - a. Primary status.
 - b. Device type.
 - c. Present average value.
 - d. Present sensitivity selected.
 - e. Sensor range (normal, dirty, etc.).
 3. Weatherproof Duct Housing Enclosure: NEMA 250, Type 4X; NRTL listed for use with the supplied detector.
 4. Each sensor shall have multiple levels of detection sensitivity.
 5. Sampling Tubes: Design and dimensions as recommended by manufacturer for specific duct size, air velocity, and installation conditions where applied.
 6. Relay Fan Shutdown: Rated to interrupt fan motor-control circuit.

2.6 HEAT DETECTORS

- A. General Requirements for Heat Detectors: Comply with UL 521.
- B. Heat Detector, Combination Type: Actuated by either a fixed temperature of 135 deg F or a rate of rise that exceeds 15 deg F per minute unless otherwise indicated.
1. Mounting: Twist-lock base interchangeable with smoke-detector bases.

2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.
- C. Heat Detector, Fixed-Temperature Type: Actuated by temperature that exceeds a fixed temperature of 190 deg F.
1. Mounting: Twist-lock base interchangeable with smoke-detector bases.
 2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.

2.7 NOTIFICATION APPLIANCES

- A. General Requirements for Notification Appliances: Connected to notification appliance signal circuits, zoned as indicated, equipped for mounting as indicated and with screw terminals for system connections.
1. Combination Devices: Factory-integrated audible and visible devices in a single-mounting assembly, equipped for mounting as indicated and with screw terminals for system connections.
- B. Chimes, Low-Level Output: Vibrating type, 75-dBA minimum rated output.
- C. Chimes, High-Level Output: Vibrating type, 81-dBA minimum rated output.
- D. Horns: Electric-vibrating-polarized type, 24-V dc; with provision for housing the operating mechanism behind a grille. Comply with UL 464. Horns shall produce a sound-pressure level of 90 dBA, measured 10 feet from the horn, using the coded signal prescribed in UL 464 test protocol.
- E. Visible Notification Appliances: Xenon strobe lights comply with UL 1971, with clear or nominal white polycarbonate lens mounted on an aluminum faceplate. The word "FIRE" is engraved in minimum 1-inch- high letters on the lens.
1. Rated Light Output:
 - a. 15/30/75/110 cd, selectable in the field.
 2. Mounting: Wall mounted unless otherwise indicated.
 3. For units with guards to prevent physical damage, light output ratings shall be determined with guards in place.
 4. Flashing shall be in a temporal pattern, synchronized with other units.
 5. Strobe Leads: Factory connected to screw terminals.
 6. Mounting Faceplate: Factory finished, red.

2.8 REMOTE ANNUNCIATOR

- A. Description: Annunciator functions shall match those of fire-alarm control unit for alarm, supervisory, and trouble indications. Manual switching functions shall match those of fire-alarm control unit, including acknowledging, silencing, resetting, and testing.

1. Mounting: Flush cabinet, NEMA 250, Type 1.
- B. Display Type and Functional Performance: Alphanumeric display shall match those of fire-alarm control unit. Provide controls to acknowledge, silence, reset, and test functions for alarm, supervisory, and trouble signals.

2.9 ADDRESSABLE INTERFACE DEVICE

- A. Description: Microelectronic monitor module, NRTL listed for use in providing a system address for alarm-initiating devices for wired applications with normally open contacts.

2.10 DIGITAL ALARM COMMUNICATOR TRANSMITTER

- A. Digital alarm communicator transmitter shall be acceptable to the remote central station and shall comply with UL 632 and be listed and labeled by an NRTL.
- B. Functional Performance: Unit shall receive an alarm, supervisory, or trouble signal from fire-alarm control unit and automatically capture one telephone line(s) and dial a preset number for a remote central station. When contact is made with central station(s), signals shall be transmitted. If service on line is interrupted for longer than 45 seconds, transmitter shall initiate a local trouble signal and transmit the signal indicating loss of telephone line to the remote alarm receiving station over the remaining line. Transmitter shall automatically report telephone service restoration to the central station. If service is lost on both telephone lines, transmitter shall initiate the local trouble signal.
- C. Local functions and display at the digital alarm communicator transmitter shall include the following:
 1. Verification that telephone line is available.
 2. Programming device.
 3. LED display.
 4. Manual test report function and manual transmission clear indication.
 5. Communications failure with the central station or fire-alarm control unit.
- D. Digital data transmission shall include the following:
 1. Address of the alarm-initiating device.
 2. Zone of the supervisory signal.
 3. Zone of the trouble-initiating device.
 4. Loss of ac supply or loss of power.
 5. Low battery.
 6. Abnormal test signal.
 7. Communication bus failure.
- E. Secondary Power: Integral rechargeable battery and automatic charger.
- F. Self-Test: Conducted automatically every 24 hours with report transmitted to central station.

PART 3 - EXECUTION

3.1 EQUIPMENT INSTALLATION

- A. Comply with NFPA 72 for installation of fire-alarm equipment. All wiring to be in conduit.
- B. Equipment Mounting: Install fire-alarm control unit on finished floor with tops of cabinets not more than 72 inches above the finished floor.
 - 1. Comply with requirements for seismic-restraint devices specified in Division 16 Section "Vibration and Seismic Controls for Electrical Systems."
- C. Install wall-mounted equipment, with tops of cabinets not more than 72 inches above the finished floor.
 - 1. Comply with requirements for seismic-restraint devices specified in Division 16 Section "Vibration and Seismic Controls for Electrical Systems."
- D. Smoke- or Heat-Detector Spacing:
 - 1. Comply with NFPA 72, "Smoke-Sensing Fire Detectors" Section in the "Initiating Devices" Chapter, for smoke-detector spacing.
 - 2. Comply with NFPA 72, "Heat-Sensing Fire Detectors" Section in the "Initiating Devices" Chapter, for heat-detector spacing.
 - 3. Smooth ceiling spacing shall not exceed 30 feet.
 - 4. Spacing of detectors for irregular areas, for irregular ceiling construction, and for high ceiling areas shall be determined according to Appendix A or Appendix B in NFPA 72.
 - 5. HVAC: Locate detectors not closer than 5 feet from air-supply diffuser or return-air opening.
 - 6. Lighting Fixtures: Locate detectors not closer than 12 inches from any part of a lighting fixture.
- E. Duct Smoke Detectors: Comply with NFPA 72 and NFPA 90A. Install sampling tubes so they extend the full width of duct.
- F. Heat Detectors in Elevator Shafts: Coordinate temperature rating and location with sprinkler rating and location.
- G. Single-Station Smoke Detectors: Where more than one smoke alarm is installed within a dwelling or suite, they shall be connected so that the operation of any smoke alarm causes the alarm in all smoke alarms to sound.
- H. Remote Status and Alarm Indicators: Install near each smoke detector and each sprinkler water-flow switch and valve-tamper switch that is not readily visible from normal viewing position.
- I. Audible Alarm-Indicating Devices: Install not less than 6 inches below the ceiling. Install bells and horns on flush-mounted back boxes with the device-operating mechanism concealed behind a grille.

- J. Visible Alarm-Indicating Devices: Install adjacent to each alarm bell or alarm horn and at least 6 inches below the ceiling.
- K. Device Location-Indicating Lights: Locate in public space near the device they monitor.
- L. Fire-Alarm Control Unit: Surface mounted, with tops of cabinets not more than 72 inches above the finished floor.
- M. Annunciator: Install with top of panel not more than 60 inches above the finished floor.

3.2 CONNECTIONS

- A. Make addressable connections with a supervised interface device to the following devices and systems. Install the interface device less than 3 feet from the device controlled. Make an addressable confirmation connection when such feedback is available at the device or system being controlled.
 - 1. Supervisory connections at valve supervisory switches.

3.3 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Division 16 Section "Electrical Identification."
- B. Install framed instructions in a location visible from fire-alarm control unit.

3.4 GROUNDING

- A. Ground fire-alarm control unit and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to fire-alarm control unit.

3.5 FIELD QUALITY CONTROL

- A. Field tests shall be witnessed by authorities having jurisdiction.
- B. Tests and Inspections:
 - 1. Visual Inspection: Conduct visual inspection prior to testing.
 - a. Inspection shall be based on completed Record Drawings and system documentation that is required by NFPA 72 in its "Completion Documents, Preparation" Table in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter.
 - b. Comply with "Visual Inspection Frequencies" Table in the "Inspection" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72; retain the "Initial/Reacceptance" column and list only the installed components.
 - 2. System Testing: Comply with "Test Methods" Table in the "Testing" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.

3. Test audible appliances for the public operating mode according to manufacturer's written instructions. Perform the test using a portable sound-level meter complying with Type 2 requirements in ANSI S1.4.
 4. Test audible appliances for the private operating mode according to manufacturer's written instructions.
 5. Test visible appliances for the public operating mode according to manufacturer's written instructions.
 6. Factory-authorized service representative shall prepare the "Fire Alarm System Record of Completion" in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter in NFPA 72 and the "Inspection and Testing Form" in the "Records" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.
- C. Reacceptance Testing: Perform reacceptance testing to verify the proper operation of added or replaced devices and appliances.
- D. Fire-alarm system will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.
- F. Maintenance Test and Inspection: Perform tests and inspections listed for weekly, monthly, quarterly, and semiannual periods. Use forms developed for initial tests and inspections.
- G. Annual Test and Inspection: One year after date of Substantial Completion, test fire-alarm system complying with visual and testing inspection requirements in NFPA 72. Use forms developed for initial tests and inspections.

END OF SECTION 13852

Garfield County Assessor/Treasurer

Parcel Detail Information

[Assessor/Treasurer Property Search](#) | [Assessor Subset Query](#) | [Assessor Sales Search](#)
[Clerk & Recorder Reception Search](#)

[Basic Building Characteristics](#) | [Tax Information](#)

[Parcel Detail](#) | [Value Detail](#) | [Sales Detail](#) | [Residential/Commercial Improvement Detail](#)
[Land Detail](#) | [Photographs](#) | [Mill Levy Revenues Detail](#)

Tax Area	Account Number	Parcel Number	2008 Mill Levy
006	R060100	218527100060	60.554

Owner Name and Mailing Address

HOLY CROSS ENERGY
PO BOX 2150
GLENWOOD SPGS, CO 81602-2150

Assessor's Parcel Description (Not to be used as a legal description)

SECT,TWN,RNG:27-6-89 DESC: A TR IN
THE SENE. STATE ASSESSED
PRE:R060053 BK:1002 PG:0009 BK:1002
PG:0007 BK:0706 PG:0303 BK:0441
PG:0042 BK:0314 PG:0005

Location

Physical Address:	2311 ³⁷⁹⁹ HIGHWAY 82 GLENWOOD SPRINGS	
Subdivision:		
Land Acres:	0	
Land Sq Ft:	0	
Section	Township	Range
27	6	89

2009 Property Tax Valuation Information

	Actual Value	Assessed Value
Land:	0	0
Improvements:	0	0
Total:	0	0

Additional Value Detail**Most Recent Sale**

Sale Date:	
Sale Price:	

Additional Sales Detail**Basic Building Characteristics**

Number of Residential Buildings:	0
Number of Comm/Ind Buildings:	0

No Building Records Found**Tax Information****No Tax Records Found**Mill Levy Revenues DetailTop of Page

Assessor Database Search Options | Treasurer Database Search Options
Clerk & Recorder Database Search Options

Garfield County Home Page

The Garfield County Assessor and Treasurer's Offices make every effort to collect and maintain accurate data. However, Good Turns Software and the Garfield County Assessor and Treasurer's Offices are unable to warrant any of the information herein contained.

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 Database & Web Design by Good Turns Software.

County copy

Holy Cross Energy Phase 2B

Electrical Operations Center Remodel

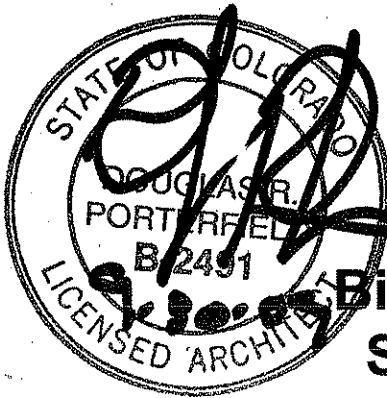
APPROVED

SUBJECT TO NOTED
EXCEPTIONS & INSPECTIONS
GARFIELD COUNTY
BUILDING DEPARTMENT

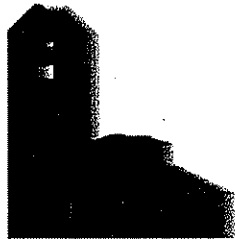
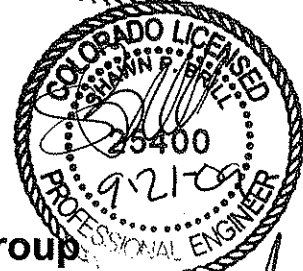
Date 11/5/09 By 12/6/5

FIELD COPY

NO INSPECTION WITHOUT
THESE PLANS ON SITE
of

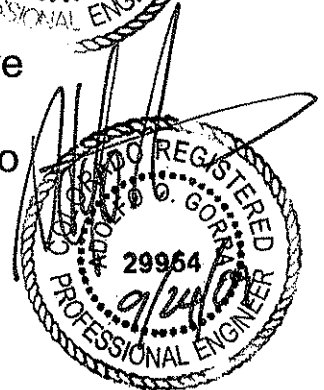


**Project Manual
Bid/Construction Set
September 8, 2009**



DPA

DPA Architectural Group
406 South Hyland Park Drive
Suite C
Glenwood Springs, Colorado
81601
970-945-4040



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Not Used

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SECTION 00100

INSTRUCTIONS TO BIDDERS

Holy Cross Energy: Phase 2B Electrical Operations Remodel

1. DOCUMENTS

Contract Documents, complete with construction drawings and project manual, are available at the office of FCI Constructors, 3070 I-70 B Building A Grand Junction, CO 81504

2. CONDITIONS AFFECTING THE WORK

Bidders shall make careful examination of the drawings and project Manual, visit the site of the proposed construction, and acquaint themselves with all conditions affecting the work before making their proposal. They will be held responsible for any errors in their proposal resulting from their failure to make such examination.

2A. The Owner reserves the right to accept all or portions of the bid proposal as is in the best interest of the Owner if it elects to utilize in-house staff or owner-selected vendors for any phase of work.

3. FEDERAL, STATE AND LOCAL LAWS

Bidders are expected to familiarize themselves with the laws and acts of the State of Colorado and the ordinances of the county in which the project is located. The bidders' attention is directed to the fact that all applicable state laws, municipal ordinances and the rules and regulations of all authorities having jurisdiction over the construction of the project shall apply to the Performance Contract throughout, and they will be deemed to be incorporated into the Contract.

4. TIME OF COMPLETION

The Contractors must agree to commence work upon receipt of Notice to proceed. Such notice will be issued by the Architect after the opening of the bids provided the Contractors have fulfilled all requirements necessary for execution of the contract. Such requirements are specified under the Supplementary Conditions.

Based on ongoing new construction and renovations at Holy Cross Energy, this project will be required to be completed in area phases that will allow continuous operations of the existing building during the remodel. Refer to

drawings for phase area designations.

5. INTERPRETATION OF DOCUMENTS

No interpretation of the meaning of the plans, specifications or other pre-bid documents will be made to any bidder orally.

Only interpretations made in conformity with the following procedure will be valid. Interpretations either written or oral by any of the Architect's consultants will not be valid.

Each request for such interpretation should be in writing and emailed to DPA Architectural Group at dpamitch@qwestoffice.net and must be received before:

Five (5) calendar days prior to proposal submittal date.

Any and all such interpretations and any supplemental instructions will be in the form of written addenda which, if issued, will be emailed to the respective addresses furnished for such purposes, not later than (2) days prior to the date fixed for the receipt of Proposal. Failure to receive any such addenda or interpretation shall not relieve such bidder from any obligation under his bid as submitted. All addenda so issued shall become a part of the Contract Documents.

Definition of Terms: All terms used herein and elsewhere in the Project Documents (unless the context or other direction to the contrary is expressly given) shall have the meaning which is assigned to them elsewhere in the Project Documents.

Or Equal: Where the phrase "or equal" or "or equal as approved by the Architect" occurs in the Contract Documents, do not assume that materials, equipment or methods will be approved by the Architect unless the item has been specifically approved for this work by the Architect. The decision of the Architect shall be final. No materials or products will be approved as substitutes or equals until reviewed by the Owner after bid opening. Any material or product substitutions should appear on bid form as a deduct alternate for each requested substitution or equal.

6. PERFORMANCE BOND AND LABOR AND MATERIAL PAYMENT BOND

Each bidder shall include in his proposal a sum sufficient to cover the cost of providing a 100% performance and labor and material payment bond for each contract as specified under the Supplementary conditions.

7. POWERS OF ATTORNEY

Attorneys-In-Fact who execute any documents in connection with the bidding process or the Contract, including but not limited to persons executing for sureties and including but not limited to persons executing for sureties on and Performance and Payment Bonds, must present an effective and manually executed copy of their power of attorney.

8. SPECIAL CONDITIONS

Attention is particularly called to those parts of the Contract Documents and Specifications which deal with the following:

1. Inspection and Testing of Materials
2. Insurance Requirements
3. Time and Project Format Schedules
4. Worker Parking and Construction Phasing Plan

9. PROPOSALS

Proposals shall be submitted by the Contractors on copies of the appropriate proposal forms included in these Specifications.

The proposal form and all attached documents shall be placed in a sealed envelope marked for identification and delivered to the place of Bid Opening prior to the date and hour stipulated in the Invitation to Bid.

10. WITHDRAWAL OF PROPOSAL

Proposals which have been submitted may be withdrawn by any bidder who desires to do so, without prejudice to himself, at any time prior to the time set for opening bids.

Bid submitted may not be withdrawn after scheduled closing time for receipt of bids for thirty (30) days.

11. TELEGRAPHIC MODIFICATION

Any bidder may modify his bid by telegraphic communication at any time prior to the scheduled closing time for receipt of bids, provided such telegraphic communication is received by the Owner prior to the closing time and provided further the Owner is satisfied that a written confirmation of the telegraphic modification over the signature of the bidder was mailed prior to the closing time. The telegraphic communication shall not reveal the bid price, but should provide the addition or subtraction or other modification so that the final prices or terms

will not be known by the Owner until the sealed bid is opened. If written confirmation is not received within two (2) days from the closing time, no consideration will be given to the telegraphic modification.

12. DISQUALIFIED BIDDERS

Bids will not be accepted, nor contract awarded, to any person who is in arrears to the Owner upon debt or contract, or who is a defaulter as surety or otherwise upon any obligation to the Owner.

13. CHANGES AND SUBSTITUTIONS

No changes or substitutions will be approved prior to bid opening. Any contractor-proposed change or substitution shall be enumerated on the Bid Form as individual deduct alternates.

In addition, each Bid Form, including changes or substitutions, shall be accompanied by complete catalog sheets, manufacturer specifications, technical evaluation, testing results, and other pertinent data which will make it possible to properly evaluate the items proposed for use.

The Bidder shall base the proposal upon the use of the items specifically named in the specifications or on the drawings issued by the Architect.

14. PARTIAL INFORMATION

No partial sets of contract documents shall be issued. The Architect and Owner disclaim any and all responsibility for errors or omissions made by parties using partial information in compiling their proposals.

15. CONSULTANTS

As a matter of identification, the names of consultants employed by the Architect for various phases of the work are listed on the drawings.

Bidders or material suppliers shall not communicate directly with any of the consultants, without the permission of the Architect.

16. TAXES

Holy Cross Energy and its vendors are required to pay only Colorado State Sales tax of 2.9% on the purchase amount of materials used on site.

The Glenwood Springs City Sales Tax does not apply to deliveries made of materials to Holy Cross Energy Facilities which are located outside the city limits.

Garfield County sales tax applies only to purchased made within Garfield County.

RTA Sales Tax applies only to purchases made within the City of Glenwood Springs.

17. INSURANCE

All Subcontractors to the Construction Manager shall maintain Commercial General and Automobile Liability Insurance in the following amounts:

- A. For subcontract amount totaling \$200,000.00 or less, at least one million dollars (\$1,000,000.00) combined single limit.
- B. For subcontract amounts totaling over \$200,000.00, at least two million dollars (\$2,000,000.00) combined single limit.

18. WARRANTY

All work shall warranted and guaranteed for a period of one (1) year after the Notice of Acceptance unless shown otherwise in the contract documents.

END OF SECTION

SECTION 00805

ALLOWABLE MARKUP

1.01 REFERENCE
01028 CHANGE ORDER PROCEDURES

2.01 NOTE USED

3.0 MARKUPS

3.01 The allowable markup for the combined total of onsite and offsite overhead and profit included in the total cost of the Owner shall be based on the following schedule:

1. For the Contractor, for Work performed by the Contractor's own forces; Seven percent(7%) of the cost.
2. For the Contractor, for work performed by the Contractor's Subcontractor, Seven percent (7%) of the amount due the Subcontractor.
3. For each Subcontractor or Sub-subcontractor involved for work performed by that Subcontractor or Sub-subcontractor's own forces, seven percent (7%) of the cost.
4. For each Subcontractor for work performed by the Subcontractor's Sub-subcontractor, seven percent (7%) of the amount due the sub-subcontractor.

3.02 COST ITEMIZATION

1. In order to facilitate checking of quotations for extras or credits, all proposals, except those so minor that their propriety can immediately be seen by inspection, shall be accomplished by a complete itemization of cost including labor, materials and subcontracts. Labor and materials shall be itemized in the manner prescribed above. Where major cost items are subcontracts, they shall be itemized also.

END OF SECTION

SECTION 00900

USE OF INSTRUMENTS OF SERVICE

1.01 DESCRIPTION

Use of printed or digital drawings and specifications prepared by the Architect and Consultants.

2.01 INDENTIFICATION

All drawings and specifications, whether in hard copy or digital format, has been generated and provided as part of DPA Architectural Group and/or their consultant sub-contractor's services and are instruments of professional service to the Owner and are the property of the Architect for the following Owner and Project:

Owner: Holy Cross Energy
Project: Holy Cross Energy, Phase 2B Electrical Operations Center Remodel

3.01 TERMS OF USE

Receipt and/or utilization of the above described materials and information by the undersigned shall be deemed as an Agreement including the following conditions and acknowledgments:

1. The automatic translation and conversion for drawings, data and information from the electronic systems and formats used by DPA Architectural Group or their consultants to alternate systems and formats will result in the introduction of anomalies, errors, or variations of scale and data specifics.
2. All information on the digital files is considered instruments of service of DPA Architectural Group and their consultants and shall not be used for other projects, for additions to the project, or completion of this project by others. Digital Files shall remain the property of DPA Architectural Group and their consultants and in no case shall transfer of these files be considered a sale. If the undersigned party utilizes the digital data provided by DPA Architectural Group and/or their consultants for in-house remodel, renovations or modification of any kind, the undersigned shall indemnify, protect and hold harmless DPA Architectural Group and its consultants from any and all claims or suits, damage, liability or cost including reasonable attorney's fees and costs of defense, whatsoever that may result from the use of the digital drawings or arising from any changes made by anyone other than DPA Architectural Group and their consultants.
3. Due to probability that copies of the drawings, data and information delivered to the undersigned by DPA Architectural Group and their consultants may be altered, whether inadvertently or otherwise, the original, dated generation of data by DPA Architectural Group and their consultants as provided in hard copy or digital form, shall be enforced as the governing standard in the event of any discrepancies between such copies and the original data provided.
4. All drawings, data and information are instruments of service of DPA Architectural Group and their consultants, who shall be deemed the author of the drawings, data and

SECTION 00900
USE OF INSTRUMENTS OF SERVICE

Page 2

information, and shall retain all common law, statutory law and other rights, including copyrights.

5. The use of Digital Files prepared by DPA Architectural Group and their consultants shall not in any way obviate the Contractor's responsibility for the proper checking and coordination of dimensions, details, member sizes and gage, and quantities of materials as required to facilitate complete and accurate fabrication and erection of the project. Written dimensions provided on the plans shall govern. Contractor shall not query any dimensions from digital files

END OF SECTION

SECTION 01005

SUMMARY, ALTERNATES, ALLOWANCES

PART 1 - GENERAL

1.00 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Supplementary conditions and other Division-1 Specification sections, apply to work of this section.

1.01 PROJECT/WORK IDENTIFICATION:

A. Name of project is Holy Cross Energy, Phase 2B- Electrical Operations Remodel. The contract documents are prepared by the Architect, DPA Architectural Group.

B. Contract Documents indicate the work of contract, and related provisions of project which may include, but are not necessarily limited to the following:

Existing site conditions and restrictions

Alterations and coordination's with existing work.

Other work to be performed concurrently by Owner.

Other work to be performed concurrently by separate contractors.

Other work subsequent to work of contract.

Alternates which are work of Contract, and alternates which are not work of Contract.

Allowances established as work of Contract.

Pre-negotiated material/equipment orders assigned as work of contract.

Pre-purchased material/equipment for Contract with purchase price included in Contract Sum.

Requirements for Owner partial occupancy prior to substantial completion of work of Contract.

1.02 RESERVED

1.03 MECHANICAL/ELECTRICAL PROVISION OF GENERAL WORK

General: Except as otherwise indicated, comply with applicable requirements of Division-15 sections for mechanical provisions within units of general work, and comply with applicable requirements of Division-16 sections for electrical provisions within units of general work. refer to Division-15 and Division-16 sections for characteristics of mechanical and electrical services to be connected to units of general work, and provide units manufactured/fabricated for proper connections and utilization of available services as indicated.

1.04 ELECTRICAL PROVISIONS

Except as otherwise indicated, comply with applicable provisions of NEC and standards by NEMA, for electrical components of general work. provide UL listed and labeled products where applicable. Electrical components are recognized to include, but not by way of limitation, motors, motor starters, internal equipment wiring, integral control switches and similar electrical devices, electrical heating coils, integrated lighting equipment, electronic equipment, electrical sensors and signals, communication equipment scientific devices and similar electrical components. Where not otherwise indicated for the work, comply with the following requirements:

Performance Requirements for Completed Work:

General: The contract documents indicated intended occupancy and utilization of building and its individual systems and facilities. Compliance with governing regulations is intended and required, for the work and for Owner's occupancy and utilization. in addition to the requirement that every element of the work comply with applicable requirements of contract documents, it is also required that the work as a whole (the building project) comply with the following general building performances.

1.05 ALTERATION AND COORDINATION

A. General: The work of this Contract includes coordination of entire work of project, including preparation of general coordination drawings/diaphragms/schedules, and control of site utilization; from the beginning of activity, through the project close-out and warranty periods.

1.06 ALTERNATES

Not Used

1.07 ALLOWANCES

Not Used

END OF SECTION

SECTION 01010

SUMMARY OF WORK

PART 1 - GENERAL

1.0 RELATED DOCUMENTS:

Drawings and general provisions of the Contract, including General and Supplementary conditions and other Division-1 Specification sections, apply to work of this section.

1.1 SUMMARY

Section Includes:

General description of the work of the entire Project with limitations or coordination with other contracts, if any.

1.2 GENERAL

The work to be done under this Contract is the construction in a workmanlike manner, to the satisfaction of the Architect, of the Work as shown, documented, and set forth in the Contract Documents.

If these documents or job conditions make it impossible to produce first class work or to warranty the work or its performance, or should discrepancies appear among the Contract Documents, request interpretation, correction or clarification prior to bidding. If the Contractor fails to make such request, work must be performed in a satisfactory manner and no request for added cost or extension of time will be considered.

Should conflict occur in or between Drawings and Specifications, Contractor (or Installer) is deemed to have estimated on the more expensive way of doing work unless he shall have asked for and obtained written decision before submission of Bid as to which method or materials will be required.

The Contractor represents that he fully understands the nature and extent of the work, all factors and conditions affecting or which may be affected by it and characteristics of its various parts and elements and their fitting together and functioning.

1.3 PROJECT DESCRIPTION

Briefly and without force and effect upon the contract documents, the Work of the Contract can be summarized as follows:

Project Identification: Holy Cross Energy: Phase 2B Electrical Operations Remodel

1.4.1 SCOPE OF WORK RESPONSIBILITY

Work as described in these documents and specifications have been assigned by the Owner and outlined below. All items described as Furnished By and/or Installed By shall be considered with the Scope of Work of this project. The attached list also describes the following work :

- Other work to be performed concurrently by Owner.
- Other work to be performed concurrently by separate contractors.
- Other work subsequent to work of contract.
- Pre-negotiated material/equipment orders assigned as work of contract.

OWNER – Holy Cross Energy or Owner Sub-Contractors under a separate agreement

GC- FCI

NA- Not Applicable

Description	Furnished By	Installed By
Sitework		
A. Earthwork & Retaining Walls		
<u>Onsite (defined as the immediate boundary of the project)</u>		
Existing fences, power poles, cisterns demo and removal	NA	NA
Mass Excavation & Site Cut/Fill	GC	GC
Export Excess Spoil or Import Suitable Fill @ Site	GC	GC
Building Excavation	GC	GC
Export Excess Spoil or Import Suitable Fill @ Building	GC	GC
CIP Concrete Retaining Walls	NA	NA
Dry Stack Boulder Retaining Walls	NA	NA
Masonry Retaining Walls	NA	NA
Fine Grade Site	GC	GC
Strip/Store/Spread Topsoil	GC	GC
Soil Amendments	GC	GC
<u>Offsite (defined as beyond the immediate boundary of the project)</u>		
Mass Excavation & Cut/Fill	NA	NA
Export Excess Spoil or Import Suitable Fill	NA	NA
CIP Concrete Retaining Walls	NA	NA
Dry Stack Boulder Retaining Walls	NA	NA
Masonry Retaining Walls	NA	NA
Fine Grading Offsite	NA	NA

SECTION 01010
SUMMARY OF WORK

Strip/Store/Import/Spread Topsoil		NA	NA
Soil Amendments		NA	NA
B. Site Utilities			
<u>Onsite</u>			
Domestic Water Lines, Valves & Fittings Onsite		NA	NA
Fire Lines, Valves, Fittings & Fire Hydrants Onsite		NA	NA
Storm Lines, Inlets, Manholes & Tie-Ins Onsite		GC	GC
Onsite Storm Detention/Rip Rap		NA	NA
Sanitary Sewer Lines, Cleanouts, Manholes & Taps Onsite		NA	NA
Primary Electric Lines & New XFMR Onsite		NA	NA
Pads and rough in for Primary Electric AT New XMFR Onsite Trenching/conduit/pull string/backfill		NA	NA
Secondary Power Feeds to Building from New XFMR Onsite		NA	NA
Main CATV Lines & Pedestals Onsite		NA	NA
CATV Conduit & Pulltape from Onsite Pedestal to Main Building Trench/ backfill.		NA	NA
CATV Cable from Onsite Pedestal to Building w/Termination		NA	NA
Main Tele/Data Lines & Pedestals Onsite		OWNER	OWNER
Tele/Data Conduit & Pulltape from Onsite Pedestal to Building Trench/backfill		NA	NA
Tele/Data Cable from Onsite Pedestal to Building w/Termination		NA	NA
Natural Gas Line Onsite up to & Including New Gas Meter		OWNER	KINDER
Natural Gas Line Onsite - Trenching Only		GC	GC
Other Gas/Fuel/Live Steam Lines		NA	NA
Existing XFMR, tele vault and underground power lines demo		NA	NA
<u>Offsite</u>			
Domestic Water Lines, Valves, Fittings & Physical Taps Offsite		NA	NA
Fire Lines, Valves, Fittings, Hydrants & Physical Taps Offsite		NA	NA
Storm Lines, Inlets, Manholes & Tie-Ins Offsite		NA	NA
Offsite Storm Detention/Rip Rap/CIP Wing Walls		NA	NA
Sanitary Sewer Lines, Cleanouts, Manholes & Taps Offsite		NA	NA
Primary Electric Lines & New XFMR(s) Offsite		NA	NA
Main CATV Lines & Pedestals Offsite		NA	NA
Main Tele/Data Lines & Pedestals Offsite		NA	NA
Natural Gas Line from Existing Main to Site Boundary		NA	NA
Other Gas/Fuel/Live Steam Lines Brought to Site Boundary		NA	NA
C. Vehicular & Pedestrian Paving			
<u>Onsite</u>			
Curb & Gutter Onsite		NA	NA
Vertical Curb Onsite		NA	NA
Asphalt Paving @ Parking & Drive Lanes Onsite		GC	GC

SECTION 01010
SUMMARY OF WORK

Vehicular Control Bollards & Guard Railings			NA	NA
Precast Concrete Parking Stop Blocks			NA	NA
Concrete Drive Pans			GC	GC
Pedestrian Paving/Bike Paths Onsite			NA	NA
Street Cut & Patch @ Onsite Utility Work in Section "B" Above			NA	NA
Pedestrian Paving/Bike Paths/Vehicular Paving Onsite			NA	NA
<u>Offsite</u>				
Curb & Gutter Offsite			NA	NA
Vertical Curb Offsite			NA	NA
Asphalt Paving @ Parking & Drive Lanes Offsite			NA	NA
Vehicular Control Bollards & Guard Railings			NA	NA
Concrete Drive Pans Offsite			NA	NA
Pedestrian Paving/Bike Paths Offsite			NA	NA
Street Cut & Patch @ Offsite Utility Work in Section "B" Above			NA	NA
D. Site Landscaping				
<u>Onsite</u>				
Fertilizers & Soil Amendments			NA	NA
Special Topsoil			NA	NA
Irrigation Mains			NA	NA
Irrigation Distribution, Heads, Controllers, & Systems			NA	NA
Existing Tree and Large Planting Relocation			NA	NA
New Trees & Other Large, New Plantings			NA	NA
Shrubs/Bushes			NA	NA
Landscaping Edging			NA	NA
Sod			NA	NA
Native & Turf Seeding Work			NA	NA
Standard Ground Covers			NA	NA
Special Ground Cover Material			NA	NA
Slope Protection Systems			NA	NA
Gravel & Bark Mulch and/or Trims			NA	NA
Pruning & Shaping			NA	NA
Ornamental Accents			NA	NA
Landscaping Boulders & Ornamental Stone			NA	NA
Ties, Poles & Dividers			NA	NA
Fixed Planters			NA	NA
Soil & Plants @ Fixed Planters			NA	NA
Moveable Planters/Soil			NA	NA
Soil & Plants @ Moveable Planters			NA	NA
Site Lighting (including conduit, fixtures, lamping, controllers, & testing)			NA	NA
Planting Maintenance until Final Completion			NA	NA
Landscaping Warranty & Maintenance for First Year after FCO			NA	NA

SECTION 01010
SUMMARY OF WORK

<u>Offsite</u>		
Fertilizers & Soil Amendments	NA	NA
Special Topsoil	NA	NA
Irrigation Mains	NA	NA
Irrigation Distribution, Heads, Controllers, & Systems	NA	NA
Existing Tree and Large Planting Relocation	NA	NA
New Trees & Other Large, New Plantings	NA	NA
Shrubs/Bushes	NA	NA
Landscaping Edging	NA	NA
Sod	NA	NA
Native & Turf Seeding Work	NA	NA
Standard Ground Covers	NA	NA
Special Ground Cover Material	NA	NA
Slope Protection Systems	NA	NA
Gravel & Bark Mulch and/or Trims	NA	NA
Pruning & Shaping	NA	NA
Ornamental Accents	NA	NA
Landscaping Boulders & Ornamental Stone	NA	NA
Ties, Poles & Dividers	NA	NA
Fixed Planters	NA	NA
Soil & Plants @ Fixed Planters	NA	NA
Moveable Planters/Soil	NA	NA
Soil & Plants @ Moveable Planters	NA	NA
Site Lighting (including conduit, fixtures, lamping, controllers, & testing)	NA	NA
Planting Maintenance until Final Completion	NA	NA
Landscaping Warranty & Maintenance for First Year after FCO	NA	NA
E. Site Equipment, Furnishings & Specialties		
Ornamental & Architectural Fencing & Gates	NA	NA
Chain Link Fencing & Gates	NA	NA
Trash Receptacles	NA	NA
Bike Racks	NA	NA
Benches	NA	NA
Bleachers & Other Seating not with Above	NA	NA
Telephone Booths	NA	NA
Mail Boxes/Kiosks	NA	NA
Parking Attendant Booth(s)	NA	NA
Flag Poles & Flags	NA	NA
Flag Pole Bases & Lighting	NA	NA
Gazebo & Associated Structure/Electrical	NA	NA
Greenhouses(s) & Associated Structure/Mechanical/Electrical	NA	NA
Water Features/Fountains	NA	NA
Ornamental Stone Signage	NA	NA
Playground Equipment	NA	NA
Plaques & Memorials	NA	NA

SECTION 01010
SUMMARY OF WORK

Swimming Pools			NA	NA
Covered Walkways			NA	NA
Turnstiles, Physical Traffic Barriers, & Other Access Control			NA	NA
Other Site Equipment & Furniture			NA	NA
F. Site Signage & Signalization				
<u>Onsite</u>				
Traffic Signalization			NA	NA
Traffic Control Gates and Access Devices			NA	NA
Directional/Traffic Striping			NA	NA
Directional/Traffic Signage			NA	NA
Building Identification Signage (Attached to Building)			NA	NA
Building Monument Signage (Separate from Building) - 1			NA	NA
Building Monument Signage (Separate from Building) - 1 by others			NA	NA
Ornamental Stone Signage @ Landscaping			NA	NA
Plaques & Memorials			NA	NA
Structural Supports @ Above Monument Sign(s) - 1			NA	NA
Structural Supports @ Above Monument Sign(s) - 1 by others			NA	NA
Architectural Cladding @ Above Monument Sign(s) - 1			NA	NA
Architectural Cladding @ Above Monument Sign(s) - 1 by others			NA	NA
Landscaping & Irrigation System @ Above Monument Sign(s)			NA	NA
Lighting @ Above Monument Sign(s)			NA	NA
Conduit, Rough-ins and Connections @ all of above			NA	NA
Testing @ all above Signage			NA	NA
<u>Offsite</u>				
Traffic Signalization			NA	NA
Directional/Traffic Signage and Striping			NA	NA
Building Monument Signage (in Public Right-of-Way)			NA	NA
Structural Supports @ Above Monument Sign(s)			NA	NA
Architectural Cladding @ Above Monument Sign(s)			NA	NA
Landscaping & Irrigation System @ Above Monument Sign(s)			NA	NA
Lighting @ Above Monument Sign(s)			NA	NA
Conduit, Rough-ins and Connections @ all of above			NA	NA
Testing @ all above Signage			NA	NA
Building				
A. Furniture				
Moveable			OWNER	OWNER
Fixed			GC	GC

SECTION 01010
SUMMARY OF WORK

Fixed - Custom		GC	GC
Artwork		OWNER	OWNER
Blocking for Artwork		NA	NA
B. Floors			
Carpet		NA	NA
Carpet padding		NA	NA
Concrete Floor Sealer		GC	GC
Marble or Tile @ Floors		NA	NA
Sheet Vinyl		NA	NA
VCT		NA	NA
Wood		NA	NA
Wall Base		GC	GC
C. Ceilings			
ACT Grid		GC	GC
ACT Panels		GC	GC
Fire Taped Gyp Board		GC	GC
Final Tape & Finish @ Gyp Board		GC	GC
Stucco		NA	NA
Paint		GC	GC
Millwork and Trims		GC	GC
D. Demising, Code-Required & Exterior Perimeter Walls + Millwork/Finishes			
Fire Taped Gyp Board		GC	GC
Final Tape & Finish @ Gyp Board		GC	GC
Stucco		NA	NA
Millwork, Blocking and Trims		GC	GC
Vinyl Wallcoverings		NA	NA
FRP Wallcoverings		GC	GC
Paint		GC	GC
Marble or Tile @ Walls		NA	NA
E. Interior Partitions + Millwork/Finishes			
Fire Taped Gyp Board		GC	GC
Final Tape & Finish @ Gyp Board		GC	GC
Stucco		NA	NA
Millwork, Blocking and Trims		GC	GC
Custom Millwork and Trims		GC	GC
Vinyl Wallcoverings		NA	NA
FRP Wallcoverings		GC	GC
Paint		GC	GC
Marble or Tile @ Walls		NA	NA
F. Lighting			
Plug-in & Moveable Lighting		OWNER	OWNER
Direct Connect/Wall Sconce		GC	GC

SECTION 01010
SUMMARY OF WORK

Recessed, Ceiling Mounted and Pendant Fixtures		GC	GC
G. Doors			
Wood Door Leafs		GC	GC
HM Door Leafs		GC	GC
HM Frames		GC	GC
Finishes		GC	GC
Hardware		GC	GC
Millwork		GC	GC
Vision Kits		GC	GC
Connecting Doors		GC	GC
Balcony Door(s)		NA	NA
H. Window Coverings @ Exterior Glazing & Interior Lites			
Horizontal Blinds		NA	NA
Draperies/Valance		NA	NA
Blocking for Blinds/Draperies/Valance		GC	GC
Electrical Operators for Windows and/or Blinds		GC	GC
Conduit & Rough-ins @ Above Operators		GC	GC
Wiring, Installation & Testing @ Above Operators		GC	GC
I. Electrical			
Conduit, Pulltape & Rough-ins @ Security System		GC	GC
Security System Wiring, Terminations & Testing		OWNER	OWNER
Conduit, Pulltape & Rough-ins @ Fire Alarm System		GC	GC
Fire Alarm System Equipment, Wiring, Terminations & Testing		GC	GC
Conduit, Pulltape & Rough-ins @ Telephone System		GC	GC
Telephone/Data Wiring, Terminations, and Testing		OWNER	OWNER
J. Mechanical			
Fan Coil Units & High Pressure Duct		GC	GC
Medium & Low Pressure Duct		GC	GC
Grilles, Registers & Diffusers		GC	GC
Fire Sprinkler System at building only		GC	GC
Plumbing Fixtures		GC	GC
Controls		GC	GC
Low Voltage Wiring		GC	GC
High Voltage Wiring		GC	GC
Magnetic Starters		GC	GC
K. Audio/Visual			
Conduit, Pullwire, Sleeves & Boxes		GC	GC
Fixed/Recessed Audio/Paging System Speakers		GC	GC
Moveable Audio Speakers		NA	NA
Audio/Paging Equipment		OWNER	OWNER
Televisions w/Remote & Swivel		NA	NA
CATV Equipment, Wiring, Terminations & Testing		GC	GC

SECTION 01010
SUMMARY OF WORK

VCRs			NA	NA
Portable Clocks/Radios/Stereos			NA	NA
A/V Wiring, Terminations, & Testing not Specifically Mentioned Above			GC	GC
L. Finish Carpentry				
Special Trim			GC	GC
Closet Shelf and Rod			GC	GC
Millwork -			GC	GC
Millwork - All Other			GC	GC
Custom Millwork			GC	GC
Blocking for Above			GC	GC
M. INTERIOR AMMENITIES/EQUIPMENT				
Disposal			NA	NA
Refrigerators/Freezers/ Microwave/Dishwasher/			NA	NA
Toilet and Bathroom Specialties			GC	GC
Interior Specialties			GC	GC
Interior Signage			GC	GC
Vehicle and Special Equipment			GC	GC
Plam/Corian/Marble Tops			GC	GC
Steel Tops			NA	NA
Mirror - Framed			GC	GC
Mirror - Non-Framed			GC	GC
Backing for Mirrors			GC	GC
Washer/Dryer			NA	NA

Elevators

A. Passenger Elevators - Standard Cab				
Cab Interior Walls and Ceilings			NA	NA
Floor System			NA	NA
Door - Interior			NA	NA
Door - Exterior			NA	NA
Door Frame and Sill			NA	NA
Decorative Lighting			NA	NA
Call Numbers/Buttons			NA	NA
Motor, Controls, etc.			NA	NA
Telephone			NA	NA
A. Service Elevators/If Provided				
Finishes (all surfaces)			NA	NA
Call Numbers/Buttons			NA	NA
Lighting			NA	NA
Motor, Controls, etc.			NA	NA
Telephone			NA	NA

SECTION 01010
SUMMARY OF WORK

END OF SECTION

SECTION 01026

UNIT PRICES

PART 1 - GENERAL

1.0 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1-Specification sections, apply to work of this section.

1.1 SUMMARY

- A. Section Includes:

Requirements and descriptions for those items for which indefinite quantities can be expected and , therefore, pre-agreed prices per unit of work are established as a means to determine adjustments to the Contract Price after actual quantities are determined.

- 1. Unit prices include all necessary labor, materials, equipment, overhead, profit and applicable taxes.

- B. Related Sections:

Refer to the Drawings and individual specification sections for the work requirements for each unit cost.

1.2 QUANTITIES AND COST ADJUSTMENTS

- A. As soon as the work involved in each unit cost item has been completed, submit documentation to establish the actual quantities provided. Submit to the Architect for review and issuance of Change Order.
- B. Change Order amount for each unit cost item will be based on actual quantities multiplied by the unit cost. This unit cost includes all mark-ups, overhead and profit.

PART 2 - PRODUCTS (Not Applicable)

SECTION 01026
UNIT PRICES

Page 2

PART 3 - EXECUTION

3.1 SCHEDULE OF UNIT PRICE ITEMS
Not Used

END OF SECTION

SECTION 01028

CHANGE ORDER PROCEDURES

PART 1 - GENERAL

1.0 RELATED DOCUMENTS

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

1.1 SUMMARY

- A. Section Includes:

Procedures for processing Change Orders and Construction Change Directives.

Refer to Exhibit A of the contract for definitions and contractual requirements.

- B. Related Sections:

1. Percentage allowances for Contractor's overhead and profit: Supplementary Conditions.
2. Allowable Markup: Section 00805.
3. Contract Closeout Procedures: Section 01701
4. Project Record Documents: Section 01720

1.2 SUBMITTALS

- A. Submit the name of individual authorized to accept changes, and to be responsible for informing others in the Contractor's employ of changes in the work.
- B. Proposal Request Forms: Submit on AIA form G709

1.3 DOCUMENTATION

- A. Maintain detailed records of the work completed. Provide complete information for evaluation of proposed changes and to substantiate changes in Contract Sum or Contract Time.
- B. If requested by Architect or Owner, provide the following additional data to

support calculations:

1. Quantities of products, labor and equipment.
 2. Taxes, insurance and bonds.
 3. Overhead and profit within the limits set forth in the Contract.
 4. Justifications for any change in Contract Time.
 5. Credit for deletions from the Contract and similar documentation.
- C. Include with request for Change Order resulting from work performed under a Construction Change Directive the following additional information:
1. Origin and date of Directive.
 2. Dates, time and by whom work was performed.
 3. Time records and wage rates paid.
 4. Invoices and receipts for products, equipment and subcontracts.

1.4 PRELIMINARY PROCEDURES

- A. The Owner through the Architect may submit a Proposal Request which will include description of change and may also include supplementary or revised drawings and specifications and projected time for execution. The time period for which the request will be valid will also be stated.
- B. The Contractor may make a claim for added costs or extension of time by submitting a request to the Architect which describes the claim, the reasons for the claim, change in Contract Sum and Contract Time and full documentation. Include a statement on the effect of the change on the work of separate contractors, if any. For requested substitutions of products, follow procedures and documentation specified in Section 01630.

1.5 AUTHORIZATION

Claims by Contractor:

- A. Architect will follow procedures set forth in the Contract which may result in one or more of the following:
1. A written decision on the claim.
 2. Issuance of a Construction Change Directive
 3. Issuance of a Change Order
- B. Requests for Change Proposal:

After receipt of Contractors' response to a request for a change, Architect will evaluate and either request additional information, issues a Construction

Change Directive or issue a Change Order.

1.6 PROCESSING

Construction Change Directives:

- A. Architect will prepare Construction Change Directives, with Owner's Architect's signatures, in 3 copies, one each for Owner, Architect and Contractor.
- B. Contractor will proceed with the work directed and respond promptly to the stated amount or method for determining costs and time impact by:
 1. Agreement with the directive.
 2. Providing data to substantiate any disagreement with the Directive.
- C. Architect will resolve any differences as mutually agreeable to the parties and issue a Change Order or direct the Contractor to continue the work with costs determined under Exhibit A of the Contract.

Change Orders:

- A. Contractor will furnish supporting documentation for the Change Order as requested by the Architect in 3 copies. Architect will prepare and sign the Change Order in 3 copies, and forward to the Contractor who will sign all copies and forward to Owner for signature and distribution to Architect and Contractor.

1.7 CORRELATION

- A. Promptly revise the Schedule of Values on the Application for Payment Form by indication each authorized Change Order or Construction Change Directive as a separate line item and adjusting the Contract Sum as shown on the Change Order or Construction Change Directive.
- B. Promptly revise the Progress Schedule to reflect any change in the Contract Time and resubmit.
- C. Promptly enter changes in the Project Record Documents.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

SECTION 01040

COORDINATION

PART 1 - GENERAL

1.0 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1-Specification sections, apply to work of this section.

1.1 SUMMARY

Section Includes:

- A. Requirements for coordination, supervision and administration for Project, including but not necessarily limited to:
 - 1. Coordination with Owner's Security
 - 2. Construction Coordination
 - 3. Administrative and supervisory personnel.
 - 4. General installation provisions.
 - 5. Cleaning and protection.

Related Sections:

- 1. For descriptions of the work of the entire Project within and outside of the work of this contract: Section 01010.
- 2. Procedures and field engineering: Section 01105
- 3. Project meetings: Section 01200

1.2 COORDINATION WITH OWNER'S SECURITY

1.3 SUBMITTALS

Coordination Drawings:

- A. For locations where several elements of equipment, mechanical or combined mechanical and electrical work must be sequenced and positioned with precision in order to fit into the available space, prepare coordination shop drawings showing the actual physical dimensions at accurate scale required for the installation. Prepare and submit coordination drawings prior to purchase/fabrication/installation of any of the elements involved in the coordination.
- B. Lay out the mechanical and electrical work in conformity with the Contract Drawings, coordination drawings and other shop drawings, product data and similar requirements, so that the entire mechanical plant will perform as an integrated system properly interfaced with electrical work and other work.

Staff Names:

- A. Within 15 days of Notice to Proceed, submit a list of the Contractor's principal staff assignments, including the Superintendent and other personnel in attendance at the site; their addresses and telephone numbers.
- B. Post copies of the list in the Project meeting room, the temporary field office and each temporary telephone.

1.4 GENERAL COORDINATION

A. General:

- 1. Each entity involved in the performance of work for the entire Project shall cooperate in the overall coordination of the work; promptly, when requested, furnish information concerning its portion of the work; and respond promptly and reasonably to the decisions and requests of persons designated with coordination, supervisory, administrative, or similar authority.
- 2. Where necessary, prepare memoranda for distribution to each party involved outlining special procedures required for coordination. Include such items as required notices, reports, and attendance at meetings.
 - a. Prepare similar memoranda for the Owner and separate Contractors where coordination of their work is required.

B. Administrative Procedures:

- 1. Coordinate scheduling and timing of required administrative procedures with other construction work. Such administrative activities include, but

are not limited to, the following:

- a. Preparation of schedules.
- b. Installation and removal of temporary facilities.
- c. Delivery and processing of submittals.
- d. Progress meetings.
- e. Project closeout activities.

C. Conservation:

1. Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water and materials.

D. Site Utilization:

1. In addition to the site utilization limitations and requirements shown on the drawings, and indicated by the Contract Documents, administer the allocation of available space equitably among entities needing access and space, so as to produce the best overall efficiency in the performance of the total work of the project. Schedule deliveries so as to minimize the space and time requirements for storage of materials and equipment on the site; but do not unduly risk delays in the work.

E. Coordination Meetings:

1. Include in scheduled meetings, coordination of various entities and activities as set forth in Section 01200. Where necessary, schedule additional coordination meetings for this purpose on an as-needed basis.

F. Layout:

1. It is recognized that the Contract Documents are diagrammatic in showing certain physical relationships of the various elements and systems and their interfacing with other elements and systems. Establishment and coordination of these relationships is the exclusive responsibility of the Contractor. Do not scale the drawings. Lay out and arrange all elements to contribute to safety, efficiency and to carry the harmony of design throughout the Work. In case of conflict or un-dimensioned locations, verify required positioning with Architect.

G. Substrate Examination:

1. The Installer of each element of the work must examine the conditions of the substrate to receive the work, dimensions and spaces adjacent, tolerances, interfacing with other elements and services and the conditions under which the work will be performed, and must notify the Contractor in writing of conditions detrimental to the proper or timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the Installer.

H. Large and Heavy Equipment:

1. Wherever possible, prearrange for the movement and positioning of large equipment into the building structure, so that enclosing walls and roofs will neither be delayed nor need to be removed.
2. Otherwise, advise Contractor of opening requirements to be maintained for the subsequent entry of large equipment units. Coordinate the movement of heavy items with shoring and bracing, so that the building structure will not be overloaded during the movement and installation.
3. Where equipment or products to be installed on the roof are too heavy to be hand-carried, do not transport across roof deck; position by crane or other device so as to avoid overloading the roof deck.

1.5 COMPLETE SYSTEMS

- A. It is the intent of the Contract Documents that all systems, including mechanical and electrical, be complete and functional to provide the intended or specified performance. The Contractor shall provide all incidental items and parts necessary to achieve this requirement.
- B. Provide correctly sized power, utilities, piping, drains, services and their connections to equipment and systems requiring them, whether or not specific items are listed in the schedule at the end of this section.

1.6 MECHANICAL/ELECTRICAL/EQUIPMENT COORDINATION

A. General:

1. Sequence, coordinate and integrate the various elements of equipment, mechanical work and electrical work so that various systems and mechanical plant will perform as indicated and be in harmony with other work of the building. Neither the Architect or his engineering

consultants will supervise the coordination, which is the exclusive responsibility of the Contractor.

2. Comply with the following requirements:
 - a. Install piping, duct work and similar services straight and true, aligned with other work, close to walls and overhead structure, allowing for insulation, concealed (except where indicated as exposed) in occupied spaces, and out-of-the-way with maximum passageway and headroom remaining in each space.
 - b. Install electrical work in neat, organized manner with conduit and similar services in or parallel with building lines, and concealed unless indicated as exposed.
 - c. For all work maintain maximum practical overhead clearance but not less than 6" above ceiling. Where exposed, maintain 7'-0" minimum clearance.
 - d. Arrange all work to facilitate maintenance and repair or replacement of equipment. Locate services requiring maintenance on valves and similar units in front of services requiring less maintenance. Connect equipment for ease of disconnecting, with minimum of interference with other work.
 - e. Provide space to permit removal of coils, tubes, fan shafts, filters, other parts which may require replacement.
 - f. Locate operating and control equipment and devices for easy access. Furnish access panels where units are concealed by finishes and similar work.
 - g. Integrate mechanical work in ceiling plenums with suspension system, light fixtures and other work, so that required performances of each will be achieved.
 - h. Give the right-of-way to piping systems required to slope for drainage over other service lines and duct work.
 - i. Advise other trades of openings required in their work for accommodation of mechanical and electrical elements. Provide and place sleeves and anchors required in other work.

B. Access Panels:

1. Access panels for concealed valves, controls, dampers, pull boxes and other devices requiring access and located in concealed positions other than above lift-out ceilings will be furnished by Installer of item needing access. furnish panels as specified in Section 08300. Coordinate locations with other trades and with Architect.

1.7 COMPATIBILITY

Provide products and equipment which are compatible with other work requiring mechanical/electrical interface including electrical connections, control devices, water, drain and other piping connections. Verify electrical characteristics, fuel requirements and other interface requirements before ordering equipment and resolve conflicts that may arise.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION PROCEDURES

A. Inspection of Conditions:

1. Require the Installer of each major component to inspect both the substrate and conditions under which work is to be performed. Do not proceed until unsatisfactory conditions have been corrected in an acceptable manner.
 - a. Inspect materials or equipment immediately upon delivery and again prior to installation. Reject damaged and defective items.
 - b. Re-check measurements and dimensions, before starting each installation.

B. Manufacturer's Instructions:

1. Comply with manufacturer's installation instructions and recommendations, to the extent that those instructions and recommendations are more explicit or stringent than requirements contained in Contract Documents.

C. Installation:

1. Provide attachment and connection devices and methods necessary for securing work. Secure work true to line and level. Allow for expansion and building movement.

2. Install each component during weather conditions and project status that will ensure the best possible results. Isolate each part of the completed construction from incompatible material as necessary to prevent deterioration.
 3. Coordinate temporary enclosures with required inspections and tests, to minimize the necessity of uncovering completed construction for that purpose.
- D. Visual Effects:
1. Provide uniform joint widths in exposed work. Arrange joints in exposed work to obtain the best visual effect. Refer questionable choices to the Architect for final decision.
- E. Mounting Heights:
1. Where mounting heights are not indicated, install individual components at standard mounting heights recognized within the industry for the particular application indicated. Refer questionable mounting height decisions to the Architect for final decision.

3.2 CLEANING AND PROTECTION

During handling and installation, clean and protect construction in progress and adjoining materials in place. Apply protective covering where required to ensure protection from damage or deterioration at substantial completion.

Clean and maintain completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

Limiting Exposures:

- A. Supervise construction activities to ensure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period. Where applicable, such exposures include, but are not limited to, the following:
 1. Excessive static or dynamic loading.
 2. Excessive internal or external pressures.
 3. Excessive high or low temperatures.
 4. Thermal shock.
 5. Excessively high or low humidity.

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COORDINATION

6. Air contamination or pollution.
7. Water or ice.
8. Solvents.
9. Chemicals.
10. Light.
11. Radiation.
12. Puncture.
13. Abrasion.
14. Heavy traffic.
15. Soiling, staining and corrosion.
16. Bacteria.
17. Rodent and insect infestation.
18. Combustion.
19. Electrical current.
20. High speed operation.
21. Improper Lubrication.
22. Unusual wear or other misuse.
23. Contact between incompatible materials.
24. Misalignment.
25. Excessive weathering.
26. Unprotected storage.
27. Improper shipping or handling.
28. Theft.
29. Vandalism.

END OF SECTION

SECTION 01045

CUTTING AND PATCHING

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Related Work Specified Elsewhere:
 - 1. Excavation and Back Fill: Section 02200 Earthwork.

- B. Work Included: contractor shall be responsible for all cutting, fitting and patching including related excavation and back Fill, required to complete the work or to:
 - 1. Make its parts fit together properly.
 - 2. Uncover portions of the work to provide for installation of ill-timed work.
 - 3. Remove and replace defective work.
 - 4. Remove and replace work not conforming to requirements of Contract Documents.
 - 5. Remove samples of installed work as specified for testing.
 - 6. Provide routing penetrations of non-structural surfaces for installation of piping and electrical conduit.

1.02 QUALITY ASSURANCE

- A. Notification of Architect: Notify Architect well in advance of executing any cutting or alternation 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 or operational elements.
 - 5. The visual qualities of sight-exposed elements.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Comply with specifications and standards for each specific product involved.

PART 3 - EXECUTION

3.01 INSPECTION

- A. Inspect existing conditions of the project, including elements subject to damage or to movement during cutting and patching.
- B. After uncovering work, inspect the conditions affecting the installation of products, or performance of the work.
- C. Report unsatisfactory or questionable conditions to the Architect; do not proceed with the work until the architect has provided further instructions.

3.02 PREPARATION

- A. Provide adequate temporary support as necessary to assure the structural value or integrity of the affected portion of the work.
- B. Provide devices and methods to protect other portions of the project from damage.
- C. Provide protection from the elements for that portion of the project which may be exposed by cutting and patching work, and maintain excavations free from water.

3.03 CUTTING AND PATCHING

- A. General: Openings in construction which are required by other contractors shall be provided by crafts involved. It is the responsibility of various contractors to supply in advance, proper and sufficiently detailed information. In the event of failure to supply this advance information, all cutting as may be required shall be done only after concurrence of Architect and at expense of negligent party.
- B. Cutting: Execute cutting and demolition by methods which will prevent damage to other work, and will provide proper surfaces to receive installation of repairs.

Execute excavating and back filling methods which will prevent settlement or damage to other work.

Employ the original installer or fabricator to perform cutting and patching for:

1. Weather-exposed or moisture-resistant elements.
2. Sight-exposed finished surfaces.

Cut concrete or masonry using a masonry saw or core drill as applicable. Pneumatic tools will not be allowed unless approved by Architect.

- C. Fitting: Executing fitting and adjustment of products to provide a finished installation to comply with specified products, functions, tolerances and finishes.

Fit work airtight to pipes, sleeves, ducts, conduit and other penetration through surfaces.

- D. Patching: Wherever any pipe, conduit, duct, steel member, bracket, equipment, or other material penetrates or passes through fire-resistant wall, ceiling or floor, completely seal voids in construction with cement grout, plaster or fire-resistant material, embedding sealing material full thickness of wall ceiling or floor.

- E. Finishing: Where surfaces are exposed, finish with same materials specified in finish schedule or material that is on constructed surfaces.

Refinish entire surface as necessary to provide an even finish to match adjacent finishes:

1. For continuous surfaces, refinish to nearest intersection.
2. For an assembly, refinish the entire unit.

END OF SECTION

SECTION 01120

ALTERATION PROJECT PROCEDURES

PART 1 - GENERAL

1.1 REQUIREMENTS INCLUDED

- A. Coordinate work of trades and schedule elements of alterations and renovation work by procedures and methods to expedite completion of the work.
- B. In addition to demolition, specifically shown, cut, move and remove items as necessary to provide access or to allow alterations and new work to proceed. Include such items as:
 - 1. Repair or removal of hazardous or unsanitary conditions.
 - 2. Removal of unsuitable or extraneous materials not marked for salvage, such as abandoned furnishings and equipment, and debris such as rotted wood, rusted metals and deteriorated concrete.
 - 3. Cleaning of surfaces, and removal of surface finishes, as needed to install new work and finishes.
- C. Patch, repair and refinish existing items to remain, to the specified conditions for each material, with a workmanlike transition to adjacent new items of construction.
- D. Cutting and repairing of existing roof caused by demolition, alteration or any other items within Scope of Work for which penetration of existing roof is necessary. Repair should be made with similar materials to match existing conditions and shall conform to any testing and/or requirements for proper assembly. Architect will be notified of existing conditions and will verify proper conformance.

1.2 RELATED REQUIREMENTS

- A. Cutting and Patching: Section 01045
- B. Use of Existing Utilities: Section 01500, Construction Facilities and Temporary Controls.
- C. Cleaning During Construction: Section 01500.

1.3 ALTERATIONS, CUTTING AND PROTECTION

- A. Assign the work of moving, removal, cutting and patching to trades qualified to perform the work in a manner to cause least damage to each type of work, and provide means of returning surfaces to appearance of new work.
- B. Perform cutting and removal work to remove minimum necessary, and in a manner to avoid damage to adjacent work.
 - 1. Cut finish surfaces such as masonry, tile, plaster or metals by methods to terminate surfaces in a straight line at a natural point of division.
- C. Protect existing finishes, equipment and, adjacent work which is scheduled to remain, from damage.
 - 1. Protect existing and new work from weather and extremes of temperature.
 - a. Maintain existing interior work above 60 degrees F.
 - b. Provide weather protection, waterproofing, heat and humidity control as needed to prevent damage to remaining existing work and to new work.
- D. Provide temporary enclosures to separate work areas from existing building and from area occupied by Owner, and to provide weather protection.

PART 2 - PRODUCTS

2.1 PRODUCTS FOR PATCHING, EXTENDING AND MATCHING

- A. General requirements that work be complete:
 - 1. Provide same products or types of construction as that in existing structure, as needed to patch, extend or match existing work.
 - a. Generally, Contract Documents will not define products or standards of workmanship present in existing construction; Contractor shall determine products by inspection and any necessary testing, and workmanship by use of the existing as a sample of comparison.
 - 2. Presence of a product, finish, or type of construction, requires that patching, extending or matching shall be performed as necessary to make work complete and consistent.

PART 3 - EXECUTION

3.1 PERFORMANCE

- A. Patch and extend existing work using skilled mechanics who are capable of matching existing quality of workmanship. Quality of patched or extended work shall be not less than that specified for new work.

3.2 LAYING OUT WORK

- A. Verify dimensions and elevations indicated in layout of existing work. Refer discrepancies between drawings, specifications and existing conditions to Architect for adjustment before work affected is performed. Failure to make such notification shall place responsibility upon Contractor to carry out work in satisfactory, workmanlike manner.
- B. The Contractor shall be held responsible for the location and elevation of the construction contemplated by the Construction Documents.
- C. Prior to commencing work, carefully compare and check Architectural, Structural, Mechanical and Electrical drawings, each with the other that in any way affects the location or elevation of the work to be executed, and should any discrepancy be found, immediately report the same to the Architect for verification and adjustment.

3.3 LOCATION OF EQUIPMENT AND PIPING

- A. Drawings showing location of equipment, piping, duct work, etc. are diagrammatic and job conditions shall not always permit their installation in the location shown. When this situation occurs, it shall be brought to the Architect's attention immediately and the relocation determined in a joint conference.
- B. The Contractor shall be responsible for the relocating of any items without first obtaining the Architect's approval. he shall remove and relocate such items at his own expense if so directed by the Architect.

3.4 PATCHING EXISTING FACILITIES

- A. Existing structure, facilities, etc. that are damaged or removed due to required construction work, shall be patched, repaired or replaced, and be left in their original state of repair by the Contractor, to satisfaction of the Architect.

3.5 INTEGRATING EXISTING WORK

- A. Protect existing improvements from damage.

- B. Contractor's operations shall be confined to the immediate vicinity of the new work and shall not in any way interfere with or obstruct the ingress or egress to and from adjacent facilities.
- C. Where new work is to be connected to existing work, special care shall be exercised not to disturb or damage the existing work more than necessary. All damaged work shall be replaced, repaired and restored to its original condition at no cost to the Owner.

3.6 ADJUSTMENTS

- A. Where partitions are removed, patch floors, walls and ceilings with finish materials to match existing.
 - 1. Where removal of partitions results in adjacent spaces becoming one, rework floors and ceilings to provide smooth planes without breaks, steps or bulkheads.
 - 2. Where extreme change of plane or two inches or more occurs, request instructions from Architect as to method of making transition.

3.7 DAMAGED SURFACES

- A. Patch and replace any portion of an existing finished surface which is found to be damaged, lifted, discolored, or shows other imperfections, with matching materials.
 - 1. Provide adequate support of substrate prior to patching the finish.
 - 2. Refinish patched portions of painted or coated surfaces in a manner to produce uniform color and texture over entire surface.
 - 3. When existing surface cannot be matched, refinish entire surface to nearest intersections.

3.8 TRANSITION FROM EXISTING TO NEW WORK

- A. When new work abuts or finishes flush with existing work, make a smooth and workmanlike transition. patch work shall match existing adjacent work in texture and appearance so that the patch or transition is invisible at a distance of five feet.
 - 1. When finished surfaces are cut in such a way that a smooth transition with new work is not possible, terminate existing surface in a neat manner along a straight line at a natural line of division, and provide trim appropriate to finished surface.

3.9 DUST CONTROL

- A. Precaution shall be exercised at all times to control dust created as a result of any operations during the construction period. If serious problems arise due to air borne dust, and when directed by Architect, operations causing such problems shall be temporarily discontinued and steps taken to control the dust.

3.10 FIRE PROTECTION

- A. Maintain good housekeeping practices to reduce the risk of fire damage and injury to workmen. All scrap materials, rubbish and trash shall be removed daily from in and about the work area and shall not be permitted to be scattered to adjacent areas.
- B. Suitable storage space shall be provided outside the immediate building area for storing flammable materials and paints; no storage will be permitted in the building. Excess flammable liquids being used inside the building shall be kept in closed metal containers and removed from the building during unused periods.
- C. A fire extinguisher shall be available at each location where cutting or welding is being performed. Where electric or gas welding or cutting work is done, interposed shields of noncombustible material shall be used to protect against fire damage due to sparks and hot metal. When temporary heating devices are used, a watchman shall be present to cover periods when other workmen are not on the premises.
- D. Provide fire extinguishers in accordance with the recommendations of NFPA Bulletins Nos. 10 and 241.

3.11 CLEANING

- A. Perform periodic and final cleaning as specified in Section 01710, 01500 and as follows:
 - 1. Clean Owner-occupied areas daily, when used by Contractor.
 - 2. Clean spillage, over spray, and heavy collection of dust in Owner-occupied area immediately.
- B. At completion of work of each trade, clean area and make surfaces ready for work of successive trades.
- C. At completion of work in each area, provide final cleaning and return space to a condition suitable for use by Owner.

END OF SECTION

SECTION 01090

REFERENCE STANDARDS

PART 1 - GENERAL

1.0 RELATED DOCUMENTS

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

1.1 SUMMARY

Section Includes:

- A. General information and listing of reference standards.

1.2 REFERENCE STANDARD

A. Applicability of Standards:

- 1. Except where Contract Documents include more explicit or stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into Contract Documents. Such standards are made a part of the Contract Documents by reference. Individual Sections indicate which codes and standards the Contractor must keep available at the project site for reference.

B. Conflicting Requirements:

- 1. Where compliance with two or more standards is specified, and they establish different or conflicting requirements for minimum quantities or quality levels, the most stringent requirement will be enforced, unless the Contract Documents indicate otherwise. Refer requirements that are different, but apparently equal, and uncertainties as to which quality level is more stringent to the Architect for a decision before proceeding.

C. Publication Dates:

- 1. Comply with standard in effect as of date of Contract Documents.

D. Copies of Standards:

1. Each entity engaged in construction on the Project is required to be familiar with industry standards applicable to that entity's construction activities. Copies of applicable standards are not bound with the Contract Documents.
 - a. Where copies of standards are needed for proper performance of a recognized construction activity, the Contractor shall obtain copies directly from the publication source.

1.3 ABBREVIATIONS

Trade Associations, Standards and Abbreviations:

References in the Contract Documents to publications and recommendations, by either acronym, name or abbreviation, include but are not necessarily limited to the following trade associations, technical societies, government agencies, recognized authorities and standards:

AA	Aluminum Association
AABC	Associated Air Balance Council
AAMA	American Architectural Manufacturers Association
AAN	American Association of Nurserymen
AASHTO	American Association of State Highway & Transportation Officials
AATCC	American Association of Textile Chemists & Colorists
ACI	American Concrete Institute
ACIL	American Council of Independent Laboratories
ACPA	American Concrete Pipe Association
ADC	Air Diffusion Council
AFBMA	Anti-Friction Bearing Manufacturer's Association
AGA	American Gas Association
AHA	American Hardboard Association
AHAM	Association of Home Appliance Manufacturers
AI	The Asphalt Institute
AIA	The American Institute of Architects
A.I.A.	American Insurance Association
AIHA	American Industrial Hygiene Association
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
AITC	American Institute of Timber Construction
ALI	Associated Laboratories
ALSC	American Lumber Standards Committee
AMCA	Air Movement and Control Association
ANSI	American National Standards Institute

SECTION 01090
REFERENCE STANDARDS

APA	American Plywood Association
A.P.A.	American Parquet Association
API	American Petroleum Institute
ARI	Air Conditioning and Refrigeration Institute
ARMA	Asphalt Roofing Manufacturer's Association
ASA	Acoustical Society of America
ASC	Adhesive and Sealant Council
ASHRAE	American Society of Heating, Refrigeration & Air Conditioning Engineers
ASME	American Society of Mechanical Engineers
ASPE	American Society of Plumbing Engineers
ASSE	American Society of Sanitary Engineers
ASTM	American Society for Testing and Materials
AWI	Architectural Woodwork Institute
AWPA	American Wood Preserver's Association
AWPB	American Wood Preserver's Bureau
AWS	American Welding Society
AWWA	American Water Works Association
BHMA	Builders' Hardware Manufacturer's Association
BIA	Brick Institute of America
BIFMA	Business & Institutional Furniture Manufacturer's Association
CAGI	Compressed Air and Gas Institute
CAUS	Color Association of the United States
CBM	Certified Ballast Manufacturers Association
CDA	Copper Development Association
CE	Corps of Engineers (U.S. Department of the Army)
CFR	Code of Federal Regulations
CGA	Compressed Gas Association
CISCA	Ceiling and Interior Systems Contractors Association
CISPI	Cast Iron Soil Pipe Institute
CLFMI	Chain Link Fence Manufacturers Institute
CPSC	Consumer Products Safety Commission
CRI	The Carpet and Rug Institute
CRSI	Concrete Reinforcing Steel Institute
CS	Commercial Standard (U.S. Department of Commerce)
CSI	The Construction Specification Institute
CTI	Ceramic Tile Institute of America
CSSB	Cedar Shake and Shingle Bureau
DHI	Door and Hardware Institute
DLPA	Decorative Laminate Products Association
DOC	Department of Commerce
DOT	Department of Transportation

SECTION 01090
REFERENCE STANDARDS

ECSA	Exchange carrier's Standards Association
EIA	Electronic Industries Association
EIMA	Exterior Insulation Manufacturer's Association
EJMA	Expansion Joint Manufacturer's Association
EA	Environmental Protection Agency
ETL	ETL Testing Laboratories, Inc.
FAA	Federal Aviation Administration
FCC	Federal Communications Commission
FCI	Fluid Controls Institute
FGMA	Flat Glass Marketing Association
FHA	Federal Housing Administration (U.S. Dept. of HUD)
FM	Factory Mutual Research Organization
FPL	Forest Products Laboratory (U.S. Dept. of Agriculture)
FS	Federal Specification (General Services Administration)
FTI	Facing Tile Institute
GA	Gypsum Association
GSA	General Services Administration
HEI	Heat Exchange Institute
HI	Hydronics Institute
H.I.	Hydraulic Institute
HMA	Hardwood Manufacturer's Association
HPMA	Hardwood Plywood Manufacturer's Association
HUD	Housing and Urban Development
IBD	Institute of Business Designers
ICBO	International Conference of Building Officials
ICEA	Insulated Cable Engineer's Association, Inc.
IEC	International Electrotechnical Commission (available from ANSI)
IEEE	Institute of Electrical and Electronic Engineers
IESMA	Illuminating Engineering Society of North America
IGCC	Insulating Glass Certification Council
ILI	Indiana Limestone Institute of America
IMI	International Masonry Institute
IMSA	International Municipal Signal Association
IRI	Industrial Risk Insurers
ISA	Instrument Society of America
LPI	Lighting Protection Institute
MBMA	Metal Building Manufacturer's Association
MCCA	Mechanical Contractors' Association of America
MFMA	Maple Flooring Manufacturer's Association

SECTION 01090
REFERENCE STANDARDS

MIA	Marble Institute of America
MIL	Military Standardization Documents (U.S. Department of Defense)
ML/SFA	Metal Lath/Steel Framing Association
MRCA	Midwest Roofing Contractor's Association
MSS	Manufacturer's Standardization Society of the Valve & Fitting Industry
NAAMM	The National Association of Architectural Metal Manufacturers
NAPA	National Asphalt Pavement Association
NAPF	National Association of Plastic Fabricators (Now DLPA)
NBGQA	National Building Granite Quarries Association
NBHA	National Builders Hardware Association (Now DHI)
NBS	National Bureau of Standards (U.S. Dept. of Commerce)
NCMA	National Concrete Masonry Association
NEC	National Council on Radiation Protection and Measurement
NECA	National Electrical Contractors Association
NEII	National Elevator Industry, Inc.
NEMA	National Electrical Manufacturer's Association
NFPA	National Fire Protection Association
N.F.P.A.	National Forests Products Association
NHLA	National Hardwood Lumber Association
NIST	National Institute of Standards and Technology
NKCA	National Kitchen Cabinet Association
NLGA	National Lumber Grades Authority
NOFMA	National Oak Flooring Manufacturers Association
NPA	National Particleboard Association
NPCA	National Paint and Coating Association
NRCA	National Roofing Contractor's Association
NSF	National Sanitation Foundation
NSPE	National Society of Professional Engineers
NSSEA	National School Supply and Equipment Association
NTMA	The National Terrazzo and Mosaic Association
NWMA	National Woodwork Manufacturers Association (Now NWWDA)
NWWDA	National Wood Window & Door Association (Formerly NWMA)
OSHA	Occupational Safety and Health Administration
PCA	Portland Cement Association
PCI	Prestressed Concrete Institute
PDI	Plumbing & Drainage Institute
PEI	Porcelain Enamel Institute
PS	Product Standard of NBS (U.S. Dept. of Commerce)
RFC I	Resilient Floor Covering Institute
RIC	Roof Insulation Committee
RIS	Redwood Inspection Service
RMA	Rubber Manufacturer's Association

SECTION 01090
REFERENCE STANDARDS

SAMA	Scientific Apparatus Makers Association
SDI	Steel Deck Institute
S.D.I.	Steel Door Institute
SGCC	Safety Glazing Certification Council
SIGMA	Sealed Insulation Glass Manufacturer's Association
SJI	Steel Joist Institute
SMACNA	Sheet Metal & Air Conditioning Contractor's National Association
SPIB	Southern Pine Inspection Bureau
SPRI	Single Ply Roofing Institute
SSPC	Steel Structures Painting Council
SSPMA	Sump and Sewage Pump Manufacturer's Association
SWI	Steel Window Institute
SWPA	Submersible Wastewater Pump Association
TCA	Tile Council of America, Inc.
TIMA	Thermal Insulation Manufacturer's Association
TPI	Truss Plate Institute
UBC	Uniform Building Code
UL	Underwriters' Laboratories
USDA	United States Department of Agriculture
USPS	United States Postal Service
WCLIB	West Coast Lumber Inspection Bureau
WCMA	Wall Covering Manufacturer's Association
WIC	Woodwork Institute of California
WRI	Wire Reinforcing Institute
WSC	Water Systems Council
WSFI	Wood and Synthetic Flooring Institute
WWPA	Western Wood Products Association (Grading Rules)
W.W.P.A.	Woven Wire Products Association

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION

SECTION 01105

ADMINISTRATION, PROCEDURES, CODES

PART 1 - GENERAL

1.0 RELATED DOCUMENTS

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

1.1 SUMMARY

- A. General administrative requirements and procedures and related applicable codes.

1.2 CODES

- A. Obtain all permits, inspections, approvals and certificates required by law. Conform to all laws, ordinances, rules and regulations applicable to the location of the Project.

Regulations:

- A. In addition to the above conform to the following standards and regulations:

Obtain copies of the following regulations and retain at the Project site, available for reference by parties who have a reasonable need for such reference.

- 1 2003 International Building Code
- 2 ICC/ANSI A117.1-1998 Accessible and Usable Buildings and Facilities
- 3 2003 International Fire Code
- 4 2003 International Mechanical Code
- 5 2003 International Plumbing Code
- 6 2006 IECC

Publication Dates:

- A. Comply with codes and standards in effect at the date of the Contract Documents, except where a standard of a specific date or edition is indicated.

1.3 EXISTING UTILITIES

- A. The existence and location of underground utilities and construction indicated as existing are not guaranteed.
- B. Before starting any work disturbing, moving or penetrating the ground, call the owning utilities, to locate, stake and identify depth of all buried utilities within the construction limits. Obtain location information for water and sewer lines from the appropriate entity.

1.4 SURVEYS, LAYOUTS, LEVELS

General:

- A. Working from lines and levels established by the property survey, establish and maintain bench marks and other dependable markers to set the lines and levels for the work at each story of construction and elsewhere on the site as needed to properly locate every element of the work of the entire project.
 - 1. As construction proceeds, check every major element for line, level and plumb.
- B. Calculate and measure required dimensions as shown within recognized tolerances. Do not scale the drawings to determine dimensions. Advise entities engaged in construction activities of the marked lines and levels provided for use.
- C. Record deviations from the required lines and levels, and advise the Architect promptly upon detection of deviations exceeding indicated or recognized tolerances. Record deviations which are accepted (not corrected) on the record drawings. Refer to Section 01720 for record drawing requirements.

Site Improvements:

- A. Locate and lay out site improvements, including pavements, stakes for grading, fill and topsoil placement, utility slopes and invert elevations by instrumentation and similar appropriate means.

Building Lines and Levels:

- A. Locate and lay out batter boards for structures, building foundations, column grids and locations, floor levels and control lines and levels required for mechanical and electrical Work.

Basic Layout:

- A. The Contractor will locate and maintain positions for building corners and

primary wall lines for all entities engaged in construction and will establish final grading control levels. All other layouts, grade stakes and levels required for the Work are the responsibility of each Installer.

Layout Procedures:

- A. Verify layout information shown on the drawings, in relation to the property survey and existing bench marks, before proceeding with the layout of the actual work. Locate and protect existing benchmarks and control points. Preserve permanent reference points during construction.
 - 1. Do not change or relocate benchmarks or control points without prior written approval. Promptly report lost or destroyed reference points, or requirements to relocate reference points because of necessary changes in grades or locations.
 - 2. Promptly replace lost or destroyed project control points. Base replacements on the original survey control points.
- B. Establish and maintain a minimum of two permanent benchmarks on the site, referenced to data established by survey control points.
 - 1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.
- C. As the work proceeds, maintain an accurate surveyor's log or record book of such checks, available for the Architect's reference at reasonable times.

1.5 CONTRACTOR'S CONSTRUCTION SCHEDULE

- A. Furnish Construction Schedule, as required by General Conditions, not less than 4 copies.
 - 1. Prepare the schedule on a sheet, or series of sheets, of stable transparency, or other reproducible media, of sufficient width to show data for the entire construction period.
 - 2. Secure time commitments for performing critical elements of the Work from parties involved. Coordinate each element on the schedule with other construction activities; include minor elements involved in the sequence of the Work. Show each activity in proper sequence. Indicate graphically sequences necessary for completion of related portions of the Work.
 - 3. Coordinate the Contractor's construction schedule with the schedule of

values, list of subcontracts, submittal schedule, progress reports, payment requests and other schedules.

4. Indicate completion in advance of the date established for Substantial Completion. Indicate Substantial Completion on the schedule to allow time for the Architect's procedures necessary for certification of Substantial Completion.

Bar Chart Schedule:

- A. Prepare a fully developed, horizontal bar chart type Contractor's construction schedule. Submit within 30 days of the date established for "Commencement of the Work."
 1. Provide a separate time bar for each significant construction activity. Provide a continuous vertical line to identify the first working day of each week. Use the same breakdown of units of the Work as indicated in the "Schedule of Values".
 2. Within each time bar, indicate estimated completion percentage in 10% increments. As Work progresses, place a contrasting mark in each bar to indicate Actual Completion.
 3. Include listing of Subcontractors, suppliers and materials men with name of contact person, address and phone number.

Updating:

- A. The schedules shall be updated and reissued monthly and shall reflect actual job progress, delays or gains of time and any rescheduling. The original schedule and each updating shall be furnished in 4 copies, one to the Owner and three to the Architect. All costs for this scheduling shall be borne by the Contractor. Submit Architect's copies as a part of each pay request which will not be processed without such updates.
 1. When schedule revisions affect the submittals schedule, revise that schedule and submit to Architect with revised Construction Schedule.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Properly carton, crate, cover and protect materials, products and equipment for shipping, handling and storing. Use appropriate means for hoisting and loading which will prevent damage or over stress to items being handled or shipped. Store them under roof in controlled environment wherever feasible otherwise store off the ground under suitable coverings properly secured against wind and weather. Protect all items from rain, snow, moisture, wind,

cold, heat, frost, sun, staining, discoloration, deterioration and physical damage from any cause. Refer to individual sections for specific requirements.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION

SECTION 01200

PROJECT MEETINGS

1.01 PRE-CONSTRUCTION CONFERENCE

A. Pre-construction Conference and Site Mobilization Conference: A meeting will be scheduled by the Architect within 10 days following Notice Administrative requirements such as subcontractor lists, schedule of values, payment applications, pay-out schedules, progress charts, change order procedures, sales tax records, and project closeout will be reviewed in detail. Representatives of the General Contractor, Mechanical and Electrical Subcontractors, Owner, Architect and Architect's Consultants will be present. Job site procedures to include the following items will be discussed.

1. Procedures for maintaining record documents.
2. Owner's Requirements.
3. Construction facilities and controls.
4. Temporary utilities.
5. Security and housekeeping procedures.
6. Materials testing.
7. Requirements of start-up trades.
8. Building Layout
9. Use of Architect's Consultants.

1.02 PROGRESS MEETINGS

A. The Contractor shall schedule weekly progress meetings at Contractor's job site field office. Representatives of the General Contractor and Architect will be present. Also invited as appropriate to items under discussion will be selected subcontractors or suppliers and the Architect's Consultants. The following items will be discussed:

1. Review of work progress since previous meetings.
2. Field observations, problems, conflicts.
3. Problems which impede construction schedule.
4. Review of off-site fabrication, delivery schedules.
5. Corrective measures and procedures to regain projected schedule.
6. Revisions to construction schedule.
7. Plan progress, schedule during succeeding work period.
8. Coordination of Schedules.
9. Maintenance of quality standards.
10. Review submittal schedules; expedite as required.

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PROJECT MEETINGS

Page 2

11. Review proposed changes for effect on other trades, construction schedule, and completion date.
12. Coordination of separate contracts.
13. Other business as required.

END OF SECTION

SECTION 01310

SCHEDULES, REPORTS, PAYMENTS

PART 1 - GENERAL

1.00 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division-1 Specification sections, apply to work of this section.

1.01 COORDINATION

- A. Coordinate both the procedural timing and the listing (naming and sequencing) of reports/activities required by provisions of this section and other sections, to afford consistency and logical coordination between submitted reports or lists. Maintain coordination and correlation between separate reports by updating at monthly or shorter time intervals. Make appropriate distribution of each report and updated report to entities involved in the work including Architect/Engineer and Owner. In particular, provide close coordination of progress schedule, schedule of values, listing of subcontractors, schedule of submittals, progress reports, and payment requests.

1.02 PRELIMINARY PROGRESS SCHEDULE

- A. Bar-Chart Schedule: Not more than 15 days following "Notice of Award", submit a bar-chart type progress schedule indicating a time bar for each major category or unit of work to be performed at site, properly sequenced and intermeshed, and showing completion of the work sufficiently in advance of date established for substantial completion of the work. With submittal of bar chart, submit a tabulation (by date) of submittals required during first 90 days of Construction Time; as required either directly by date/period relation in contract documents, or necessitated by lead times related to individual time bars shown on schedule for associated work. At Contractor's option, submittal dates may be shown on bar-chart schedule, in lieu of being tabulated.

1.03 FULLY DEVELOPED PROGRESS SCHEDULE

- A. Bar-Chart Schedule: Based on preliminary development of progress schedule (if any), and whatever updating and feedback may have occurred,

during project start-up, secure critical time commitments for performing major elements of the work. Within 30 days of date established for "commencement of the work", submit a comprehensive bar-chart type progress schedule indicating (by stage-coded symbols) a time bar for each major category or unit of work to be performed at site, and including minor units which are, nevertheless, involved in overall sequencing of the work. Arrange schedule to graphically show major sequences required in intermeshing of work, and to show how substantial completion is scheduled to allow for Architect's or Engineer's procedure for certification thereto. Prepare and maintain schedule sufficiently wide sheet or series of sheets, of stable transparency or other reproducible stock, to show required data clearly for entire Construction Time, and to permit reproduction for required distribution.

- B. Phasing: Arrange schedule with notations to show how sequence of work is affected by requirements for phased completion, work by separate contractors, work by Owner, pre-purchased materials, coordination with existing work, limitations of continued occupancies, non-interruptible services, partial occupancy prior to substantial completion, site restrictions, provisions for future work, seasonal variations, environmental control, and similar provisions of total project. Refer to other sections of Division-1 and other contract documents for requirements.

- C. Distribution: Following initial submittal to and response by Architect/Engineer, print and distribute progress schedule to Architect/Engineer (3 copies), Owner, separate contractors (if any), principal subcontractors and suppliers or fabricators, and others with a need-to-know schedule-compliance requirement. Post copies in project meeting rooms and field (temporary) offices. Distribute and post subsequent updated issues to same entities, whenever revisions are made; except delete entities from distribution which have completed assigned work and are no longer involved in performance of scheduled work.

1.04 SUBMITTAL SCHEDULE:

- A. General: Immediately following development and acceptance of fully developed progress schedule, prepare a complete schedule of work-related submittals. Submit within 10 days of date required for establishment of progress schedule. Correlate submittal schedule with listing of principal subcontractors, as required by the General Conditions, and with the "listing of products" or "procurement schedule" as specified in "Products and Substitutions" sections and elsewhere in contract documents.

- B. Form: Prepare schedule in chronological sequence of "first submittals". show category of submittal, name of subcontractor, generic description of work covered, related section numbers, activity or event number on progress schedule, scheduled date for first submission and blank columns for actual date of submittal, resubmittal, and final release or approved by Architect or Engineer.

1.05 PROGRESS MEETINGS, REPORTING:

- A. Initial Progress Meeting: Schedule initial progress meeting, recognized as "Pre-Construction Meeting", for a date not more than 15 days after date of commencement of the work. Use it as an organizational meeting, and review responsibilities and personnel assignments.
- B. Progress Meeting: Weekly, to be attended by a representative of the Owner, Architect, Contractor and major subcontractors at the Project Site.
- C. Schedule Updating: Immediately following each progress meeting, where revisions to progress schedule have been made or recognized, revise progress schedule. Reissue revised schedule concurrently with report of each meeting and the submittal of progress payment requests.

1.06 SCHEDULE OF VALUES:

- A. General: Prepare schedule of values, as required by General Conditions, in coordination with preparation of progress schedule. Correlate line items with other administrative schedules and forms required for the work, including progress schedule, payment request form, listing of subcontractors, schedule of allowances schedule of alternates, listing of products and principal suppliers and fabricators, and schedule of submittals. Provide breakdown of Contract Sum in sufficient detail to facilitate continued evaluation of payment requests and progress reports. Break down principal subcontract amounts into several line items. Round off to nearest whole dollar, but with total equal to Contract Sum. Submit (3) copies of schedule of values to Architect/Engineer no later than 14 days after Notice to Proceed.
- B. Schedule Updating: Update and resubmit schedule of values when change orders affect listing and when actual performance of the work involves necessary changes of substance to values previously listed.

1.07 PAYMENT REQUESTS:

- A. General: Except as otherwise indicated, sequence of progress payments is to be regular, and each must be consistent with previous applications and

payments. It is recognized that certain applications involve extra requirements, including initial application, application at times of substantial completion, and final payment application.

- B. Waivers of Lien: For each payment application, submit waivers of lien from every entity (including Contractor) who could lawfully and possibly file a lien in excess of \$100 arising out of Contract and related to the work covered by payment. Submit partial waivers for amount requested (prior to deduction or retainage) on each item; and when application shows completion of item, submit final of full waivers. Owner reserves right to designate which entities involved in the work must submit waivers.
- C. Waiver Delays: Each progress payment must be submitted with Contractor's waiver for period of construction covered by application; but may, at Contractor's option, be submitted with waivers from subcontractors, sub-subcontractors and suppliers for previous period of construction covered by previous application; except final payment application must be submitted with (or preceded by) final or full waivers from every entity involved with performance of the work.
- D. Waiver Forms: Submit waivers on forms, and executed in a manner, acceptable to Owner.
- E. Payment Application Times: The "date" for each progress payment is as indicated in Contractor Agreement.
- F. Payment Application Forms: Certificate For Contractors Payment shall be made on forms as required by Owner's Representative.
- G. Application Preparation: Except as otherwise indicated, complete every entry provided for on the form, including notarization and execution by authorized persons. Incomplete applications will be returned by Architect without action. Entries must match current data of schedule of values and progress schedule and report. Listing must include amounts of change orders issued prior to first day of the "period of construction" covered by application.
- H. Initial Payment Application: The principal administrative actions and submittals which must precede or coincide with submittal of first payment application can be summarized as follows, but not necessarily by way of limitation:

Listing of subcontractors and principal supplier and fabricators.
Schedule of values.
Progress schedule (final).

- Schedule of principal products.
 - Schedule of unit prices.
 - Schedule of submittals.
 - Listing of Contractor's staff assignments and principal consultants.
 - Copies of acquired building permits and similar authorizations and licenses from governing authorities for current performance of the work.
 - Performance and/or payment bonds (if required).
 - Evidence satisfactory to Owner that Contractor's insurance coverages have been secured.
 - Data needed to acquire Owner's insurance coverages.
 - Initial settlement survey and damage report, if required.
 - Initial progress report, including report of pre-construction meeting.
- I. Application at Time of Substantial Completion: Following issuance of Architect's final "certificate of substantial completion," and also in part as applicable to prior certificates on portions of completed work as designated, a "special" payment application may be prepared and submitted by Contractor. The principal administrative actions and submittals which must proceed or coincide with such special applications can be summarized as follows, but not necessarily by way of limitation.
1. Occupancy permits and similar approvals or certifications by governing authorities and franchised services, assuring Owner's full access and use of completed work.
 2. Warranties (guarantees), maintenance agreements and similar provisions of contract documents.
 3. Test/adjust/balance records, maintenance instructions, meter readings, start-up performance reports, and similar change-over information germane to Owner's occupancy, use, operation and maintenance of completed work.
 4. Final cleaning of work.
 5. Application for reduction (if any) of retainage, and consent of surety.
 6. Advice to Owner on coordination of shifting insurance coverage's, including proof of extended coverage's as required.
 7. Final progress photographs, where required.
 8. Listing of contractor's incomplete work, recognized as exceptions to Architect's/Engineer's Certificate of substantial completion.

- C. Architect:
1. Check drawings by making notes and corrections on sepia tracings; stamp "No Exceptions Taken", "Revise and Re-submit", "Rejected", etc. as required.
 2. In the event that the drawings require a consultant's check, route tracing and two prints through the consultant and back to the Architect as necessary.
 3. Retain marked prints, or reproducible from marked sepia.
 4. Return marked sepias to contractor.
- D. General Contractor:
1. Print necessary copies for record, distribution, etc.
 2. Send sepia tracings to Subcontractor.
 3. Maintain one final set for Record Documents. See 01700 Closeout.
- E. Re-submittal: In the event the drawings have to be re-submitted to the Architect, the original sepia tracings shall be returned directly to the General Contractor anywhere in the above routing necessary. The Subcontractor shall make his corrections and re-route new sepia tracings as outlined above.
- F. References: Shop drawings shall be referenced to applicable drawings or specification Sections to facilitate ease and accuracy of checking.

1.03 PRODUCT DATA

- A. Subcontractor: Subcontractor shall submit six (6) copies of brochure material and any required samples, or as otherwise indicated in various Sections.
- B. Routing: Routing will be as indicated above for shop drawings with the Architect and Engineer retaining four (4) copies for file and returning two copies to the Contractor for his file and distribution to the Subcontractor as applicable.
- C. Reference: Product data shall be referenced to applicable drawings or specification sections to facilitate ease and accuracy of checking.

1.04 JOB SITE DOCUMENTS

- A. Only accepted shop drawings or product data shall be kept at the job site. The Contractor shall keep a complete set of such documents on file at the job site.

SECTION 01340
SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

1.05 FIELD MEASUREMENTS

- A. Required Field Measurements are the responsibility of the General Contractor and will be made after shop drawings have been checked by the Architect.

1.06 SAMPLES

- A. The Architect will provide the General Contractor with a check list indicating all materials where color, texture or finish is subject to selection by the Architect. Certain other samples will also be requested for use by the Architect in preparation of color and material samples presentations for the Owner.
- B. Promptly after receipt of checklist, the General Contractor shall assemble and deliver to the Architect a complete collection of all required samples.
- C. Upon receipt of such complete collection of samples, the Architect will, with reasonable promptness, make the selections and prepare and deliver to the General Contractor a schedule covering all items subject to selection.
- D. The Architect reserves the right not to make individual determination or selections until all samples of all materials are furnished to him.

END OF SECTION

SECTION 01400

QUALITY CONTROL

1.01 TESTING - GENERAL

The Contractor shall provide such equipment and facilities as the Architect may require for conducting field tests and for collecting and forwarding samples. The Contractor shall not use any materials or equipment represented by samples until tests, if required, have been made and the materials or equipment found to be acceptable. Any product which becomes unfit for use after approval thereof shall not be incorporated into the work.

All materials or equipment proposed to be used may be tested at any time during their preparation use. The General Contractor shall furnish the required samples without charge and shall give sufficient notice of the placing of orders to permit the testing. Products may be sampled either prior to shipment or after being received at the site of the work.

Tests shall be made by an accredited testing laboratory. Except as otherwise provided, sampling and testing of all materials and the laboratory methods and testing equipment shall be in accordance with the latest standards and tentative methods of the American Society for Testing Materials (ASTM).

Where additional or specific information concerning testing methods, sample sizes, etc., is required, such information is included under the applicable sections of the Specifications.

Any modification of, or elaboration on, these test procedures which may be included for specific materials under their respective sections in the Specifications shall take precedence over these procedures.

The General Contractor shall be responsible for providing samples of sufficient size for test purposes and for cooperating with the Owner or his representative in obtaining and preparing samples for tests. All tests will be in accordance with standard test procedures and will be performed by a laboratory selected by the Owner. Results of all tests shall be provided to the Owner, Architect, General Contractor and the applicable subcontractor.

1.02 TESTING AT THE OWNER'S EXPENSE

- A. Concrete: Primary mix design, slump tests and cylinder compression tests. Refer to special inspection requirements on Structural Drawings.
- B. Soils: Subsoil investigation, physical analysis and compaction tests.

Refer to special inspection requirements on Structural Drawings.

- C. Masonry: Mortar and/or Prism tests.
Refer to special inspection requirements on Structural Drawings.
- D. Weld Tests: X-Ray or ultrasonic tests.
Refer to special inspection requirements on Structural Drawings.
- E. Asphalt: Mix design, density tests for subgrade, base course and asphalt.
Refer to Section 02612 for testing requirements.

1.03 TESTING AT CONTRACTOR'S EXPENSE

- A. Material Substitution: Any tests of basic material or fabrication equipment offered as a substitute for specified items on which a test may be required in order to provide its compliance with the Specifications.
- B. Mechanical/Electrical: Tests on mechanical or electrical systems required to insure their proper installation and operation.
- C. Failed Tests: Any test that fails shall be paid for by the installing contractor subject to the following conditions:
 - 1. Quantity and nature of tests will be determined by the Architect.
 - 2. All tests shall be taken in the presence of the Architect or his representative. Notify Architect at least 48 hours in advance.
 - 3. Proof of noncompliance will make the installing contractor liable for any corrective action which the Architect feels is prudent including complete removal and replacement of defective material.
 - 4. Nothing contained herein is intended to imply that the installing contractor does not have the right to have tests performed on any material at any time for his own information and job control so long as the Owner does not assume responsibility for costs or for giving them consideration when appraising quality of materials.

1.04 TEST REPORTS

Reports of all tests made by testing laboratories, whether at Owner's or Contractor's expense shall be distributed by the testing laboratory as follows:

- 1 Copy - Contractor
- 1 Copy - Applicable supplier or subcontractor
- 1 Copy - Owner

1 Copy - Applicable Engineer
1 Copy - Architect
Other Copies - As directed

1.05 CONTRACTOR'S QUALITY CONTROL SYSTEM

The General Contractor shall establish a quality control system to perform a sufficient inspection and tests of all items of work, including that of his subcontractors, to ensure conformance to the Contract Documents for materials, workmanship, construction, finish, the functional performance and identification. This control shall be established for all construction by testing laboratories or engineer employed by the Owner. Contractor's control system shall specifically include all testing assigned to the contractor or his subcontractors by various sections of the Specifications.

Contractor's quality control system is the means by which he assures himself that his construction complies with the requirements of the contract Documents. Controls shall be adequate to cover all construction operations and should be keyed to the proposed construction schedule.

Contractor shall maintain correct records on an appropriate form for all inspections and tests performed, instructions received from the Architect, and actions taken as a result of those instructions. These records shall include evidence that the required inspections or tests have been performed (including type and number of inspections or tests, nature of defects, causes for rejection, etc.) proposed or directed remedial action, and corrective action taken. Contractor shall document inspections and tests as required by each Section of the Specifications.

Contractor shall furnish to Architect, with his proposed Schedule of Values and Construction Progress Schedule, his quality control plan which shall include the personnel, procedures, instructions, and records to be used. The plan shall specifically include the following:

1. A list of control tests which the Contractor understands he or his subcontractors are to perform.
2. Procedures for reviewing all shop drawings, product data, samples or other submittals before submission to Architect. Include procedures for obtaining required field measurements.
3. Method of documenting quality control operations, inspection and testing including samples of proposed forms.

END OF SECTION

SECTION 01405

SUSTAINABLE REQUIREMENTS

1.0 General

Holy Cross Energy is attempting to follow the practices as recommended by LEED. The LEED program is a compilation of creating an environmentally friendly building and site, energy efficient building and using/reusing local materials and resources. The general contractor and all subcontractors are required to assist the Owner to achieve the goal of getting a LEED certification.

1.02 Criterion

BB= Required to be included in Base Bid
GC= To be provided by General Contractor
NC = Not Required

Item Designation	Requirement
BB -	A. The GC will create and utilize a Construction Waste Management Plan for this project. The project goal is to recycle at least 50% of construction, demolition, and land clearing debris. Bidders are to include necessary manpower to sort all construction waste into the appropriate recycle dumpster. The Construction Waste Management Plan includes recycling dumpsters furnished and labeled by the GC for all metal, cardboard/paper, wood, masonry/cmu block, concrete/asphalt, land clearing debris, and dirt. All other construction debris is to be disposed of in the general trash dumpster furnished by the GC. GC will be responsible for documenting weight and destination (tickets) of all waste leaving the site.
BB	B. Implement site sediment and erosion control plan that conforms to best management practices in the EPA; Storm Water Management for Construction Activities, EPA Document No. EPA- 832/R-92-005.
NC	C. If applicable, give preference to materials with recycled content. Provide information based on manufacturer data regarding post-consumer and post-industrial recycled content. Document recycled content by providing calculations or material / product specification / MSDS verifying quantities of recycled material content.

- D. Use at least 20% of building materials manufactured locally. Locally is defined as within a 500 mile radius of the project site. Document locally manufactured materials and provide the distance (miles) between the project site and the product manufacturer. .
 - E. Of the regionally manufactured materials referenced above, use a minimum of 50% of building materials that are extracted, harvested or recovered within 500 miles of the project site.
- NC
- F. The GC will be responsible for developing and implementing an Indoor Air Quality (IAQ) Management Plan for the construction and pre-occupancy phases of the building. Bidders are to include all necessary costs associated with complying with the GC's IAQ Plan as follows:
During construction meet or exceed the minimum requirements of the Sheet Metal and Air Conditioning National Contractors Association (SMACNA) IAQ Guideline for Occupied Buildings under Construction, 1995, AND protect stored on-site or installed absorptive materials from moisture damage, AND replace all filtration media immediately prior to occupancy (Filtration media shall have a Minimum Efficiency Reporting Value (MERV) of 13 as determined by ASHRAE 52.2-1999).
 - G. The GC's pre-occupancy phase of the IAQ plan includes the following: Conduct a minimum two-week building flushout with new filtration media at 100% outside air after construction ends and prior to occupancy, and replace all filtration media with new MERV 13 filtration media after the flushout, OR, conduct a baseline indoor air quality testing procedure consistent with current EPA's *Protocol for Environmental Requirements, Baseline IAQ and Materials, for the Research Triangle Park Campus, Section 01445*.
- BB -
- H. . Carpet systems shall meet or exceed the VOC levels required by the Carpet & Rug Institutes' Green Label Indoor Air Quality Test Program.
- BB
- I. Adhesives and Sealants must not exceed the VOC content limits of South Coast Air Quality Management District Rule #1168, AND all sealants used as a filler must meet or exceed the requirements of the Bay Area Air Quality Management District Regulation 8, Rule 51.
- BB
- J. Paints and coatings must not exceed the VOC and chemical component limits of Green Seal's Standard GS-11 requirements.
- BB
- K. Composite wood or agrifiber products must contain no added urea-formalde-hyde resins.
- NC

NC

L. Use a minimum of 50% of wood-based materials certified in accordance with the Forest Stewardship Council guidelines for wood building components including but not limited to framing, flooring, finishes, furnishings, and non-rented temporary construction applications such as bracing, concrete form work and pedestrian barriers.

1.03 Tracking and Documentation – Required in Base Bid by General Contractor.

1. Review project-specific construction and documentation LEED requirements related to construction processes outlined above..

End of Section

SECTION 01410

WASTE RECYCLING

1.0 General

Holy Cross Energy is attempting to the practices as recommended by LEED. The LEED program is a compilation of creating an environmentally friendly building, energy efficient building and using/reusing local materials and resources. The general contractor and all subcontractors are required to assist the Owner to achieve the goal. .

1.02 Criterion

The following recycling program shall be implemented during the construction of the project:

1. 10 yard roll-off containers will be placed on site for recycling. Each container will have a sign in front of it that displays the material to be recycled. The following material must be recycled on this project:
 - a. Steel (rebar, steel, aluminum, etc.. will all be mixed in one container)
 - b. Cardboard
 - c. Concrete (this includes masonry).
2. All other waster will be placed in general waste dumpsters. DO NOT place recyclable materials in the general waste dumpsters.
3. The General Contractor shall monitor the subcontractors to insure the recycling is taking place.
4. One written warning will be given to each subcontractor not recycling the above referenced materials. Each citation thereafter will result in a \$250.0 fine.

1.03 Tracking and Documentation

1. All weight tickets must be given to general contractor to track on a recycling spreadsheet for weight of products and materials delivered on site with weights of recycled materials removed from the site.
2. If concrete is sent back because it is not used, the general contractor shall be provided the yardage returned and obtain from the concrete batch plant documentation of recycling of returned concrete materials.
3. Issue a citation to any subcontractor not complying with the recycling program requirements.
4. All recycling documentation shall be provided to the owner.

END OF SECTION

SECTION 01500

TEMPORARY FACILITIES

PART 1 - GENERAL

1.0 RELATED DOCUMENTS

Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1-Specification sections, apply to work of this section.

1.1 SUMMARY

A. Section Includes:

Minimum requirements for temporary services, utilities and facilities. Nothing in this section is intended to limit types and amounts of temporary work required, and no omission from this section will be recognized as an indication by Architect that such temporary activity is not required for successful completion of the work. The use of alternative facilities equivalent to those specified is the Contractor's option, subject to Architect's acceptance.

1. Except as otherwise indicated, the costs of providing and using temporary utility services are included in the Contract Sum.

1.2 QUALITY ASSURANCE

A. Standards

1. Comply with governing regulations, industry standards and utility company regulations and recommendations including, but not necessarily limited to, code compliance, permits, inspections, testing, and health, safety, fire, pollution and environmental compliances.
2. Comply with NFPA Code 241 "Building Construction and Demolition Operations," ANSI A10 Series and NECA Electrical Design Library "Temporary Electrical Facilities."
 - a. Refer to "Guidelines for Bid Conditions for Temporary Job Utilities and Services," prepared jointly by AGC and ASC, for industry recommendations.
 - b. Electrical Service: Comply with NEMA, NECA and UL standards and regulations for temporary electric service. Install service in compliance with National Electric Code (NFPA 70).

B. Definitions

1. *Cold Weather Protection* is defined as all heating required during construction period prior to enclosure of the buildings.
2. *Temporary Heat* is defined as all heating required after enclosure of the buildings or floors. A building or floor is closed in when it is roofed and such protection at doorways, windows, and other openings as will provide a reasonable heat retention is provided. Use of permanent equipment is subject to provisions of Division 15.

C. Temporary Utilities

1. Engage the appropriate local utility company to install temporary service or connect to existing service. Where the company provides only part of the service, provide the remainder with matching, compatible materials and equipment; comply with the company's recommendations.

1.3 PROJECT CONDITIONS

A. Scheduled Uses

1. Provide temporary facilities and services at the time first needed at the site; and maintain, expand and modify the facilities as needed throughout the construction period and do not remove until no longer needed. At the earliest feasible time, and when acceptable to the owner, change over from the use of temporary utility service to permanent service.

B. Temporary Use of Permanent Facilities

1. Regardless of assigned responsibility for initial installation of a temporary facility, the primary Installer of the corresponding permanent facility shall assume responsibility for its operation, maintenance and protection during use as a temporary facility prior to the Owner's acceptance and assumed operation of the facility.

C. Conditions of Use

1. Keep temporary services and facilities clean and neat in appearance. Operate in a safe and efficient manner. Take necessary fire prevention measures. Do not overload facilities, or permit them to interfere with progress. Do not allow hazardous, dangerous or unsanitary conditions, or public nuisances to develop or persist on the site.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

Provide either new or used materials and equipment for temporary facilities, which are in substantially undamaged and serviceable condition. Provide types and qualities which are recognized in the construction industry as suitable for the intended use in each application.

Comply with the requirements of Section 06100 for temporary facilities using carpentry materials.

PART 3 - EXECUTION

3.1 GENERAL

Use qualified workers for the installation of temporary facilities. Locate facilities where they will serve the Project adequately, and result in minimum interference with performance of the work. Locate field offices for easy access to and observation of the construction work.

3.2 TEMPORARY FACILITIES BY CONTRACTOR

A. Use of Site

1. The Contractor shall limit his use of the premises to the work areas indicated, so as to allow for Owner occupancy and use by the public.
2. Confine operation to areas within Contract limits indicated. Portions of the site beyond areas in which construction operations are indicated are not to be disturbed.
3. Contractor must maintain the North road open at all times for access by the fire department.

B. Field Offices

1. Provide insulated, weathertight temporary offices of sufficient size to accommodate required office personnel at the Project site. Keep the office clean and orderly for use for small progress meetings.

C. Storage and Fabrication Facilities; (For work not subcontracted)

1. Install individual trailers or sheds as required to accommodate the work; sized, furnished and equipped properly including temporary utilities as needed.

D. Sanitary Facilities

1. Comply with governing regulation including safety and health codes for the type number, location, operation and maintenance of fixtures and facilities, but provide not less than the specified requirements. Install sanitary facilities in available locations which will best serve the needs of personnel at the project site.
 - a. Provide temporary toilets as required.
 - b. Supply and maintain toilet tissue, paper towels, paper cups and similar disposable materials as appropriate for each sanitary facility, and provide

appropriate waste paper containers for used materials.

2. Drinking Water: Supply drinking water for construction personnel by drinking fountains connected to water system or by containerized tap-dispensers with paper cups.
- E. Project Identification and Temporary Signs
1. Prepare project identification sign(s) at location(s) indicated or as directed. Support and install signs on suitable posts and framing of treated wood or steel. Maintain signs throughout the construction period. Do not permit installation of unauthorized signs,
- F. Temporary Telephones
1. Provide temporary telephone service for all personnel engaged in construction activities throughout the construction period. Pay for services except for toll calls which will be paid for by party making such calls.
 2. Include as part of the telephone system a telephone answering machine, a separate voice-data telephone line and a facsimile machine with adequate paper supply.
- G. Temporary Power
1. Temporary Electrical Power to be provided by Owner
- H. Thermometer
1. Install an official project outdoor thermometer, in a shaded-from-the-sun, conveniently readable location, which will give reasonable accurate readings of the actual temperatures, and which can be reached easily for resetting. Instrument: Re-settable type indicating daily maximum and minimum temperatures. Keep a permanent daily log of those readings.
- I. Walks
1. Install and maintain temporary walkways around the construction work and to offices, toilets and similar places at the site.
- J. Temporary Enclosure
1. Provide temporary enclosure for protection of construction in progress and completed from exposure, foul weather, other construction operations and similar activities.
 2. Provide temporary enclosure wherever temporary heat is needed and permanent building enclosure is not yet completed nor adequate for the

containment of temporary heat.

3. Coordinate temporary enclosures with ventilating and material drying or curing requirements to avoid dangerous conditions and deleterious effects.
4. Close openings through floor or roof decks and horizontal surfaces with load-bearing wood-framed construction.

K. Temporary Elevator Use

1. Not Used

L. Barricades, Warning Signs and Lights: (For work not subcontracted)

1. Comply with standards and code requirements for the erection of structurally adequate barricades. Paint with appropriate colors, graphics and warning signs to inform personnel and the public of the hazard being protected against. Where appropriate and needed, provide lighting, including flashing red or amber lights.

M. Enclosure Fence

1. When excavating begins, install an enclosure fence with locked entrance gates.
2. Locate to enclose that portion of the site determined by the Contractor to be sufficient to accommodate his construction operations. Provide open mesh galvanized fencing as acceptable to Architect, 6 ft. height.

N. Heating During Construction

1. Cold Weather Protection: Provide such heat and fuel, heating units, equipment as necessary to protect the work from damage due to cold. Maintain equipment and surroundings in a clean, safe condition.
2. Provide temporary heat required by construction activities, for curing or drying of completed installations or protection of installed construction from adverse effects of low temperatures or high humidity. Select safe equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce the ambient condition required and minimize consumption of energy.
3. Provide temporary heat as necessary to heat enclosed spaces to the temperatures described below:
 - a. Except as otherwise specified, maintain a minimum temperature of 50 degrees and a maximum temperature of 78 degrees. At all times during the placing, setting and curing of plaster, drywall and ceramic tile, provide sufficient heat to produce a uniform temperature in the spaces involved of not less than 55 degrees. Before, during and through the placing of wood

finish and the application of other interior finishing, varnishing, painting, etc., and until final acceptance of the work, provide sufficient heat to produce a temperature of not less than 60 degrees.

- b. Include power and operating costs.

O. Heating Facilities

1. Except where use of the permanent system is authorized, provide vented self-contained LP gas or fuel oil heaters with individual space thermostatic control.
 - a. Use of gasoline-burning space heaters, open flame, or salamander type heating units is prohibited.
2. Ventilation: Provide such temporary ventilation as may be required to prevent hazardous accumulation of fumes, remove excess humidity, ventilate sanitary facilities and storage spaces for volatile and hazardous materials.

P. Miscellaneous Facilities

1. Provide ladders, ramps, temporary stairs, for access to all levels of the construction for general access by all trades. Individual contractors and subcontractors will furnish their own stepladders, scaffolds, staging, work platforms and other facilities for use of their workers and as necessary to the expeditious completion of their work. Provide waste chutes as required by applicable laws and regulations.

Q. Temporary Fire Protection

1. Until fire protection needs are supplied by permanent facilities, install and maintain temporary fire protection facilities of the types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 10 "Standard for Portable Fire Extinguishers", and NFPA 241 "Standard for Safeguarding Construction, Alterations and Demolition Operations."
 - a. Locate fire extinguishers where convenient and effective for their intended purpose, but not less than one extinguisher on each floor at or near each usable stairwell.
 - b. Store combustible materials in containers in fire-safe locations.
 - c. Maintain unobstructed access to fire extinguishers, fire hydrants, temporary fire protection facilities, stairways and other access routes for fighting fires. Prohibit smoking in hazardous fire exposure areas.
 - d. Provide supervision of welding operations, combustion type temporary heating units, and similar sources of fire ignition.

R. Protection of Work

1. The Contractor shall obtain the advice and recommendations of his installers for procedures to protect their work. Installers are responsible for protecting their work and that of other trades while working at the job site or in an area thereof. When the installer is no longer working in the area or at the job, the Contractor shall provide protective measures and materials to assure that each element will be without damage or deterioration (other than normal weathering for exterior exposed materials) throughout the remainder of the construction period up to the date of substantial completion final acceptance. Remove protective coverings and materials at the appropriate time but no later than final cleaning operations.
2. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings. Protect finished floors and stairs from traffic, movement of heavy objects, and storage.
3. Prohibit traffic and storage on waterproofed and roofed surfaces, on lawn and landscaped areas.
4. Always protect excavation, trenches, and building from damage from rain water, spring water, ground water, backing up of drains or sewers. Provide pumps, equipment, enclosures, to provide this protection.

S. Security

1. Provide security program and facilities to protect Work, existing facilities and Owner's operations from unauthorized entry, vandalism and theft. Coordinate with Owner's security program.
2. Install substantial temporary enclosure of partially completed areas of construction. Provide locking entrance to prevent unauthorized entrance, vandalism, theft and similar violations of security.
 - a. Storage: Where materials and equipment must be stored, and are of value or are attractive for theft, provide a secure lockup. Enforce discipline in connection with the installation and release of material to minimize the opportunity for theft and vandalism.

T. Environmental Protection

1. Provide protection, operate temporary facilities and conduct construction in ways and by methods that comply with environmental regulations, and minimize the possibility that air, waterways and subsoil might be contaminated or polluted, or that other undesirable effects might result. Avoid use of tools and equipment which produce harmful noise. Restrict use of noise making tools and equipment to hours that will minimize complaints from persons or firms near the site.

3.3 TEMPORARY FACILITIES BY APPROPRIATE SUBCONTRACTOR

A. Water Service (by Mechanical)

1. Install water service and distribution piping, of sizes and pressures adequate for construction until permanent water service is in use. Users will provide their own hoses at valved outlet points.
2. Obtain water services from nearby City water main.
3. Provide minimum 1" pipe size primary distribution piping for temporary water to each location of use. For construction use of water provide 1" hose outlet with vacuum, breaker and 0.75" hose adapter.
4. Provide at least one hose outlet for each prime floor level of construction, and space outlets so that every area of work requiring water can be reached with a 100-ft. length hose.

B. Temporary Fire Protection (by Mechanical for standpipes, sprinklers)

1. During construction provide temporary standpipes and other fire protection as required by authorities having jurisdiction. Maintain in operating condition until permanent systems are in working order.
2. Permanent Fire Protection: At the earliest feasible days in each area of the Project, complete the installation including connected services and place into operation and use. Instruct key personnel on use of facilities.

C. Heat and Ventilation

1. Where permanent systems are used for temporary heat and ventilation, Mechanical Installer shall maintain equipment, clean, adjust, put in new condition before building occupancy as specified in Division 15.

D. Light and Power (by Electrical)

1. Provide a weatherproof, grounded, electric power distribution system of sufficient size, capacity and power characteristics to accommodate all activities during construction period. Include transformers, overload protected disconnects, automatic ground fault interrupters and main distribution switch gear.
2. Extend from temporary service point and meter provided by Contractor.
3. Provide the following services:
 - a. Sufficient 220v outlets for special tools, welding equipment and similar devices requiring such service at locations where required.
 - b. Sufficient circuits and duplex 120v single phase outlets so located that any

part of the work can be reached with a 75 ft. extension cord to accommodate normal power tools and supplemental lighting.

- c. Temporary light to levels and as required by governing regulation but not less than minimum 5 footcandle illumination in all areas accessible to workers during hours they are at the job; minimum 10 footcandles for shop areas; 20 footcandles or more where detailed or finishing work is being done, supplemented as may be required.
 - d. Provide additional exterior and interior lighting as required for warning, public safety, and project security.
4. Contractor and each Subcontractor furnishes his own extension cords for power as required by him. Electric Utility power charges will be paid by Contractor.
 5. Where permanent light fixtures have been used for temporary lighting, supply temporary lamps and replace with new lamps at time of Substantial Completion.

3.4 FACILITIES BY SUBCONTRACTORS REQUIRING THEM

A. Storage and Fabrication Facilities

1. Install individual trailers or sheds as required to accommodate the work, sized, furnished and equipped properly including temporary utilities as needed.
2. Sizes, quantities and locations are under control of the Contractor.
3. Spaces within the building may be used when approved by the Contractor, provided permanent construction elements are adequately protected.

B. Barricades, Warning Signs and Lights

1. Comply with standards and code requirements for the erection of structurally adequate barricades.
2. Paint with appropriate colors, graphics and warning signs to inform personnel and the public of the hazard being protected against. Where appropriate and needed, provide lighting, including flashing red or amber lights.

C. Cold Weather Protection

1. Provide such heat and fuel, heating units, equipment as necessary to protect the work from damage due to cold. Maintain equipment and surroundings in a clean, safe condition.

3.5 OPERATIONS AND TERMINATION

A. Supervision

1. Enforce strict discipline in the use of temporary facilities. Limit availability of temporary facilities to essential and intended uses to minimize waste and abuse.
- B. Janitorial Services
1. Provide daily janitorial services for temporary offices, toilets, and similar areas at the project site. Require users of other temporary facilities to maintain clean and orderly premises.
- C. Maintenance
1. Installing entity shall maintain temporary facilities in good operating condition until removal. Protect from damage by freezing temperatures and similar elements.
 - a. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation and similar facilities on a 24-hour day basis where required to achieve indicated results and to avoid possibility of damage.
 - b. Prevent water filled piping from freezing. Maintain markers for underground lines. Protect from damage during excavation operation.
- D. Termination and Removal
1. At the time the need has ended for each temporary facility, or when it has been replaced by authorized use of a permanent facility, or at the time of Substantial Completion, promptly remove the facility unless requested by the Architect to be retained for a longer period of time.
 2. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with the temporary facility. Repair damaged work, clean exposed surfaces and replace construction which cannot be satisfactorily repaired.
 3. Materials and facilities that constitute temporary facilities are the property of the installing entity.

END OF SECTION

SECTION 01630

SUBSTITUTIONS AND PRODUCT OPTIONS

PART 1 - GENERAL

1.01 SUBSTITUTIONS

A. Direct reference in the specification to any article, device, product, materials fixture, form or type of construction, etc. by name, make or catalog number, with or without the words "or approved equal", shall be interpreted as establishing a standard of quality and shall not be construed as limiting competitions and the Contractor in such cases may, at his option, use any article, device, product, materials, fixtures, form or type of construction, which in the judgment of the Architect, expressed in writing, is equivalent to that named.

If the Contractor elects to utilize any article, device, product, material, fixture, form or type of construction other than those defined in the contract documents, the Contractor shall list such substitutions as deduct alternates on submitted Bid Form for Owner evaluation after bid opening. In addition, the Contractor shall provide complete technical data and laboratory reports, if applicable, on the proposed substitution. No substitutions will be reviewed prior to bid opening.

1.02 PRODUCT OPTIONS

A. For products specified only by reference standards, select any product meeting standards, by any Manufacturer.

B. For products names by naming several products or Manufacturers, select any product and Manufacturer named. Requesting party must submit request as provided herein for any product no specifically named.

1.03 WARRANTIES (GUARANTEES)

A. Categories of Specific Warranties: Warranties on the work are in several categories, including those of General Conditions, and including (but not necessarily limited to) the following specific categories related to individual units of work specified in sections of divisions 2 through 16 of these specifications:

Special Project Warranty (Guarantee): A warranty specifically written and signed by Contractor for a defined portion of the work; and, where required, countersigned by subcontractor, installer, manufacturer or other entity engaged by Contractor.

Specified Product Warranty: A warranty which is required by contract documents, to be provided for a manufactured product incorporated into the work; regardless of whether manufacturer has published warranty without regard for specific incorporation of product into the work, or has written and executed a special project warranty as a direct result of contract document requirements.

Coincidental Product Warranty: A warranty which is not specifically required by contract documents (other than as specified in this Section); but which is available on a

product incorporated into the work, by virtue of the fact that manufacturer of product has published warranty in connection with purchases and uses of product without regard for specific applications except as otherwise limited by terms of warranty.

B. Refer to individual sections of Divisions 2 through 16 for the determination of units of work which are required to be specifically or individually warranted, and for the specific requirements and terms of those warranties (or guarantees).

C. General Limitations: It is recognized that specific warranties are intended primarily to protect Owner against failure of the work to perform as required, and against deficient, defective and faulty materials and workmanship, regardless of sources. Except as otherwise indicated, specific warranties do not cover failures in the work which result from: 1) Unusual and abnormal phenomena of the elements, 2) The Owner's misuse, maltreatment or improper maintenance of the work, 3) Vandalism after time of substantial completion, or 4) Insurrection or acts of aggression including war.

D. Related Damages and Losses: In connection with contractor's correction of warranted work which has failed, remove and replace other work of project which has been damaged as a result of such failure, or must be removed and replaced to provide access for correction of warranted work.

Consequential Damages: Except as otherwise indicated or required by governing regulations, special project warranties and product warranties are not extended to cover damage to building contents (other than work of Contract) which occurs as a result of failure of warranted work.

E. Reinstatement of Warranty Period: Except as otherwise indicated, when work covered by a special project warranty or product warranty has failed and has been corrected by replacement or restoration, reinstate warranty by written endorsement for the following time period, starting on date of acceptance of replaced or restored work.

A period of time equal to original warranty period of time.

F. Replacement Cost, Obligations: Except as otherwise indicated, costs of replacing or restoring failing warranted units or products is Contractor's obligation, without regard for whether Owner had already benefited from use through a portion of anticipated useful service lives.

G. Rejection of Warranties: Owner reserves the right, at time of substantial completion or thereafter, to reject coincidental product warranties submitted by Contractor, which in opinion of Owner tend to detract from or confuse interpretation of requirements of contract documents.

H. Contractor's Procurement Obligation: Do not purchase, subcontract for, or allow others to purchase or sub-subcontract for materials or units of work for project where a special project warranty, specified product warranty, certification or similar commitment is required, until it has been determined that entities required to countersign such commitments are willing to do so.

I. Specific Warranty Forms: Where a special project warranty (guarantee) or specified product warranty is required, prepare a written document to contain terms and

appropriate identification, ready for execution by required parties. Submit draft to Owner (through Architect/Engineer) for approval prior to final executions.

PART 2 - PRODUCTS

2.01 GENERAL PRODUCT COMPLIANCES

A. General: The compliance requirements, for individual products as indicated in contract documents, are multiple in nature and may include generic, descriptive, proprietary, performance, prescriptive, compliance with standards, compliance with codes, conformance with graphic details and other similar forms and methods of indicating requirements, all of which must be complied with. Also "allowances" and similar provisions of contract documents will have a bearing on the selection process.

B. Procedures for Selecting Products: Contractor's options for selecting products are limited by contract document requirements, and governing regulations, and are not controlled by industry traditions or procedures experienced by Contractor on previous construction projects. Required procedures include, but are not necessarily limited to, the following for various indicated methods of specifying:

Single Product/Manufacturer Name: Provide product indicated, except advise Architect/Engineer before proceeding, where known that named product is not a feasible or acceptable selection.

Two or More Product/Manufacturer Names: Provide one of the named products, at Contractor's option; but excluding products which do not comply with requirements. Do not provide or offer to provide an unnamed product, except where none of named products comply with requirements or are a feasible selection, advise Architect/Engineer before proceeding.

"Or Equal": Where named products in specifications test are accompanied by the term "or equal", or other language of similar effect, comply with those contract document provisions concerning "substitutions" for obtaining Architect's/Engineer's approval (or change order) to provide an unnamed product.

"Named", except as otherwise indicated, is defined to mean manufacturer's name for product, as recorded in published product literature, of latest issue as of date of contract documents. Refer requests to use products of a later (or earlier) model to Architect/Engineer for acceptance before proceeding.

Standards, Codes and Regulations: Where only compliance with an imposed standard, code or regulation is required, selection from among products which comply with requirements including those standards, codes and regulations, is Contractor's option.

Performance Requirements: provide products which comply with specific performances indicated, and which are recommended by manufacturer (in published product literature or by individual certification) for application indicated. Overall performance of a product is implied where product is specified with only certain specific performance requirements.

Prescriptive Requirements: Provide products which have been produced in accordance

with prescriptive requirements, using specified ingredients and components, and complying with specified requirements for mixing, fabricating, curing, finishing, testing and similar operations in manufacturing process.

Visual Matching: Where matching of an established sample is required, final judgment of whether a product proposed by Contractor matches sample satisfactorily is architect's judgment. Where no product within specified cost category is available, which matches sample satisfactorily and complies with requirements, comply with contract document provisions concerning, "substitutions" and "change orders" for selection of a matching product outside established cost category, or, of a product not complying with requirements.

Visual Selection: except as otherwise indicated, where specified product requirements include ". . . as selected from manufacturer's standard colors, patterns, textures . . ." or words of similar effect, the selection of manufacturer and basic product (complying with requirements) is Contractor's option, and subsequent selection of color, pattern and texture is Architect's selection. Where specified product requirements include ". . . as selected from standard colors, patterns, textures available within the industry . . .", or words to that effect, selection of product (complying with requirements, and within established cost category) is Architect's selection, including designation of manufacturer where necessary to obtain desired color, pattern or texture.

END OF SECTION

SECTION 01700

CONTRACT CLOSEOUT

PART 1 - GENERAL

1.01 RELATED REQUIREMENTS SPECIFIED ELSEWHERE

- A. Schedule of Values: Section 01310 Schedule of Values
- B. Cleaning: Section 01710 Cleaning
- C. Closeout Submittals Required of Trades: The respective sections of specifications.

1.02 SUBSTANTIAL COMPLETION

- A. The following procedures shall apply at the conclusion of Project.
- B. Contractor:
 - 1. Submit written certification to Architect that project, or designated portion of project, is substantially complete.
 - 2. Submit list of major items to be completed or corrected.
- C. Architect will make an inspection within seven days after receipt of certification, together with Owner's Representative.
- D. Should Architect consider that Work is substantially complete:
 - 1. Architect shall prepare, and submit to Contractor, a list of items to be completed or corrected, as determined by the inspection.
 - 2. Architect will prepare and issue a Certificate of Substantial Completion, AIA G704, complete with signature of Owner and Contractor, accompanied by Architect's list of items to be completed or corrected.
 - 3. Owner occupancy of Project of Designated Portion of Project:
 - a. Contractor shall:
 - (1) Obtain certificate of occupancy.
 - (2) Perform final cleaning in accordance with Section 01710 Cleaning.
 - b. Owner will occupy Project, under provisions stated in Certificate of Substantial Completion.
 - 4. Contractor: Complete work listed for completion or correction within designated time.
- E. Should Architect consider that Work is not substantially complete:

1. He shall immediately notify Contractor, in writing, stating reasons.
2. Contractor: Complete Work, and send second written notice to Architect certifying that Project, or designated portion of Project, is substantially complete.
3. Architect will re-inspect Work.

1.03 FINAL INSPECTION

- A. The following procedures shall apply at the conclusion of the Project.
- B. Contractor shall submit written certification that:
 1. Contract Documents have been reviewed.
 2. Project has been inspected for compliance with Contract Documents.
 3. Work has been completed in accordance with Contract Documents.
 4. Equipment and systems have been tested in presence of Owner's Representative and are operational.
 5. Project is completed and ready for final inspection.
- C. Architect will make final inspection within seven days after receipt of certification.
- D. Should Architect consider that Work is finally complete in accordance with requirements of Contract Documents, he shall request Contractor to make Project Closeout submittals.
- E. Should Architect consider that Work is not finally complete:
 1. He shall notify Contractor, in writing, state reasons.
 2. Contractor shall take immediate steps to remedy the stated deficiencies, and send second written notice to Architect certifying that Work is complete.
 3. Architect will reinspect Work.

1.04 RE-INSPECTION COSTS

- A. Should Architect be required to perform inspections in addition to those specified above because of failure of Work to comply with original certifications of Contractor, Owner will compensate Architect for additional services, and deduct amount paid from final payment to Contractor.

1.05 CLOSEOUT SUBMITTALS

- A. Submit the following to the Architect before Final Payment Request:
 1. Project Record Documents: See Article 1.08, this section.

2. Operating and Maintenance Data: See Article 1.06, this section.
3. Evidence of Payments and Release of Liens: The Contractor is required to submit the following before his final Application for Payment:
 - a. Contractor's Affidavit of Payment of Debts and Claims: AIA G706
 - b. Contractor's Affidavit of Release of Liens: AIA G706A, with:
 - (1) Consent of Surety to Final Payment: AIA G707
 - (2) Contractor's release or waiver of liens.
 - (3) Separate releases of waivers of liens for subcontractors, subcontractor, suppliers and others with lien rights, against property of Owner, together with list of those parties.
4. Warranties: As specified in individual sections.
5. Maintenance Materials and Spare Parts: In lieu of delivery to the Architect, submit receipt indicating maintenance materials and spare parts have been turned over to the Owner's Representative.
6. Keys: Submit receipt indicating all required keys have been turned over to the Owner's Representative.
7. Miscellaneous Keys, Switches, and Wrenches: At the completion of the project, all loose keys for hose bibs, adjustment keys and wrenches for door closers and panic hardware, keys for electrical switches, electrical panes, etc., shall be accounted for and turned over to the General Contractor for transmittal to Owner. Submit receipts indicating receipt by Owner's Representative.
8. Inspection Certificates: The General Contractor and/or each Subcontractor shall, upon completion of the work, secure in triplicate certificates from any state of local governing bodies having jurisdiction indicating that the work is in strict accordance with the applicable codes and deliver same to the Architect.
9. Certificate of Occupancy: Deliver Certificate of Occupancy to Owner.

1.06 OPERATING AND MAINTENANCE DATA

A. Mechanical - By Mechanical Contractor

1. Prepare a maintenance manual for the complete system in accordance with the following outline:
 - a. Alphabetical list of components of system, with the company who installed each component and the company responsible for servicing it. Include name, address, and a 24-hour telephone number.
 - b. Operating instructions for complete system with sequence of operation for cold start, normal operating shutdown for short period, shutdown for long period, and temperature control.
 - c. Maintenance instructions with schedule of frequency of lubrication, cleaning, adjustment, replacement, etc.
 - d. Complete manufacturer's data on each device, including installation instructions and specifications arranged alphabetically.

- e. Blueprints of complete wiring and control wiring and/or piping diagrams, with schematic operational diagram for each system.
 2. Submit one copy of the maintenance manual to the Architect for approval, and then re-submit three corrected and bound copies to the Architect for the Owner.
 3. The above procedure shall be done at the conclusion of construction.
- B. Electrical - By electrical Contractor
 1. Submit three hard-bound sets of instructions and material lists for the following:
 - a. Lighting fixtures catalog data identified by drawing type and lamps supplied for respective fixtures.
 - b. Fire alarm system.
 2. The operating and maintenance manual will contain the following:
 - a. Complete parts list
 - b. Complete information as to whom the Owner will contact for service and parts. Include name, address and 24-hour telephone number.
 - c. Evidence that an authorized service organization regularly carries a complete stock of repair parts for the above items and systems and that the organization is available for service.
 3. Deliver to the General Contractor for transmittal to the Architect immediately after completion of electrical work.
 4. The above procedure shall be done at the conclusion of construction.

1.07 DEMONSTRATIONS

A. Mechanical Systems - By Mechanical Contractor

Instruct the Owner, at a time to be designated by the Architect, in the proper operation and maintenance of system, using the maintenance manual as a guide. This shall be done at the conclusion of construction.

B. Electrical System - By Electrical Contractor

Upon completion of the work, at a time to be designated by the Architect, demonstrate to the Owner the operation of the entire electrical installation, including any and all special systems provided under this contract. This shall be done at the conclusion of construction.

1.08 PROJECT RECORD DOCUMENTS

- A. Job Site Documents: Maintain at the job site, in an organized filing system, one record copy of the following:
 1. Drawings
 2. Specification

3. Addenda
4. Reviewed shop drawings
5. Change orders
6. Other modifications to Contract
7. Field test records

Do not use record documents for construction purposes. Maintain documents in clean, dry legible condition, apart from documents used for construction.

- B. Record Information: Label each document "Record Document". Mark all information with contrasting color using ink. Keep each record current. Do not permanently conceal any work until required information is recorded.

Record following on drawings:

1. Depth of foundation elements.
2. Horizontal and vertical location of underground utilities.
3. Location of internal utilities and appurtenances concealed in construction.
4. Field changes of dimension and detail.
5. Changes by change order or field order.
6. Details not on original contract drawings.

Record following information on specifications:

1. Manufacturer, trade name, catalog number and supplier of each product and item of equipment actually installed.
2. Change by change order or field order.
3. Other matters not originally specified.

Maintain shop drawings as record documents recording changes made after review as specified for drawings above.

- C. Submittal: At completion of project, deliver record documents to Architect with transmittal letter containing date, project title and number, contractor's name and address, titled and number of each record document, and certification that each document is complete and accurate.
- D. Digital AsBUILTs: After marked up drawings are reviewed by the Architect, he will provide the Contractor with AutoCad digital file of all drawings. The Contractor shall then obtain a draftsman to transfer all changes as shown on the marked up drawings to digital drawing

files. After changes are made, marked up drawings and digital files of all drawings shall be delivered to the Architect.

1.09 FINAL ADJUSTMENT OF ACCOUNTS

- A. Submit final statement of account to Architect at conclusion of entire project.
- B. Statement shall reflect all adjustments.
 - 1. Original Contract Sum
 - 2. Additions and deductions resulting from:
 - a. Previous Change Orders
 - b. Unit Prices
 - c. Other Adjustments
 - d. Deductions for Un-corrected Work
 - e. Deductions for Re-inspection Payments
 - 3. Total Contract Sum, as adjusted
 - 4. Previous payments
 - 5. Sum remaining due
- C. Architect will prepare final Change Order, reflecting approved adjustments to Contract Sum not previously made by Change Order.

1.10 FINAL APPLICATION FOR PAYMENT

- A. Contractor shall submit final application in accordance with requirements of General and Supplementary Conditions.

1.11 FINAL CERTIFICATE FOR PAYMENT

- A. Architect will issue final certificate in accordance with provisions of General Conditions.
- B. Should final completion be materially delayed through no fault of Contractor, Architect may issue a Semi-Final Certificate for Payment in accordance with provisions of General Conditions.

1.12 POST-CONSTRUCTION INSPECTION

- A. Prior to expiration of one year from Dates of Substantial Completion, Architect will make visual inspection of Project in company with Owner and Contractor to determine whether correction of Work is required, in accordance with provision of General Conditions.
- B. For guarantees beyond one year, Architect will make inspections at request of Owner, after notification to Contractor.
- C. Architect will promptly notify Contractor, in writing, of any observed deficiencies.

END OF SECTION

SECTION 01710

CLEANING

1.01 CLEANING DURING CONSTRUCTION

A. Each Contractor shall keep the building and premises free from all surplus material, waste material, dirt and rubbish caused by his employees or work, and at the completion of his work he shall remove all such surplus material, waste material, dirt and rubbish, as well as all his tools, equipment and scaffolding, and shall leave his work clean and spotless, unless more exact requirements are specified.

B. Each Contractor shall perform his cleanup daily and shall transport his rubbish to an on-site location designated by the General Contractor who will arrange for its removal.

C. Masonry cleaning is the responsibility of the masonry Contractor and is specified under the masonry Section of the Specifications.

1.02 CLEANERS

A. With the exception of cleanup of the site and cleaning specifically assigned to Contractors under various sections of the Specifications, all final cleanup of exterior and interior of the building shall be done by professional cleaners.

1.03 FINAL CLEANING

A. General: Special cleaning for specific units of work is specified in sections of Divisions 2 through 16. General cleaning during progress of work is specified in General Conditions and as temporary services in "Temporary Facilities" section of this Division. Provide final cleaning of the work, at time indicated, consisting of cleaning each surface or unit or work to normal "clean" condition expected for a first-class building cleaning and maintenance program. Comply with manufacturers' instructions for cleaning operations. The following are examples, but not by way of limitation, of cleaning levels required:

Remove labels which are not required as permanent labels.

Clean transparent materials, including mirrors and window/door glass, to a polished condition, removing substances which are noticeable as vision-obscuring materials. Replace broken glass and damaged transparent materials.

Clean exposed exterior and interior hard-surfaced finishes, to a dirt-free condition, free of dust, stains, films and similar noticeable distracting substances. Except as otherwise indicated, avoid disturbance of natural weathering of exterior surfaces. Restore reflective surfaces to original reflective condition. Wipe surfaces of mechanical and electrical equipment clean, including elevator equipment and similar equipment; remove excess lubrication and other substances.

Remove debris and surface dust from limited-access spaces including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics and similar spaces.

Clean concrete floors in non-occupied spaces broom clean.

Vacuum clean carpeted surfaces and similar soft surfaces.

Clean plumbing fixtures to a sanitary condition, free of stains including those resulting from water exposure.

Clean light fixtures and lamps so as to function with full efficiency.

Clean project site (yard and grounds), including landscape, development areas, of litter and foreign substances. Sweep paved areas to a broom-clean condition; remove stains, petrochemicals spills and other foreign deposits. Rake grounds which are neither planted nor paved, to a smooth, even-textured surface.

B. Removal of Protection: Except as otherwise indicated or requested by Architect/Engineer, remove temporary protection devices and facilities which were installed during course of the work to protect previously completed work during remainder of construction period.

C. Compliances: Comply with safety standards and governing regulations for cleaning operations. Do not burn waste materials at site, or bury debris or excess materials on Owner's property, or discharge volatile or other harmful or dangerous materials into drainage systems; remove waste material from site and dispose of in a lawful manner.

Where extra materials of value remaining after completion of associated work have become Owner's property, dispose of these at Owner's best advantage as directed.

END OF SECTION

SECTION 02219

EXCAVATION AND EMBANKMENT FOR STRUCTURES

PART 1 GENERAL

1.1 SCOPE

- A. Work to be performed under this section shall include all labor, equipment, materials and miscellaneous items necessary to perform all excavation, backfilling, compacting, testing and related work not specified elsewhere, as shown on the Drawings and required by the Specifications.

1.2 RELATED WORK SPECIFIED ELSEWHERE

Section 33 00 00 – Utilities

1.3 FIELD CONDITIONS

A. Existing Utilities

1. Underground utilities, except service lines, known to the Engineer have been shown on the Drawings. Locations are approximate only and may prove to be inaccurate. The Contractor is responsible for verification of the existence, location and protection of all utilities within the construction limits.
2. Before commencing with work, the Contractor shall notify all public and private companies who may have utilities within the project limits. The Contractor shall coordinate with these entities all excavation performed. The Contractor shall obtain all permits required by utility owners.
3. In the event of damage to any existing utility, the Contractor shall be solely responsible for the repair and payment for repair of all such damage.
4. The Contractor shall make arrangements for and pay all costs for relocation of utilities requiring relocation as indicated on the Drawings. Should utility obstructions, not shown on the Drawings, be encountered and require relocation, the Contractor shall notify the Owner and the Engineer and shall make arrangements necessary for such relocation. The Owner shall pay the costs for such relocation.

B. Existing Improvements

1. The Contractor shall restore or protect from damage all existing improvements encountered in performance of the work. Improvements damaged as a result of this work shall be restored to original condition or better, as determined by the Engineer.
2. Adjacent property shall be protected by the Contractor from any damage. The contractor shall be held solely liable for any damage to adjacent property and shall be responsible for all costs resulting from repair of such damage.

C. Soil Conditions

1. It shall be the responsibility of the Contractor to examine soil conditions and characteristics, including the presence of groundwater, that will be encountered within the limit of construction.

1.5 PROTECTION OF WORK

A. Safety

1. All excavations shall be protected by barricades, lights, signs, etc. as required by governing federal, state and local safety codes and regulations.

B. Sheeting, Shoring, and Bracing

1. Except where banks are cut back on a stable slope, provide and maintain sheeting, shoring and bracing systems necessary to protect adjoining grades and structures from caving, sliding, erosion or other damage, and suitable forms of protection against bodily injury, all in accordance with applicable codes and governing authorities.
2. Remove sheeting and shoring systems as excavations are backfilled in a manner to protect the construction or other structures, utilities or property. Do not remove any sheeting after backfilling.
3. Sheeting and shoring systems shall be structurally designed and sufficiently braced to provide necessary restraining of retained backfill. Prior to installation of such systems, methods of installation and materials proposed shall be discussed with and approved by Engineer. All systems shall be in strict compliance with local, state and federal safety regulations. Contractor is solely liable for non-compliance.

C. Site Drainage

1. Excavation to be protected from surface water drainage at all times.

1.6 BLASTING

- A. No blasting shall be permitted without written consent of the Engineer. Blasting shall be done only after Engineer receives permission from the appropriate governmental authority(ies). Blasting shall be performed only by properly licensed, experienced individuals and in a manner such that no damage to any property or persons will occur due to either the blast or debris.
- B. Contractor shall provide proof of insurance as required by these Specifications, the governing authority or as required by Engineer prior to any blasting. All damage as the result of blasting shall be repaired, at the Contractor's expense, to the satisfaction of the Engineer. All earth or rock loosened by blasting shall be removed from excavations prior to proposed construction.

1.7 CONSTRUCTION IN STREETS

When construction operations are located within streets, make provisions at cross streets and walks for free passage of vehicles and pedestrians. Do not block streets or walks without prior approval.

PART 2 - MATERIALS

All materials for construction fills and backfills shall meet specified requirements for gradation and other factors defining suitability for the intended use. All classes of suitable material shall be free from perishable matter, debris, frozen material and stones and/or cemented pieces larger than permitted by the specified gradation. Classification of materials shall be as follows:

2.1 EXCAVATION

Excavation shall consist of the excavation of all materials of whatever character required for the Work, obtained within the right-of-way, including surface boulders and excavation for ditches and channels and not being removed under some other item.

2.2 MATERIALS FOR EMBANKMENT

- A. Embankment material shall consist of approved material acquired from excavation, hauled and placed in embankments in reasonably close conformity with the line, grades, thicknesses and typical cross sections shown on the plans or as designated.
- B. When source of embankment material is not designated on the plans, approval of the source will be contingent on the material having a resistance value of at least that shown on the plans, when tested by the Hveem Stabilometer, and a maximum dry density of not less than 90 pounds per cubic foot.

2.3 TOPSOIL

Topsoil shall consist of selectively excavated, loose, friable loam reasonably free of admixtures of sub-soil, refuse, stumps, roots, rocks, brush, weeds or other material which would be detrimental to the proper development of vegetative growth; topsoil to be free of any stone or rock greater than 3" in size.

PART 3 - METHODS AND PROCEDURES

3.1 CONSTRUCTION REQUIREMENTS

The excavation and embankments required shall be finished to smooth and uniform surfaces. Materials shall not be wasted without permission of the Engineer. The Engineer reserves the right to change grade lines, cut slopes or fill lines during the progress of the work.

3.2 EXCAVATION

Material outside of the limits of excavation will not be disturbed. Prior to beginning excavation operations in any area, all necessary clearing and grubbing in that area shall have been performed in accordance with these Specifications, The Contractor shall not excavate beyond the dimensions and elevations established. Common excavation shall include all materials of whatever nature encountered in the work for construction of excavations to the lines and graded called for on the Drawings. Structure excavation shall include all earthwork required for the construction of structures to the lines and graded called for on the Drawings. If any areas are inadvertently over-excavated, fill such over-excavation with embankment material and compact in accordance with Section 3.5

A. Tolerances

1. In those areas upon which a subbase material is required, or upon which a structure is to be constructed directly, deviation of not more than 1 inch shall be permitted when tested with a 16-foot straight edge. Deviation from grade shall not exceed 1 inch at any point.
2. In those areas upon which a base course material is required, deviation of not more than 0.04 foot shall be permitted when tested with a 16-foot straight edge. Deviation from grade shall not exceed 0.04 foot at any point.
3. In those areas where no additional construction, other than topsoil addition, will occur, the finished surface shall be smooth and shall not deviate from grade by more than 0.5 foot at any point.

B. Groundwater Control

1. Contractor to maintain facilities on site to remove all groundwater from excavated area and keep water below the bottom of the excavation to such a point such that a firm base for equipment or concrete installation exists. Facilities shall be maintained until all backfilling is in place at least 24 inches above anticipated water levels before water removal. All water removal shall be subject to approval by the Engineer.
2. Removal of water by bucketing, sump or trench diversions, intermittent pumping, or sump or submersible pumps is considered incidental to excavation work. Inclusion of a bid item for dewatering indicates dewatering by continuous pumping, well-point type systems is expected. If such dewatering system is required, in the opinion of the Engineer, this work to be paid for as indicated in the bid schedule, or if not included in the bid schedule to be considered extra work paid for at a price negotiated between Contractor and Owner prior to the start of dewatering.

C. Stockpile Excavated Material

1. Excavated material to be stockpiled so as not to endanger the work or public safety. Maintain existing vehicular and pedestrian traffic with minimum disruption. Maintain emergency access and access to existing fire hydrants and water valves. Maintain natural drainage courses and street gutters.
2. Backfill material to be segregated from stockpiled topsoil and unusable backfill materials.

D. Over-excavation

1. Whenever the site is over-excavated more than 0.1' to eliminate point bearing by rocks or stones beneath proposed structures or when grade tolerances are exceeded, the Contractor is to re-establish grade using Class 1 Backfill (CDOH Section 703.08 - Class 1). Compaction shall be 95% maximum density. All work to re-establish grade shall be at the Contractor's expense.

E. Unstable Materials

1. Materials which are not capable of supporting superimposed loadings are defined as unstable materials. Should unstable materials be encountered during excavation, immediately notify Engineer. If, in the opinion of the Engineer, unstable soil excavation is required and the Contractor could not have reasonably been expected to discover the existence of such materials during his site investigation, then a contract price for Unstable Soil Excavation shall be negotiated between Owner and Contractor. No payment shall be made for materials excavated prior to notification of the Engineer and negotiation of payment for extra work.
2. Inclusion of a bid item for Unstable Soil Excavation indicates such excavation is anticipated. The Contractor is to notify the Engineer prior to any unstable soil excavation; no payment shall be made for materials excavated prior to authorization of Engineer.

F. Rock Excavation

1. Rock excavation shall be defined as removal of boulders in excess of three (3) cubic yards or solid or fractured rock, which requires techniques, such as blasting or jacking for removal, other than those which are being employed by the Contractor or are normally used in excavation, such as use of backhoes, trenchers, draglines, etc. Should unanticipated rock conditions be encountered, immediately notify the Engineer. If in the opinion of the Engineer, rock excavation is required and the Contractor had in fact made a diligent and determined effort to remove the material using normal excavation procedures as stated above and the Contractor could not have reasonably been expected to determine the existence of such material during his site investigation, then a contract price for Rock Excavation shall be negotiated between the Contractor and the Owner. No payment shall be made for excavation performed prior to determination of a negotiated price.
2. Rock shall be removed to a 4" depth below grade. In addition, all rock loosened during jacking, blasting, etc. shall be removed from the site. For payment purposes, maximum depth to be paid for shall be 12" below

required grade. All over-excavation shall be replaced as specified in Subsection 3.3, D.

3. Inclusion of a bid item for Rock Excavation indicates such excavation is anticipated. Contractor to notify Engineer prior to any rock excavation; no payment shall be made for excavation prior to notification.

G. Disposal of Excess Excavation

1. Contractor to dispose off excess excavation off-site. The Owner shall have the right to elect to have the excess excavation disposed of at a designated site within the Work limits. Excavation may be wasted on site only if approved by the Engineer and shall be done at the direction of the Engineer. Disposal in any case shall be the sole responsibility of the Contractor.

H. All floor slabs shall be placed on at least three feet of compacted, non-expansive fill. See soils report prepared by Geotechnical Engineer

I. A minimum four inch (4") layer of free draining gravel shall be placed beneath slabs. See soils report for materials specifications.

J. Foundation walls and retaining structures shall be backfill with import granular soils and shall be placed to within two feet (2') of the ground surface and to a minimum distance beyond the walls at one-half the height of the wall. The upper two feet of the wall backfill should be an impervious soil of a pavement structure to prevent surface water infiltration into the backfill.

K. All fill material used inside building limits and within 1.5 feet of pavement grade shall be a non-expansive soil. See soils report.

3.4 EMBANKMENT AND BACKFILLING

A. Do not begin embankments until construction below grade has been approved, underground utility systems have been inspected, tested and approved and trash and debris have been cleaned from the excavation.

B. Place approved excavated material in successive uniform maximum loose layers not exceeding 8 inches for the full width of the cross-section in all accessible areas. Place material in successive uniform loose layers not exceeding 4 inches in areas not accessible or permitted for the use of self propelled rollers or vibrators. Do not place fill on muddy or frozen subgrade, or until subgrade is approved by the Engineer.

C. Plow, step, or bench sloped surfaces steeper than 4 to 1 on which fill or backfill is to be placed in such a manner that fill material will adequately

bond with existing surfaces. Scarify all surfaces to receive backfill to a depth of 6" before filling.

- D. Construct fills and embankments to the lines and grades indicated on the Drawings within tolerances stated in Section 3.3, A above.
- E. Use suitable materials removed from the excavation prior to obtaining material from borrow areas.
- F. Where otherwise suitable material is too wet, aerate, dry or blend to provide the moisture content specified for compaction.

3.5 COMPACTION

During placing and/or compacting operations of earth or earth-and-rock mixtures, the moisture content of materials in the layers being compacted shall be near optimum and uniform throughout the layer. In general, maintain the moisture content of the material being placed and compacted within 2% of optimum condition as determined as ASTM Standard D698.

A. Compaction Equipment

- 1. Perform all compaction with approved equipment well suited to location and material being compacted. Use heavy vibratory rollers or sheepsfoot rollers where heavy equipment is authorized. Do not operate heavy equipment closer to structures than a horizontal distance equal to height of backfill above bottom of structure foundation. Compact remaining area with hand tampers suitable for material being compacted. Place and compact backfill around pipes with care to avoid damage.
- 2. Compact fill materials to following densities at optimum moisture content based on ASTM D698 or AASHTO T99:
 - a. Structure fill under or within 5' horizontally of all concrete structures: 95%.
 - b. Backfill beneath or within 5' horizontally or within the area defined by a line extended at an angle of 1:1 of existing or proposed pavements, roadways, sidewalks, curbs, utility lines or other improvements: 95%.
 - c. Backfill with lagoon berm: 95%.
 - d. Backfill within public or designated rights-of-way: 90% shown or as shown on the Drawings.
 - e. Backfill within undeveloped, green or undesignated area: 85%.

B. Jetting

- 1. Jetting and water inundation are generally not permitted methods of

compaction. The Engineer may allow jetting under certain field conditions. Techniques including depth of lifts, amount of water to be used, penetration of hose jet, etc., shall be at the direction of the Engineer. No jetting will be allowed on materials with a 200-minus gradation of greater than 15%. Contractor shall pay cost of all water used, soil classification testing and compaction testing and any retesting or recompaction required. No jetting shall be done prior to written approval and direction of the Engineer.

C. Maintenance

1. Contractor to maintain all embankment in satisfactory condition during the extent of the contract and warranty period. All surface deterioration determined to be the responsibility of the Contractor and all settlement shall be repaired at once by the Contractor upon notice by the Owner. All costs for repair and all liability as a result of surface deterioration or settlement shall be the responsibility of the Contractor.

3.6 PROOF ROLLING

Proof rolling with a heavy rubber-tired roller will be required as designated on the plans or when ordered. Proof rolling shall be done after specified compaction has been obtained. Areas found to be weak and those areas which failed shall be ripped, scarified, wetted if necessary and recompacted to the requirements for density and moisture at the Contractor's expense. Equipment to be used for proof rolling may also be fully loaded, tandem axle dump truck or water truck or rubber-tired roller with equivalent loading characteristics.

3.7 SURFACE RESTORATION

All existing surface improvements and site conditions disturbed or damaged during construction to be restored to a condition equal to pre-construction condition. All restoration costs are considered incidental to excavation and backfill.

A. Improvements

1. Replace, repair or reconstruct all improvements as required. Work will not be accepted until restoration is accepted by Engineer and all affected property owners.

B. Final Grading

1. The Contractor is to re-establish existing final grade or finish to final grades as modified and shown on the Drawings. The Contractor is to backfill to proper subgrade elevation with backfill material to allow placement of surface improvements or materials.

C. Green Areas

1. Place excavated topsoil from the roadway or from pits directly upon constructed cut and fill slopes without the use of stockpiles whenever conditions and the progress of construction will permit.
2. Do not place topsoil until the areas to be covered have been properly prepared and grading operations in the area have been completed.
3. Place and spread topsoil at locations and to the thickness shown on the plans. Key to the underlying material by the use of harrows, rollers or other equipment suitable for the purpose.
4. Apply water to the topsoil at the locations and in the amounts designated. Apply in a fine spray by nozzles or spray bars in such manner that it will not wash or erode the topsoil areas.
5. All loose exposed rock larger than six inches shall be removed from slopes that are to receive topsoil.

PART 4

4.0 QUALITY CONTROL - FIELD

4.1 INSPECTION AND TESTING

Inspection and testing to be performed at the direction of the Engineer. Contractor to cooperate fully with all persons engaged in testing. Contractor to excavate as required to allow testing; Contractor to backfill all test excavation in accordance with these Specifications.

4.2 DENSITY TESTING AND CONTROL

A. Reference Standards

1. Density/moisture relationships to be developed for all soil types encountered according to ASTM D698 or AASHTO T99.

B. Field Testing

1. Testing for density during compaction operations to be done in accordance with ASTM D2922 using nuclear density methods.

C. Frequency of Testing

1. Frequency of testing to be done at the direction of the Engineer.

D. Retesting

1. In the event of failure to meet compaction criteria, Contractor shall re-excavate and re-backfill at direction of Engineer. All retesting to be paid for by Contractor and to be performed by soils testing firm approved by the Engineer.

4.3 PAYMENT FOR TESTING

Owner responsible for all costs of initial testing of backfill. Contractor to pay all costs of any retesting required.

END OF SECTION

SECTION 02221 TRENCHING, BACKFILLING AND COMPACTION

1. GENERAL

1.1. Scope. Work to be performed under this section shall include all labor, materials, equipment, tools and accessories required to perform all excavation, backfilling and compaction of underground pipelines, conduits, cables and appurtenances shown on the Drawings and specified herein.

1.2. Related Work Specified Elsewhere.

1.2.1. Section 02222 - Embedment and Base Course Aggregate

1.2.2. Section 02223 – Shallow Utilities-CATV, Telecommunications, Electric and Natural Gas

1.2.3. Section 02520 – Drainage Pipe

1.2.4. Section 02555 - Water Transmission and Distribution Lines

1.2.5. Section 02560 - Sanitary Sewer lines

1.3. Field Conditions.

1.3.1. Existing Utilities. Underground utilities, except service lines, known to the Engineer have been shown on the Drawings. Locations are approximate only and may prove to be inaccurate. The Contractor is responsible for verification of the existence, location, and protection of all utilities within the construction area.

1.3.1.1.1. Before commencing with work, the Contractor shall notify all public and private companies who may have utilities within the project limits. The Contractor shall coordinate with these entities all excavation performed. The Contractor shall obtain all permits required by utility owners.

1.3.1.1.2. In the event of damage to any existing utility, the Contractor shall be solely responsible for the repair and payment for repair of all such damage.

1.3.1.1.3. The Contractor shall make arrangements for and pay all costs for relocation of utilities requiring relocation as indicated on the Drawings. Should utility obstructions, not shown on the Drawings, be encountered and require relocation, the Contractor shall notify the Owner and the Engineer and shall make arrangements necessary for such relocation. The Owner shall pay the costs for such relocation.

1.3.2. Existing Improvements. The Contractor shall restore or protect from damage all existing improvements encountered in performance of the work. Improvements damaged as a result of this work shall be restored to original condition or better, as determined by the Engineer.

1.3.2.1.1. Adjacent property shall be protected by the Contractor from any damage. The Contractor shall be held solely liable for any damage to adjacent property and shall be responsible for all costs resulting from repair of such damage.

1.3.2.1.2. Soil Conditions. It shall be the responsibility of the Contractor to examine soil conditions and characteristics, including the presence of groundwater that will be encountered within the limits of construction.

1.4. Protection of Work

- 1.4.1. Safety. All excavation shall be protected by barricades, lights, signs, etc., as required by governing federal, state, and local safety codes and regulations.
- 1.4.2. Sheeting, Shoring and Bracing. Where trench walls are not excavated at a stable slope, the Contractor shall provide and maintain support sufficient to prevent caving, sliding or failure and property or bodily damage. Any damage due to inadequate support shall be repaired at the sole expense of the Contractor.
- 1.4.3. Under normal construction conditions, support shall be removed as work progresses. Support shall remain installed if directed by the Engineer or if pipe does not have sufficient strength to support backfill based on trench width as defined by the sheeting. Sheeting shall not be removed after the start of backfilling.
- 1.4.4. Use of a movable trench shield or coffin box will not be allowed where pipe strength is insufficient to support backfill as defined by the trench width after the trench shield is removed.
- 1.4.5. The Contractor shall be held solely responsible for any violation of applicable safety standards. Particular attention is called to minimum requirements of OSHA and COSH (Colorado Occupational Safety and Health).
- 1.4.6. Site Drainage. Excavation to be protected from any source of surface water and storm water runoff at all times. At no time shall excavated area be allowed to fill with storm water runoff. Contractor shall provide proper, temporary drainage structures at their cost to detour runoff from excavated areas.

1.5. Blasting: No blasting shall be permitted without written consent of the Engineer. Blasting shall be done only after Engineer receives permission from the appropriate governmental authority (ies). Blasting shall be performed only by properly licensed, experienced individuals and in a manner such that no damage to any property or persons will occur due to either the blast or debris. Contractor shall provide proof of insurance as required by these Specifications, the governing authority or as required by Engineer prior to any blasting. All damage as the result of blasting shall be repaired, at the Contractor's expense, to the satisfaction of the Engineer. All earth or rock loosened by blasting shall be removed from excavations prior to proposed construction.

1.6. Construction in Vehicular Traffic ways: When construction operations are located within vehicular traffic ways make provisions at impacted locations for free passage of vehicles and pedestrians. Do not block such areas without prior approval from the Owner.

1.7. Submittals.

- 1.7.1. Bedding Material
 - 1.7.1.1. Submit sieve analysis
- 1.7.2. Select Fill
 - 1.7.2.1. Submit sieve analysis

2. MATERIALS

2.1. Embedment Material Pipe line embedment material shall comply with the appropriate classes as listed below and as illustrated in the Construction Drawings:

2.1.1. Class A - Use where improper trenching or unexpected trench conditions require its use as determined by the Engineer.

2.1.1.1. Characteristics - Concrete cradle foundation with densely compacted Class 6 aggregate base backfill to 12 inches above top of pipe, or densely compacted Class 6 aggregate granular foundation with concrete arch cover to 6 inches above top of pipe.

2.1.2. Class B - Use for all PVC, DIP, CMP and concrete pipe under normal construction conditions.

2.1.2.1. Characteristics - Densely compacted Class 6 aggregate granular foundation of depth shown on Typical Details with densely compacted Class 6 aggregate 12 inches above top of pipe. 3/4" screened rock shall not be used unless approved by the Engineer.

2.2. Select Material. Subject to approval by the Engineer, select material shall be allowed in place of the aggregate backfill for Class B when excavation and soil conditions allow, but only if approved by Engineer. Contractors shall bid project based upon Class B. If Class A or select material is used, price adjustments shall be made.

2.2.1. Characteristics - Soil materials free from rocks, clods, and organic material.

2.3. Concrete for Embedment. Shall be 2000-psi concrete (28- day compressive strength).

2.4. Backfill Material

2.4.1. Characteristics - Native materials free from debris, organic matter, and frozen material. Uniformly graded sufficient to allow proper compaction.

2.4.2. Gradation - No boulders greater than 4 inch diameter in top or bottom 12 inches of backfill.

2.4.3. Generally no boulders greater than 12-inch diameter in remainder of trench.

3. METHODS AND PROCEDURES

3.1. Site Preparation

3.1.1. Clearing: Remove all vegetation, stumps, roots, organic matter, debris and other miscellaneous structures and materials from project site. Dispose of off site.

3.1.2. Topsoil Removal: Strip existing topsoil from all areas to be disturbed by construction. Topsoil to be stockpiled separately from excavated materials.

3.1.3. Pavement Removal: See Section 02101 - Removal of Structures and Obstructions.

3.2. Trench Excavation

3.2.1. Limits of Excavation. Trenches to be excavated along lines and grades shown on the Drawings, or as modified in the field by the Engineer. Trench widths for pipe loading to be measured 12 inches above top of pipe.

3.2.1.1. Minimum trench width to be the outside diameter of the pipe or conduit plus 16 inches.

3.2.1.2. Maximum trench width to be the outside diameter of the pipe or conduit plus 24 inches for all pipes or conduits with outside diameter of 24 inches or less, and plus 30 inches for all pipes or conduits with outside diameters greater than 24 inches.

3.2.1.3. If maximum trench width is exceeded, Contractor will provide at his expense, higher strength pipe, or special bedding including concrete at the direction of the Engineer.

3.2.1.4. Trench excavation not to be completed more than 100 feet in advance of pipe installation. Backfill to be completed within 100 feet of pipe installation.

- 3.2.2. Asphalt/Concrete removal: Cuts in asphalt or concrete pavement or sidewalks shall be not larger than necessary to provide adequate working space for proper installation of pipe and appurtenances. Cutting shall be started with a concrete saw in a manner which will provide a clean groove at least 1½ inches deep along each side of the trench and along the perimeter of cuts for structures. Pavement over trenches excavated for pipelines shall be removed so that a shoulder not less than 12 inches in width at any point is left between the cut edge of the pavement and the top edge of the trench. Where necessary, trench banks may be sloped back as needed, and the width of pavement removed shall be adjusted accordingly. Trench width at the bottom shall not be greater than at the top and no undercutting will be permitted. Pavement cuts shall be made to and between straight and accurately marked curbed lines which, unless otherwise required, shall be parallel to the centerline of the trench. Temporary pavement patches shall contain a minimum of 3 inches of cold mix as noted in the standard details-typical pavement section.
- 3.2.3. Groundwater Control: Contractor to maintain facilities on-site to remove all groundwater from trench and keep water at least 12 inches below the trench bottom to a point such that a firm base for pipe or conduit installation exists. Facilities shall be maintained until all concrete is cured and backfilling is in place at least 24 inches above anticipated water levels before water removal is discontinued; all water removal shall be subject to approval by the Engineer.
- 3.2.4. Stockpile Excavated Material: Excavated material to be stockpiled so as not to endanger the work or public safety. Maintain existing vehicular and pedestrian traffic with minimum disruption. Maintain emergency access and access to existing fire hydrants and water valves. Maintain natural drainage courses and street gutters.
- 3.2.4.1. Backfill material to be segregated from stockpiled topsoil and unusable backfill materials.
- 3.2.5. Excavation for Appurtenances: Excavation to be done in accordance with these Specifications and as shown on the Drawings. Adequate working clearances to be maintained around appurtenances. Provisions for base and bottom preparations shall apply to all appurtenances.
- 3.2.5.1. Precautions to be taken to maintain trench widths in the vicinity of adjacent pipelines and conduits.
- 3.3. Bottom Preparation:
- 3.3.1. Undisturbed Foundation: Where soils are suitable and have adequate strength, bottom to be graded and hand-shaped such that pipe barrel rests uniformly on undisturbed soil. All rocks or stones which may result in a point bearing on the pipe shall be removed.
- 3.3.1.1. Undisturbed grades shall be within 0.1 feet ± tolerance. Soils for final pipe grade placed within these limits shall be fine granular (100% passing No. 4 sieve) or may be native materials, hand compacted to 95% maximum density.
- 3.3.2. Bell Holes: Material to be removed to allow installation of all fitting and joint projections without affecting placement of pipe.
- 3.3.3. Over excavation: Whenever trench is over excavated to eliminate point bearing by rocks or stones or when undisturbed grade tolerances of 0.1 feet are exceeded, the Contractor is to re-establish grade using Class 6 aggregate bedding material. Compaction shall be 95% maximum density. All work to re-establish grade shall be at the Contractor's expense.
- 3.3.4. Unstable Materials: Materials which are not capable of supporting superimposed loadings are defined as unstable materials. Should unstable materials be encountered during excavation, immediately notify Engineer. If, in the opinion of the Engineer, unstable soil excavation is required and the Contractor could not have reasonably been expected to discover the existence of such materials during his site investigation, then a contract price for Unstable Soil Excavation shall be negotiated between Owner and Contractor. No

payment shall be made for materials excavated prior to notification of the Engineer and negotiation of payment for extra work.

- 3.3.4.1. Inclusion of a bid item for unstable soil excavation indicates such excavation is anticipated. The Contractor is to notify the Engineer prior to any unstable soil excavation; no payment shall be made for excavation prior to authorization of Engineer.
- 3.3.5. Rock Excavation: Rock excavation shall be defined as removal of boulders in excess of three (3) cubic yards of solid or fractured rock, which makes hand shaping of the bottom impossible and which requires techniques, such as blasting or jacking for removal, other than those which are being employed by the Contractor or are normally used in trench excavation, such as use of backhoes, trenchers, draglines, etc. Should unanticipated rock conditions be encountered, immediately notify the Engineer. If in the opinion of the Engineer, rock excavation is required and the Contractor has in fact made a diligent and determined effort to remove the material using normal excavation procedures as stated above, and the Contractor could not have reasonably been expected to determine the existence of such material during his site investigation, then a contract price for rock excavation shall be negotiated between the Contractor and the Owner. No payment shall be made for excavation performed prior to determination of a negotiated price.
 - 3.3.5.1. Rock shall be removed to a 4 inch depth below grade. Additionally, all rock loosened during jacking, blasting, etc., shall be removed from the trench. For payment purposes, maximum trench width to be paid for shall be as defined in Subsection 3.2.1. Maximum depth to be paid for shall be 12 inches below required grade. All over excavation shall be replaced as specified in Subsection 3.3.3.
 - 3.3.5.2. Inclusion of a bid item for rock excavation indicates such excavation is anticipated. Contractor to notify Engineer prior to any rock excavating; no payment shall be made for excavation prior to notification.

3.4. Backfilling:

- 3.4.1. Tamping Equipment: Except immediately next to the pipe, mechanical or air operated tamping equipment is to be used. Hand equipment such as a T-bar is to be used next to the pipe if necessary. Care to be taken when compacting under, along side, and immediately above pipe to prevent crushing, fracturing or shifting of the pipe. The Contractor is to note densities required for materials being backfilled and shall use appropriate approved equipment to obtain those densities.
 - 3.4.1.1. Wheel rolling is not considered to be an adequate compaction technique to meet these Specifications and will not be allowed. Where 85% compaction is required, wheel rolling may be considered. Before acceptance, the Contractor shall backfill a portion of the trench and pays for density testing to verify adequacy of the proposed backfill techniques.
 - 3.4.1.2. A hydro hammer may be allowed to obtain the specified density up to 4 feet in depth. The Contractor will be required to re-excavate those areas that have been tamped so that density tests can be taken to insure that the specified density is being obtained full depth.
- 3.4.2. Moisture Control: Generally maintain moisture of backfill material with $\pm 2\%$ of optimum moisture content as determined by ASTM D698. Maintain closer tolerances as needed to obtain densities required.
- 3.4.3. Compaction: Maximum density (100%) based on ASTM D698 or AASHTO T99.
 - 3.4.3.1. Bedding Material: including material used for over-excavation of any kind: 95%
 - 3.4.3.2. Select Material: 95%
 - 3.4.3.3. Backfill beneath existing or proposed pavement, roadways, sidewalks, curbs, utility lines and other improvements or within 5 feet horizontally of such improvements, or

- within a 1:1 prism from such improvements: 95%
- 3.4.3.4. Backfill within public or designated right-of-way: 90% or as shown on the Drawings.
 - 3.4.3.5. Backfill within undeveloped, green or undesignated area: 85%
 - 3.4.3.6. Backfill for any fill over over-cut grading in areas of lot/home construction: 95%.
- 3.4.4. Placing Backfill: The maximum loose lifts of backfill material to be as follows: use smaller lifts where necessary to obtain required densities:
- 3.4.4.1. Bedding and select material: 6 inches (or see Section 3.3.1).
 - 3.4.4.2. Backfill Material: 12 inches where 95% compaction required. 24 inches where less than 95% compaction required.
- 3.4.5. Backfilling Appurtenances: Backfilling to be done generally at the same time as adjacent pipelines. Backfilling procedure to conform to this section. Use special techniques or materials as shown on drawings.
- 3.4.6. Disposal of Excess Excavation: Contractor to dispose of excess excavation off-site. The Owner shall have the right to elect to have the excess excavation disposed of at a designated site within the project limits. Excavation may be wasted on-site only if approved by the Engineer. Disposal in any case shall be the sole responsibility of the Contractor.
- 3.4.7. Jetting: Jetting and water inundation are generally not permitted methods of compaction. The Engineer may allow jetting under certain field conditions. Techniques including depth of lifts, amount of water to be used, penetration of hose jet, etc., shall be at the direction of the Engineer. No jetting will be allowed on materials with a 200 minus gradation of greater than 15%. Contractor shall pay cost of all water used, soil classification testing and a retesting or recompaction required. No jetting shall be done prior to written approval and direction of the Engineer.
- 3.4.8. Maintenance of Backfill: Contractor to maintain all backfill in a satisfactory condition during the extent of the contract and warranty period. All surface deterioration determined to be the responsibility of the Contractor and all settlement shall be repaired at once by the Contractor upon notice by the Owner. All costs for repair and all liability as a result of surface deterioration or settlement shall be the responsibility of the Contractor.
- 3.4.9. Clay Barrier Water Stops: Because of the presence of ground water, a clay barrier may be required to be installed full depth in trench in place of all bedding material and backfill. This barrier shall be full depth and two feet thick and installed every 500 lineal feet of trench. Clay barrier installation shall be considered incidental to the pipe installation and not paid for separately.
- 3.5. Surface Restoration. All existing surface improvements and site conditions disturbed or damaged during construction to be restored to a condition equal to pre-construction condition. All restoration costs are considered incidental to excavation and backfill. The Contractor shall provide sufficient labor forces and equipment to maintain cleanup operations closely behind pipe laying operations. Every advantage shall be taken of periods of good weather for general cleanup, grading, topsoiling, seeding, sodding etc. Items of work such as manhole construction, road cuts, pavement replacement, and all other restoration work shall not be allowed to lag behind the pipe installation. Special attention shall be given to maintaining road crossings.
- 3.5.1. Temporary pavement patches: Patches must be kept flush with adjacent paved surfaces between asphalt paving seasons. Ruts and other depressions caused by settling, vehicular traffic etc. shall be continuously filled and graded for maintenance of smooth traveled surface and minimum inconvenience to the public.
 - 3.5.2. Improvements: Replace, repair, or reconstruct all improvements as required. Work will not be accepted until restoration is accepted by Engineer and all affected property owners.

Improvements include, by example, other utilities, culverts, structures, curb and gutter, mailboxes, signs, sprinkler systems, etc.

- 3.5.3. Final Grading: The Contractor is to re-establish existing final grade or finish final grades as modified and shown on the Drawings. The Contractor is to backfill to proper sub grade elevation with backfill material to allow placement of surface improvements or materials.
- 3.5.4. Roadways: All roadways to be restored to original condition with material types removed. Embedment and Base Course Aggregate Section 02222. Hot Bituminous Pavement Section 02612. Additional requirements are:
 - 3.5.4.1. Minimum base course material on gravel roadways or minimum depth gravel on hard surface roadways to be 8 inches, unless shown otherwise on Drawings.
 - 3.5.4.2. Minimum bituminous surfacing to be 3 inches unless shown otherwise on Drawings.
 - 3.5.4.3. Minimum concrete pavement surfacing to be 6 inches, unless shown otherwise on Drawings.
- 3.5.5. Restoration Monitoring: If in the opinion of the Engineer, cleanup and miscellaneous items of work and construction are lagging, the Contractor will be required to stop pipe installation until such work is caught up. A percentage of the unit and lump sum prices will be withheld from payments for pipe installation, manhole construction etc. in areas where cleanup and restoration have not been completed. This percentage will be in excess of the specified 10% retainage for completed work.

4. QUALITY CONTROL - FIELD

- 4.1. Compaction. It should be fully understood that it will be the sole responsibility of the Contractor to achieve the specified densities for all embedment and backfill material placed. The Contractor will be responsible for ensuring that correct methods are being used for the placement and compaction of said materials. Correct backfill methods include, but are not limited to:
 - 4.1.1. Use of proper equipment for existing soil condition encountered.
 - 4.1.2. Moisture content of existing soils; determination if water should be added or if soil should be air dried to reduce moisture content.
 - 4.1.3. Thickness of backfill lift.
 - 4.1.4. Contractor may, at his own expense, have an approved geotechnical engineer monitor the methods of backfill and compaction used to ensure that the desired densities are being obtained.
 - 4.1.5. Inspection and testing will be performed as directed by the Engineer. Testing will be conducted as a quality assurance check to verify the Contractor's compliance with the standards indicated in the Specifications.
- 4.2. Inspection and Testing. Inspection and testing to be performed at the direction of the Engineer. The Contractor shall cooperate fully with all persons engaged in testing. The Contractor shall excavate as required allowing testing. The Contractor shall backfill all test excavations in accordance with these Specifications. Any areas which require a specified density, including fill, backfill, trenches, embankments, road base, hot bituminous pavement, backfill for structures, shall be tested.
- 4.3. Density Testing and Control:
 - 4.3.1. Reference Standards: Density/moisture relationships to be developed for all soil types encountered according to ASTM D698 or AASHTO T99.
 - 4.3.2. Field Testing: Testing for density during compaction operations to be done in accordance with ASTM D2922 using nuclear density methods.

- 4.3.3. Frequency of Testing: Minimum of one (1) test every 250 feet of trench per lift or as directed by Engineer. The Contractor to excavate to depths required by Engineer for testing and backfill test holes to density specified. Testing to be paid for by Owner.
- 4.3.4. Retesting: In the event of failure to meet compaction criteria, the Contractor shall re-excavate and re-backfill at direction of Engineer. All retesting to be paid for by Contractor and to be performed by soils testing firm approved by the Engineer.
- 4.4. Payment for Testing: Owner responsible for all costs of initial testing of backfill. Contractor to pay all costs of any retesting required.

End of Section

SECTION 03 30 00

CONCRETE

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Formwork, reinforcement, accessories, cast-in-place concrete, finishing and curing.

1.02 SUBMITTALS

A. Lab Design Mix. Prior to the start of work, Contractor to submit a statement of the proportions for the concrete mixture. Statement to include:

1. Location and identification of aggregate source.
 2. Batch quantities for one (1) cubic yard of concrete including:
 - a. Weight of fine aggregate in a saturated surface dry condition.
 - b. Weight of coarse aggregate in a saturated surface dry condition.
 - c. Weight or number of 94 pound bags of cement
 - d. Weight or gallons of water
 - e. Amount and description (including manufacturer, specific product name, and number) of all admixtures.
 3. Test results on trial batch concrete made from the proposed mix design, including:
 - a. Cement factor in bags per cubic yard based on yield tests.
 - b. Water-cement ratio.
 - c. Percent of entrained air.
 - d. Consistency in inches of slump.
 - e. At least three 28-day compressive tests.
 4. Brand, type and place of manufacture of cement.
 5. Aggregate test results for grading, deleterious substances and physical properties using test procedures developed by ACI.
- B. Reinforcing Steel. Not required.
 - C. Construction Joint Location. Not required.

1.03 QUALITY ASSURANCE

- A. Construct and erect concrete formwork in accordance with ACI 301, unless

specified otherwise in this Section.

- B. Perform concrete reinforcing work in accordance with ACI 301, unless specified otherwise in this Section or the structural General Notes on the structural drawings.
- C. Perform cast-in-place concrete work in accordance with ACI 301, unless specified otherwise in this Section.
- D. Coordinate with Chemical Stain Manufacturer for all Architectural Concrete flatwork. Refer to Section 09900.

PART 2 - PRODUCTS

2.01 FORM MATERIALS

- A. Plywood: PS 1, C Grade Douglas Fir species; grade; sound, undamaged sheets with clean true edges.
- B. Lumber: Hem-Fir or Douglas Fir species; grade.
- C. Prefabricated Steel Type: 16-gauge, matched tight fitting, stiffened to support weight of concrete. Lined forms may be used in lieu of providing complete sack finish to all exposed concrete wall.
- D. Tubular Column Type: Round, spirally wound laminated materials, inside surface treated with release agent, of size required.
- E. Form Ties: Snap-off metal type or cone type.
- F. Form Release Agent: Colorless mineral oil which will not stain concrete or impair natural bonding characteristics of coating intended for use on concrete.
- G. Formed Construction Joints for Slab-on-Grade: extruded plastic, tongue and groove type profile, knockout holes to receive doweling.
- H. 03001.07 Slab Edge Joint Filler: ASTM D1751, premolded asphaltic board, 1/2 inch thick.

2.02 REINFORCEMENT MATERIALS

- A. Reinforcing Steel: ASTM A615, deformed billet steel bars, plain finish. Yield grade as indicated on Structural general notes.
- B. Welded Steel Wire Fabric: ASTM A185, plain type, in flat sheets, plain finish.
- C. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for support of reinforcing.

D. Fabricate concrete reinforcing in accordance with ACI 315.

2.03 CONCRETE MATERIALS

A. Cement: ASTM C150, Type I-II Portland type.

B. Fine and Coarse Aggregates: ASTM C33.

C. Water: Clean and not detrimental to concrete.

D. Air Entrainment Admixture: ASTM C494.

E. Bonding Agent: Polymer resin emulsion manufactured by Sika Chemical Co. or Euclid Chemical Company.

F. Non-Shrink Grout: Pre-mixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents.

G. Water Reducing Agent: ASTM C494.

2.04 COMPOUNDS, HARDENERS AND SEALERS

A. Curing Compound: Interior and exterior - Clear acrylic polymer curing and sealing compound meeting ASTM A309.

2.05 CONCRETE MIX

03001.01 Concrete

	Exterior Flatwork:	Interior Flatwork	Footings	Foundation Wall and Grade Beams
Strength:	4500	4000	4000	4000
Slump:	3 to 6	3 to 6	3 to 6	3 to 6
Admixtures:	WRA	WRA	WRA	WRA
Max. Aggr. Size:	0.75	0.75	0.75	0.75
Air:	Per local industry standard practice	Per local industry standard practice	Per local industry standard practice	Per local industry standard practice

03 30 00.29 Concrete Floor Leveler

1. Dayton LevelLayer 3 manufactured by Dayton Superior 7777 Washington Village Dr., Suite 130, Dayton OH 45459 (888) 977-9600 or approved equal.

PART 3 - EXECUTION

3.01 FORMWORK ERECTION

- A. Erect formwork, shoring and bracing to achieve design requirements.
- B. Provide bracing to ensure stability of formwork.
- C. Apply form release agent to formwork in accordance with manufacturer's instructions, prior to placing for accessories and reinforcement.
- D. Do not apply form release agent where concrete surfaces will receive special finishes or applied coverings which are effected by agent.
- E. Clean forms as erection proceeds, to remove foreign matter.

3.02 INSERTS, EMBEDDED COMPONENTS AND OPENINGS

- A. Coordinate work of other Sections in forming and setting openings, slots, recesses, chases, sleeves, bolts, anchors, and other inserts.
- B. Install concrete accessories straight, level and plumb.
- C. Place joint filler at perimeter of slab.

3.03 REINFORCEMENT PLACEMENT

- A. Place reinforcement, supported and secured against displacement.
- B. Ensure reinforcing is clean, free of loose scale, dirt or other foreign coatings.

3.04 PLACING CONCRETE

- A. Separate slabs-on-grade from vertical surfaces with 1/2 inch thick joint filler, extended form bottom of slab to within 1/4 inch of finished slab surface, or as indicated on the Structural documents.
- B. Place concrete continuously between predetermined expansion, control and construction joints. Do not break or interrupt successive pours such that cold joints occur. See structural general notes for joint spacing.

C. Screed slabs-on-grade level, maintaining surface flatness of maximum 1/4 inch in 10 feet.

3.05 FORM REMOVAL

A. Do not remove forms or bracing until concrete has gained sufficient strength to carry its own weight and imposed loads.

B. Remove formwork progressively in a manner which will not damage concrete.

3.06 SLAB FINISHING

A. Finish concrete floor surfaces in accordance with ACI 301 and/or as required by Section 09900 for Architectural Concrete.

B. Light Broom finish on exterior slabs and all interior slabs designated for Architectural Concrete.

C. Slope exterior slabs 1/8 inch in 1 foot for proper drainage.

3.07 CURING

A. Apply sealer on floor surfaces in accordance with manufacturer's instructions.

B. Immediately after placement, protect concrete from premature drying.

C. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.

3.08 FIELD QUALITY CONTROL

A. Inspection and testing will be performed by firm appointed in accordance with Section 01001.

B. Three concrete test cylinders will be taken for every 50 or less cubic yards of each class of concrete placed each day. See also structural general notes and special inspections requirements for frequency and required testing.

C. One additional test cylinder will be taken during cold weather concreting, and be cured on job site under same conditions as concrete it represents.

D. One slump test will be taken for each truck.

3.09 WALL FINISH

A. Provided hand rubbed finish at all exposed interior concrete walls.

3.10 DEFECTIVE CONCRETE

A. Modify or replace concrete not conforming to required lines, details and elevations, as directed by Architect/Engineer.

END OF SECTION

SECTION 04 05 13

MORTAR AND MASONRY GROUT

PART 1 – GENERAL

1.1 SECTION INCLUDES

- A. Mortar and grout for masonry.

1.2 ENVIRONMENTAL REQUIREMENTS

- A. Cold Weather Requirements: IMIAC - Recommended Practices and Guide Specifications for Cold Weather Masonry Construction.

1.3 MIX TESTS

- A. Testing of Mortar Mix: In accordance with ASTM C780.
- B. Testing of Grout Mix: In accordance with ASTM C1019.
- C. See also Structural drawings general notes and special inspection requirements for testing and special inspections.

1.4 QUALITY CONTROL

All work shall conform to Section 01410 Waste Recycling.

PART 2 - PRODUCTS

2.1 MATERIALS

04 05 13.01 Mortar

- A. Portland Cement: ASTM C150, Type I, gray color.
- B. Mortar Aggregate: ASTM C144, standard masonry type.
- C. Hydrated Lime: ASTM C207, Type S.
- D. Premix Mortar: ASTM C387, using gray cement, normal strength.
- E. Grout Aggregate: ASTM C404.
- F. Water: Clean and potable.

2.2 MORTAR MIXES

- A. Mortar for Non-load Bearing Walls and Partitions: ASTM C270, Type N, using the Property Method.
- B. Mortar for Reinforced Masonry: ASTM C270, Type S, using the Property Method.
- C. Pointing Mortar for Masonry: ASTM C270, Type N, using the Property Method; with maximum 2 percent ammonium stearate or calcium stearate per cement weight.
- D. Stain Resistant Pointing Mortar: One part Portland cement, 1/8 part hydrated lime, and two parts graded (80 mesh) aggregate, proportioned by volume. Add aluminum tristearate, calcium stearate, or ammonium stearate equal to 2 percent of Portland cement by weight.

2.3 MORTAR MIXING

- A. Thoroughly mix mortar ingredients in quantities needed for immediate use in accordance with ASTM C270.
- B. Add mortar color and admixtures in accordance with manufacturer's instructions.
- C. Do not use anti-freeze compounds to lower the freezing point of mortar.

2.4 GROUT MIXES

04 05 13.02 Grout

- A. Bond Beams, Lintels, Engineered Masonry: 3000 psi strength at 28 days; 7-9 inches slump; premixed type in accordance with ASTM C476.

2.5 GROUT MIXING

- A. Mix grout in accordance with ASTM C476.
- B. Do not use anti-freeze compounds to lower the freezing point of grout.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install mortar in accordance with ASTM C780. Install grout in accordance with ACI301.
- B. Work grout into masonry cores and cavities to eliminate voids. Do not displace reinforcement.

END OF SECTION

SECTION 04 20 00

UNIT MASONRY

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Concrete masonry and brick units, reinforcement, anchorage, and accessories.

1.2 SUBMITTALS

- A. Samples for Initial Selection for the following:

- 1. Mortar – Submit Technical information for structural review
- 2. CMU's – Submit Technical Information for structural review

- B. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients. Include the following:

- 1. Test reports, per ASTM C 780, for mortar mixes required to comply with property specification
- 2. Test reports, per ASTM C 1019, for grouting mixes required to comply with compressive strength requirement.

- C. Wall Reinforcement: Drawings to include wall elevations clearly indicating reinforcement steel locations.

- D. Joint Reinforcement manufacturer data.

1.3 REGULATORY REQUIREMENTS

- A. Conform to applicable code requirements for fire rated masonry construction.

1.4 ENVIRONMENTAL REQUIREMENTS

- A. Cold Weather Requirements: IMIAC - Recommended Practices and Specifications for Cold Weather Masonry Construction.

PART 2 - PRODUCTS

2.1 CONCRETE MASONRY UNITS

- 04 20 00.16 8" Concrete Block
- 04 20 00.17 6" Concrete Block
- 04 20 00.18 4" Concrete Block
- 04 20 00.20 12" Concrete Block
- 04 20 00.22 Concrete Block Bond Beam

- A. Hollow Load Bearing Block Units: ASTM C90, Grade N, Type I - Moisture Controlled, medium weight.
- B. Hollow Non-Load Bearing Block Units: ASTM C129, Type I - Moisture Controlled, medium weight.
- C. AT ALL ENTRIES AND DOORWAYS: Hollow Load Bearing Block Units: ASTM C90, Grade N, Type I - Moisture Controlled, medium weight with bull nosed edge.

2.2 REINFORCEMENT

- A. Single Wythe Joint Reinforcement: Hot dip galvanized cold-drawn steel manufactured by Dur-O-Wal as noted on structural drawings.
- B. Reinforcing Steel: ASTM A615, 60 ksi grade, deformed billet bars, unprotected finish.

2.3 FLASHINGS

04 05 23.08 Masonry Flashing

- A. DCF-Composite Thru-wall Flashing manufactured by Dur-O-Wal, Inc. or equal.

04 05 23.10 Masonry Drip Edge Flashing

- A. Drip Edge Flashing manufactured by Dur-O-Wall, Inc. or equal.

2.4 ACCESSORIES

- A. Joint Filler: Closed cell rubber foam; oversized 50 percent to joint width; self-expanding.
- B. Building Paper: No. 15 asphalt saturated felt.
- C. Nailing Strips: Softwood, preservative treated, dovetail shape, sized to masonry joints.

04 20 00.07 Weep Hole

- D. Weep Holes: Weep Hole-Clear Plastic tube D/A 1005 manufactured by Dur-O-Wall or

equal.

E. Cleaning Solution: Non-acidic, not harmful to masonry work or adjacent materials, recommended by masonry unit manufacturer.

04 05 23.04 Control Joint

F. At CMU – D/A 2002 manufactured by Dur-O-Wall or equal.

PART 3 - EXECUTION

3.1 EXAMINATION AND PREPARATION

- A. Verify that field conditions are acceptable and ready to receive Work.
- B. Coordinate placement of anchors supplied to other Sections.

3.2 COURSING

- A. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.
- B. Concrete Masonry Units: Lay in running bond. Course one unit and one mortar joint to equal 8. Form concave mortar joints.
- C. Not Used
- D. Cut mortar joints flush where bitumen damproofing is applied.
- E. Install CMU with bull nosed edge at door jambs where CMU edge is not protected by door jambs or other metal extrusions.

3.3 PLACING AND BONDING

- A. Isolate masonry partitions from vertical structural framing members with a control joint.
- B. Isolate top joint of masonry partitions from horizontal structural framing members and slabs or decks with compressible joint filler.

3.4 WEEPS AND VENTS

- A. Install weep holes in veneer at 16" on center horizontally above through-wall flashing above shelf angles and at bottom of walls.

3.5 CAVITY WALL

A. Not Used

3.6 REINFORCEMENT AND ANCHORAGES - CAVITY WALL MASONRY

A. Not Used

3.7 REINFORCEMENT AND ANCHORAGES - VENEER MASONRY

A. Not Used

3.8 REINFORCEMENT AND ANCHORAGES - REINFORCED UNIT MASONRY

- A. Install horizontal joint reinforcement 16 oc. or as indicated on plans. Place joint reinforcement continuous in first and second joint below top of walls.
- B. Place masonry joint reinforcement in first and second joints above and below openings. Extend minimum 16" each side of opening.
- C. Support and secure reinforcing bars from displacement. Maintain position within 1/2 inch of dimensioned position.

3.9 MASONRY FLASHINGS

- A. Extend flashings under veneer; turn up minimum 8 inches and bed into mortar joint of masonry seal to sheathing.
- B. Lap end joints and seal watertight.
- C. Use flashing manufacturer's recommended adhesive and sealer.

3.10 LINTELS

- A. Install loose steel lintels over window openings and door openings.
- B. Maintain minimum 8 inch bearing on each side of opening.

3.11 GROUTED COMPONENTS

- A. Reinforce bond beam and pilasters as detailed.
- B. Support and secure reinforcing bars from displacement. Maintain position within 1/2 inch of dimensioned position.
- C. Place and consolidate grout fill without displacing reinforcing.
- D. At bearing locations, fill masonry cores with per structural general notes.

3.12 ENGINEERED MASONRY

- A. Lay masonry units with core cells vertically aligned clear of mortar and unobstructed.
- B. Reinforce masonry unit cores with reinforcement bars and grout as indicated.
- C. Secure vertical reinforcement in position at top and bottom of cells and at intervals not exceeding 192 bar diameters. Splice reinforcement in accordance with Section 03001.
- D. Place mortar in masonry unit bed joints back 1/4 inch from edge of unit grout spaces; bevel back and upward. Permit mortar to cure three days before placing grout.
- E. Grout spaces less than 2 inches in width with fine grout using low lift grouting techniques. Grout spaces 2 inches or greater in width with coarse grout using high or low lift grouting techniques.
- F. When grouting is stopped for more than one hour, terminate grout 1-1/2 inch below top of upper masonry unit to form a positive key for subsequent grout placement.
- G. Low Lift Grouting: Place first lift of grout to a height of 16 inches and rod for grout consolidation. Place subsequent lifts in 8 inch increments and rod for grout consolidation.
- H. High Lift Grouting:
 - 1. Provide clean out opening no less than 4 inches high at the bottom of each cell to be grouted by cutting one face shell of masonry unit.
 - 2. Clean out masonry cells with high pressure water spray. Permit complete water drainage.
 - 3. Request that Architect/Engineer inspect the cells. Allow three days advance notice.
 - 4. After cleaning and cell inspection, seal openings with masonry units.
 - 5. Pump grout into spaces. Maintain water content in grout to intended slump without aggregate segregation.
 - 6. Limit grout lift to 48 inches and rod for grout consolidation. Wait 30 to 60 minutes before placing next lift.

3.13 CONTROL JOINTS

- A. Do not extend horizontal joint reinforcement through control joints.
- B. Form control joint with a sheet building paper bond breaker fitted to one side of the hollow contour end of the masonry unit. Fill the resultant elliptical core with grout fill. Rake joint at exposed unit faces for placement of backer rod and sealant.
- C. Size control joint in accordance with Section 07900 for sealant performance.

3.14 BUILT-IN WORK

- A. As Work progresses, build in metal door and glazed frames, fabricated metal frames, window frames, wood nailing strips, anchor bolts, plates, and other items to be built in the Work furnished by other Sections.
- B. Bed anchors of metal door and glazed frames in adjacent mortar joints. Fill frame voids solid with grout. Fill adjacent masonry cores with grout minimum 12 inches from framed openings.

3.15 TOLERANCES

- A. Maximum Variation from Plumb: 1/4 inch per story, non-cumulative; 1/2 inch in two stories or more.
- B. Maximum Variation from Level Coursing: 1/8 inch in 3 ft and 1/4 inch in 10 ft; 1/2 inch in 30 ft.

3.16 CUTTING AND FITTING

- A. Cut and fit for chases, pipes, conduit, sleeves and grounds. Coordinate with other Sections of Work to provide correct size, shape, and location.

3.17 CLEANING

- A. Remove excess mortar from glass surfaces with a damp cloth before set occurs.
- B. Number 4 steel wool can be used to remove remaining mortar.

3.18 CLEANING

- A. Remove excess mortar and mortar smears.
- B. Clean soiled surfaces with cleaning solution.

END OF SECTION

SECTION 05 10 00

STRUCTURAL STEEL

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Structural steel framing members, baseplates, plates, anchor bolts, and grouting under baseplates.
- B. Section 03001: Placement of anchors for casting into concrete.

1.02 SUBMITTALS

- A. Shop Drawings: Indicate sizes, spacing, and locations of structural members, openings, connections, and welded connections.

1.03 QUALITY ASSURANCE

- A. Fabricate structural steel members in accordance with AISC - Specification for the Design, Fabrication and Erection of Structural Steel for Buildings.
- C. See also Structural general notes and special inspection requirements for testing and special inspection.

PART 2 - PRODUCTS

05 10 00.01 Structural Steel
05 10 00.03 Tubular Steel
05 10 00.08 Steel Angle
05 10 00.09 Steel Lintel
05 10 00.10 Steel Embed Plate

2.01 MATERIALS

- A. Structural Steel Members: Refer to Structural General Notes
- B. Structural Tubing: ASTM A500, Grade B.
- C. Pipe: ASTM A53, Grade B.
- D. Bolts, Nuts, and Washers: ASTM A325.
- E. Anchor Rods: ASTM A307.
- F. Welding Materials: AWS D1.1; type required for materials being welded.
- G. Grout: Non-shrink type, pre-mixed compound consisting of non-metallic aggregate,

cement, water reducing and plasticizing additives, capable of developing a minimum compressive strength of 7,000 psi at 28 days.

H. Shop and Touch-Up Primer: SSPC 15, Type 1, red oxide. Verify if VOC compliant.

2.02 FABRICATION

A. Continuously seal joined members by continuous welds. Grind exposed welds smooth.

2.03 FINISH

A. Prepare structural component surfaces in accordance with SSPC SP 2.

B. Shop prime structural steel members that will be finish painted. Members that will be concealed by finishes need not be primed. Do not prime surfaces that will be fireproofed, field welded, in contact with concrete, or high strength bolted.

C. Paint all exposed and visible structural steel member as per Section 09900.

PART 3 - EXECUTION

3.1 EXAMINATION AND PREPARATION

A. Verify that field conditions are acceptable and are ready to receive work.

3.2 ERECTION

A. Allow for erection loads. Provide temporary bracing to maintain framing in alignment until completion of erection and installation of permanent bridging and bracing.

B. Field weld components indicated on Drawings and/or shop drawings.

C. Do not field cut or alter structural members without approval of Architect/Engineer.

D. After erection, prime welds, abrasions, and surfaces not shop primed, except surfaces to be in contact with concrete or those that will not be finish painted.

E. Grout under baseplates.

3.5 FIELD QUALITY CONTROL

A. Field inspection will be performed under provisions of Section 01001. See also Special Inspections Program in structural drawings for special inspections requirements pertaining to structural steel.

END OF SECTION

SECTION 05 30 00

STEEL DECKING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Steel deck and accessories; framing for openings up to and including 18 inches; bearing plates and angles.

1.2 SUBMITTALS

- A. Shop Drawings: Indicate decking plan, support locations, projections, openings and reinforcement, pertinent details, and accessories.
- B. Product Data: Provide deck profile characteristics and dimensions, structural properties, and finishes.

PART 2 - PRODUCTS

2.1 METAL DECK

05 30 00.01 Metal Decking

- A. Manufacturers:
 - 1. Vulcraft C Conform
 - 2. Or equals.
- B. Sheet Steel: ASTM A446, Grade B Structural Quality.
- C. Bearing Plates, Angles: ASTM A36 steel, unfinished.
- D. Welding Materials: AWS D1.1.
- E. Primer: Factory or field prime as required in Section 09 90 00. Provide touch up w/ Red oxide or compatible type. Verify compliance with VOC requirements.
- F. Flute Closures: Closed cell profiled to fit tight to the decking.

2.2 FABRICATION

- A. Non-cellular Decking: Sheet steel, configured per structural notes.
 - 1. Formed Sheet Width: 36 inches.
 - 2. Side Joints: Lapped.
 - 3. Flute Sides: Plain vertical face.

- B. Fabricate pre-coated steel with coating side down.
- C. Metal Closure Strips, Wet Concrete Stops, Cant Strips, Cover Plates, and Related Accessories: 22-gauge sheet steel.
- D. Roof Sump Pan: 14-gauge sheet steel.
- E. Weld Washers: Mild steel, uncoated.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Erect metal decking in accordance with Steel Deck Institute Design Manual for Form Decks, Roof Decks.
- B. Bear decking on steel supports with 1-1/2 inch minimum bearing. Align and level.
- C. Fasten deck to steel support members at ends and intermediate supports with fusion welds through weld washers 12 inches oc maximum, parallel with the deck flute and at each transverse flute. See structural drawings for specific attachment requirements.
- D. Weld in accordance with AWS D1.1.
- E. Refer to structural drawings for specific sidelap connection requirements. In no case shall sidelaps be fastened with less than 1-#10 TEK per span.
- F. Reinforce steel deck openings from 6 to 18 inches in size with 2 x 2 x 1/4 inch steel angles. Place angles perpendicular to flutes; extend minimum two flutes beyond each side of opening and fusion weld and/or mechanically attach to deck at each flute.
- G. Install 6 inch (150 mm) minimum wide sheet steel cover plates, of same thickness as decking, where deck changes direction, 12 inches oc maximum.
- H. Install wet concrete stops at deck edge upturned to top surface of slab.
- I. Install sheet steel closures and angle flashings to close openings between deck and walls, columns, and openings.
- J. Install single row of foam flute closures above walls and partitions perpendicular to deck flutes.
- K. Position roof sump pans with flange bearing on top surface of deck. Attach at each deck flute.
- L. Place metal cant strips in position and attach.
- M. Immediately after welding deck and other metal components in position, coat welds, weld blooms, burned areas, and damaged surface coating, with touch-up prime paint.

N. Paint all exposed decking as per Section 09900.

END OF SECTION

SECTION 05 50 00

METAL FABRICATIONS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Shop fabricated ferrous metal items, galvanized and prime painted.
- B. Steel stair frame of structural sections, with stair treads and landings.
- C. Balusters and hand-railing.
- D. Miscellaneous steel connector, bolts, attachment and trim.

1.2 SYSTEM DESCRIPTION

- A. Design to stair assembly to support live load of 100 lb/sq ft with deflection of stringer or landing framing not to exceed 1/240 of span.
- B. Design railing, wall rails, and attachments to resist lateral force of 250 lbs at any point without damage or permanent set.

1.3 SUBMITTALS

- A. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.
- B. Indicate welded connections using standard AWS A2.0 welding symbols. Indicate net weld lengths.
- C. Prepare Shop Drawings under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in the State of Colorado.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Reserved
- B. Not Used
- C. 05 50 00.23 Prefab Metal Stair
 - 1. Manufacturer: American Stair Corporation, 1-800-872-7824
 - a. Treads and Stringers: Poured in Place Tread w/ 14 GA steel riser.

- D. Guardrail and Handrail System at Mezzanine
 - 05 50 00.42 1 1/2" Dia. Steel Pipe
 - 05 50 00.43 1 1/2" SQR Steel Pipe

Intermediate Pickets – 1/2" Vertical Square Steel Picket to match American Stair guardrail.

- 05 50 00.17 Pipe Railing: ASTM A53, Grade B, schedule 40 1 1/2 diameter
- 05 50 00.18 Pipe Handrail: ASTM A53, Grade B, schedule 40 1 1/2 diameter
- 05 50 00.19 Pipe Guardrail: ASTM A53, Grade B, schedule 40 1 1/2 diameter.

- E. Not Used

- F. 05 50 00.03 Bolts
 - 05 50 00.04 Anchor Bolt
 - 05 50 00.66 Counter Sunk Bolt
- Bolts, Nuts, and Washers: ASTM A325 galvanized to ASTM A153 for galvanized members.

- G. Welding Materials: AWS D1.1.

- H. Shop and Touch-Up Primer: SSPC 15, Type 1, red oxide.

- I. 05 50 00.42 1 1/2" Dia. Steel Pipe: 1-1/2" OD steel pipe, Grade B, Schedule 40.

- J. 05 50 00.46 1 1/2" Pipe Rail Anchor Sleeve: steel pipe anchor sleeve outside sized to inside diameter of 1 1/2" steel pipe above, Grade B, Schedule 40.

- K. 05 50 00.45 8' Dia Steel Pipe Bollard filled with concrete 8" Steel pipe, 42" height, Pipe: ASTM A53, Grade B. Fill with Concrete. Shop and Touch-Up Primer: SSPC 15, Type 1, red oxide. Finish paint as per Section 09 90 00 Paint.

- L. 05 50 00.62 Wall Mounted handrail and brackets: Handrails as per 05 50 00.18 w/ McNichols, Cast Malleable handrail brackets. Finish paint as per Section 09 90 00.

2.2 FABRICATION - GENERAL

- A. Fit and shop assemble in largest practical sections, for delivery to site.
- B. Continuously seal joined members by continuous welds.
- C. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.
- D. Exposed Mechanical Fastenings: Flush countersunk screws or bolts, consistent with design of component.
- E. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication.
- F. Accurately form components required for anchorage of stairs, landings and railings to each other and to

building structure.

- G. Coordinate with structural drawings for stair opening and connections for stair support.

2.3 FABRICATION - STAIRS AND LANDINGS

- A. Fabricate stairs and landings with closed risers and treads of metal.
- B. Form treads, landings, and risers with sheet steel stock.
- C. Secure reinforced tread pans to stringers with clip angles; weld in place.
- D. Form stringers with rolled steel channels. Weld fascia plates to channels using steel sheet across channel toes.
- E. Prime paint components.
- F. Provide steel support columns for landing support.

2.4 FABRICATION - HAND-RAILING

- A. Fit and shop assemble components in largest practical sizes, for delivery to site.
- B. Grind exposed joints flush and smooth with adjacent finish surface.
- C. Accurately form components to suit stairs and landings, to each other and to building structure.

2.5 FINISHES

- A. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.
- B. Shop prime items with one coat. Do not prime surfaces in direct contact with concrete or where field welding is required.
- C. Finish coat: see Section 09900 Paint.

PART 3 EXECUTION

3.1 EXAMINATION AND PREPARATION

- A. Verify that field conditions are acceptable and are ready to receive Work.
- B. Make provisions for erection loads with temporary bracing. Keep Work in alignment.

3.2 INSTALLATION

- A. Install items plumb and level, accurately fitted, free from distortion or defects.
- B. Allow for erection loads and provide temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.
- C. Field weld components as indicated. Perform field welding in accordance with AWS D1.1.

preservative with 0.30 percent retainage.

PART 3 - EXECUTION

3.1 WOOD BLOCKING AND NAILERS

- A. Erect wood members in accordance with IBC code.
- B. Place members level and plumb. Place horizontal members crown side up.
- C. Provide and coordinate blocking as shown on plans and as required for installation and support of flashings, specialties and equipment.

3.2 SHEATHING

- A. Secure floor sheathing perpendicular to floor framing with end joints staggered. Secure sheet edges over firm bearing. Attach sheathing with glue and screws.
- B. Secure wall sheathing perpendicular to wall studs, with ends staggered, over firm bearing.

3.3 SITE APPLIED WOOD TREATMENT

- A. Site apply preservative treatment in accordance with manufacturer's instructions.
- B. Treat site-sawn ends. Brush apply two coats of preservative treatment on untreated wood in contact with cementitious materials, roofing and related metal flashings.
- C. Allow preservative to cure prior to erecting members.

END OF SECTION

SECTION 06 20 00

FINISH CARPENTRY

PART 1 GENERAL

1.1 SECTION INCLUDES

Finish carpentry items, other than shop manufactured casework; hardware and attachment accessories.

1.2 QUALITY ASSURANCE

Perform work in accordance with AWI Quality Standards.

1.3 REGULATORY REQUIREMENTS

Conform to applicable code for fire retardant requirements.

PART 2 - PRODUCTS

2.1 LUMBER MATERIALS

A. Softwood Lumber: PS 20; Custom Grade in accordance with AWI; maximum moisture content of 6 percent, #2 Pine species, with flat grain of quality capable of transparent finish.

B. Hardwood Lumber: FS MM-L-736; Custom Grade in accordance with AWI; maximum moisture content of 6 percent, White Oak species, with plain sawn grain of quality capable of transparent finish.]

2.2 FINISH MATERIALS

A. Casework or Counter tops with High pressure Laminate Finish: AWI Custom Grade.

1. Detail in accordance with drawings.

2. Laminate Plastic: 1/16" thick high pressure laminated plastic, per NEMA Class I and Fed. Spec. L-P-508f, Style D, Type 1, Class a. Suede texture, solid color. Final colors to be selected by Architect.

3. Solid colors as manufactured by Formica Corporation and/or Wilsonart.

4. The core material shall be particle board, 3/4" minimum thickness, such as supercore flakeboard, as manufactured by the Formica Corporation, or an approved close-grained hard wood plywood, not less than 5 ply, 3/4" cross-laminated and graded not less than B-D. Accepted equal such as Weyerhaeuser, Timblend, or U.S. Plywood Novaply, or approved close grained hardwood plywood.

B. 06 20 00.45 Plastic Laminate : Wilsonart solid colors to be selected by Architect.

C. 06 20 00.41 Steel Angle Counter Support

A. 1/8" Steel Work Station Counter Support Brackets, size compatible with countertop profile – Support Brackets .com. 1-888-647-0200

2.3 ACCESSORIES

A. Nails: Size and type to suit application.

B. Bolts, Nuts, Washers, Blind Fasteners, Lags, and Screws: Size and type to suit application.

C. Contact Adhesives: Water base type.

D. Wall Adhesive: Cartridge type, compatible with wall substrate, capable of achieving durable bond.

E. Primer: Alkyd primer sealer type.

2.4 HARDWARE

A. Shelf Standards and Rests: Type to suit application.

2.5 SHOP TREATMENT OF WOOD MATERIALS

A. Shop pressure treat wood materials requiring UL fire rating.

B. Deliver fire retardant treated materials cut to required sizes. Minimize field cutting.

2.6 FABRICATION

A. Fabricate to AWI standards.

PART 3 - EXECUTION

3.1 EXAMINATION AND PREPARATION

A. Prime paint surfaces of items or assemblies in contact with cementitious materials, before installation.

3.2 INSTALLATION

- A. Install work in accordance with AWI Custom quality standard.
- B. Set and secure materials and components in place, plumb and level.
- C. Install trim with nails.
- D. Install hardware in accordance with manufacturer's instructions.

3.3 SITE TREATMENT OF WOOD MATERIALS

- A. Apply preservative treatment in accordance with manufacturer's instructions.
- B. Treat site-sawn ends. Allow preservative to cure prior to erecting materials.
- C. Preservative treat items noted on Drawings as 'PT'. Fire retardant treat items noted on Drawings as 'FR-S'].
- D. Prime paint surfaces in contact with cementitious materials.

3.4 PREPARATION FOR FINISH

- A. Sand work smooth and set exposed fasteners. Apply wood filler in exposed fastener indentations.

END OF SECTION

SECTION 07 20 00

THERMAL PROTECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Board thermal insulation at perimeter foundation wall.
- B. Rigid thermal insulation at roofs
- C. Batt Insulation at Exterior walls
- D. Foam in Place Insulation at CMU walls.
- E. Acoustic Insulation

1.2 SYSTEM DESCRIPTION

- A. System performance to provide continuity of thermal and vapor barrier at building enclosure elements in conjunction with vapor and air barrier materials in Section 07190.

1.3 ENVIRONMENTAL REQUIREMENTS

- A. Install insulation adhesives in accordance with manufacturer's instructions.

1.4 SUBMITTALS

- A. Submit tapered roof insulation product data to JPS Roofing Representative for approval and compatibility with protective membrane roofing system.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

- A. 07 20 00.05 Rigid Insulation
 - 1. At Concrete Wall and CMU Interior Concealed Rigid Insulation – Styrofoam Tough R, Polyisocyanurate 2” thickness. R-13.
 - 2. At infill of existing HVAC thru-wall units to be removed- Styrofoam Tough R, Polyisocyanurate 6” thickness min..
- B. 07 20 00.01 Thermal Insulation
07 20 00.07 Batt Thermal Insulation

Manufacturers:

1. *Certainteed*: Thermal Batt Insulation paper faced with vapor barrier, 6" thickness
2. *Owen Corning*: Thermal Batt Insulation paper faced with vapor barrier, 6" thickness

C. Not Used

D. 07 20 00.13: Acoustic Batt Insulation, 2" minimum thickness.

Manufacturers:

1. *Certainteed*: Sound Control Batts.
2. *Owen Corning*: Sound Attenuation Batt - Fire Code 60

E. Not Used.

F. 07 20 00.04 Foam Cavity Insulation

Foamed In Place CMU Insulation: Thermco Foam Insulation – R-20
Thermal Corporation of America 888-385-3626

2.2 ADHESIVES

A. Adhesive: Type recommended by insulation manufacturer for application

2.3 ACCESSORIES

A. Vapor and Air Barrier: As specified in Section 07 25 00.

B. Tape: Polyester self-adhering type.

C. Insulation Fasteners: Corrosion-resistant screw-type as recommended by insulation manufacturer. For deck type, to comply with fire and insurance uplift rating requirements, provide system tested for an approved I-90 wind uplift rating and ICBO high-wind rating.

D. Clips:

1. Galvanized steel safing clips.
2. Weld on 12-gauge wire clips.
3. Studs and head pins.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that substrate, adjacent materials, and insulation boards are dry and ready to receive insulation.

3.2 INSTALLATION - BATT INSULATION

- A. Install insulation and vapor barrier in accordance with insulation manufacturer's instructions.
- B. Install in exterior walls spaces without gaps or voids.
- C. Fit insulation tight in spaces. Leave no gaps or voids. Do not install insulation on top of or within 3" of recessed light fixtures.
- D. Install friction fit insulation tight to framing members, completely filling prepared spaces.
- E. In construction spaces too small for Batt insulation or inaccessible for its installation, fill spaces with pressurized container foamed-in-place insulation.
- F. Place vapor barrier on warm side of insulation by securing in place. Extend vapor and air barrier tight to full perimeter of adjacent window and door frames and other items interrupting the plane of membrane. Tape seal in place.
- G. Retain insulation in place with spindle fasteners or clips and washers as recommended by manufacturer.
- H. Not Used.

END OF SECTION

SECTION 07 25 00

WEATHER BARRIERS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Sheet and sealant materials to continue vapor or air barrier from wall to roof construction.

1.2 SYSTEM DESCRIPTION

- A. Products of this Section to achieve continuity of building enclosure air and vapor barrier, in conjunction with materials in Sections 07210.
- B. Sheet and sealing materials to seal gaps between building enclosure components.

PART 2 PRODUCTS

2.1 SHEET MATERIALS

- A. 07 25 00.02 151b. Building Paper:
Kraft Waterproof Building Paper
Asphalt impregnated building paper as approved by IBC for exterior waterproof barrier.
- B. Reserved

PART 3 EXECUTION

3.1 EXAMINATION AND PREPARATION

- A. Verify substrate materials are dry and clean. Remove loose or foreign matter which might impair adhesion.
- B. Coordinate with Work of other affected Sections.
- C. Clean and prime substrate surfaces in accordance with manufacturer's instructions.

3.2 INSTALLATION – Sheet Barriers

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VAPOR AND AIR BARRIERS

Page 2

- A. Secure sheet barrier to wall vapor and air barrier with adhesive or tape.
- B. Lap sheet barrier to roof vapor and air barrier and seal with adhesive.
- C. Install sheet barrier between window and door frames and adjacent wall
- A. Install sheet barrier on warm side of all exterior wall insulation unless shown otherwise on drawings.

END OF SECTION

SECTION 07 60 00

FLASHING AND SHEET METAL

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work Included: General sheet metal work includes but is not necessarily limited to the following:

1. Flashing and counter-flashing
2. All other sheet metal flashing related to the above, shown on the drawings and not specified elsewhere.

1.2 QUALITY ASSURANCE

A. Reference Standards:

1. Galvanized Sheet Metal Installation: Comply with Recommendations of "Architectural Sheet Metal Manual", latest edition, as published by Sheet Metal and Air Conditioning Contractor National Association, Inc.

1.3 WARRANTY

All sheet metal work shall be warranted in writing, against defects in materials and workmanship for a period of two (2) years from date of installation. Address warranty to the Owner and deliver in duplicate upon completion of work.

1.4 RELATED SECTIONS

07 61 00 Sheet Metal Roofing
07 42 00 Metal Siding

PART 2 - PRODUCTS

2.1 GENERAL MATERIALS

07 60 00.01 Flashing
07 60 00.02 Cap Flashing
07 60 00.26 Metal Sill Cap

A. Sheet Metals: 24 gauge galvanized sheet metal hot-dip type, manufactured in accordance with ASTM A 525-65T, 1.25 oz. commercial weight zinc coated, regular spangle, as manufactured by Steelox, U.S. Steel, Republic Steel, Inland Steel or equal.

B. Solder: Composed of 50% pig lead and 50 % block tin conforming to ASTM

Specification B-32-602T.

- C. Flux: Muriatic acid shilled with zinc, or approved brand soldering flux. Acid shall be thoroughly worked off after soldering is completed.
- D. Sealant: Tremco "Mono" one part acrylic or comparable product by DAP or Pecora.
- E. Fasteners: Size and type required, in accordance with SMACNA manual.
 - 1. Fed Spec. FF-N-105, type best suited for intended use.
 - 2. Nails: Galvanized, flathead, barbed, wire slating nails not less than 12 gauge by 1" long.
 - 3. Screws and bolts: Galvanized round head
 - 4. Expansion shields: Lead sleeves
 - 5. Aluminum Construction: Aluminum fasteners

2.2 RESERVED

2.3 RESERVED

2.4 RESERVED

2.5 ACCESSORIES

- A. Provide all fasteners, anchor plates, splice plates and cant dams as required for installation of flashing systems and recommended by manufacturer.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Examine surfaces to receive flashing or sheet metal and do not begin work until all unsatisfactory conditions are corrected. All surfaces shall be smooth, sound, clean and dry and all fabric flashing shall be in place before work is started.

3.2 WORKMANSHIP

- A. Work shall be executed by skilled mechanics, workmanship equal to the best standards of practice in modern sheet metal. Accurately form work to sizes, shapes, and dimensions indicated and detailed, with all lines and angles in true alignment, straight, sharp, and erected plumb and level, in proper plane, without bulges or waves.

3.3 FIELD MEASUREMENTS

Before fabricating sheet metal, verify shapes and dimensions of surfaces to be covered.

3.4 PREPARATION OF SURFACES

Protective Coating: Coat contacting dissimilar metals with asphaltic compound.

3.5 INSTALLATION

- A. Conceal expansion provision wherever possible. Conceal fasteners from view at ground level.
- B. Counterflashing for items provided under Divisions 15 and 16 will be provided by Contractor furnishing the item to be flashed.
- C. Nailing and Cleating: Confine nailing of flashing to one edge only with nails spaced approximately 4" apart and not less than 1/2" from edge. Provide cleats as required for attachment of appurtenant items. Make cleats not less than 2" wide by 3" long of same material and one gauge heavier than metal being installed. Secure one end of cleat with two nails and fold cleat back over nail heads.
- D. Expansion and Contraction: Provide sheet metal work with expansion joints not to exceed 32' center to center, or 8' from corners. Connect runs with 6" loose-locked slip joints sealed with elastic cement. All other seams to be 1" minimum flat-locked seams sealed with elastic cement. Lap seams 3" in direction of flow. Corner joints shall be soldered after mechanical fastening.
- E. Soldering: Thoroughly clean and pre-tin joints prior to soldering. Solder slowly with heavy, well-heated coppers of blunt design to thoroughly heat seam and completely sweat solder through full width of seam. Treat edges of sheet metal with flux immediately before soldering. Thoroughly wash acid flux residue with a soda solution and rinse with clean water after soldering.
- F. Flashings: Unless otherwise indicated on the drawings, flashings shall be 24 gauge galvanized steel furnished and installed as required.
 - 1. Flashing and counterflashing shall be provided throughout.
 - 2. Use rolled edges forming a drip where roofs join vertical surfaces.
 - 3. All flashings shall be counter-flashed. Where the design of construction is such that the base and counterflashing method is impracticable, flashings shall be made continuous from the roof surface up and into the vertical surface. Flashings of this type shall be in two or more pieces soldered together. Where possible, the joints shall be made by flat or double lock seams.
 - 4. All flashings whether so indicated or not, shall be turned up a minimum of 4" behind facing materials.
 - 5. Counterflashing shall be shop formed with 1/2" hemmed exposed edge to

provide spring action against the base flashing.

6. End joints shall be lapped 3" and caulked to provide watertight assembly - do not solder.
 7. Corner joints shall be soldered after mechanical fastening.
- G. Miscellaneous Sheet Metal Work: Sheet metal items not covered specifically elsewhere in this Section of the Specifications shall be as indicated on the drawings and as required to provide a water tight installation.
- H. Formed sheet metal for metal-covered work shall accurately produce the detail and design shown, and profiles, bends and intersections shall be sharp, even and true.
- I. Joints shall be locked or lapped, and soldered, as applicable; reinforcement shall be provided as required.

3.6 PARAPET CAPS AND COPINGS

- A. Install all caps and copings as per manufacturer's recommendation.

3.7 PRECAUTIONS AGAINST DAMAGE

- A. Care shall be taken at all times to prevent damage to sheet metal work completed and in place by not walking or placing heavy materials on it.

3.8 ADJUST AND CLEAN

- A. As soon as soldering is completed, the work shall be clean of all injurious substances.
- B. At completion all damaged work shall be repaired, all debris removed and work left in perfect condition.

END OF SECTION

SECTION 07 80 00

FIRE AND SMOKE PROTECTION

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Firestopping materials and accessories.

1.2 SYSTEM DESCRIPTION

- A. Fireproofing Materials: ASTM E119 to achieve a fire rating equivalent to the assembly in which it is placed.

1.3 SUBMITTALS

- A. Product Data: Provide data on product characteristics, performance and limitation criteria.
- B. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

1.4 ENVIRONMENTAL REQUIREMENTS

- A. Do not apply materials when temperature of substrate material and ambient air is below 60 degrees F.

PART 2 PRODUCTS

2.1 07 80 00.02 FIRESTOPPING

- A. Manufacturers:
 - 1. Hev 1-Duty / Nelson Model Nelson FSP.
 - 2. United States Gypsum Co. Model Fire Code Compound
 - 3. Approved Equal
- B. Primer: Type recommended by firestopping manufacturer for specific substrate surfaces.

2.2 07 80 00.01 Fire Safing Insulation

Manufacturer:

- 1. *U. S. Gypsum*: Thermofiber safing insulation.

2.3 ACCESSORIES

- A. Dam Material: As required by manufacturer

PART 3 EXECUTION

3.1 EXAMINATION AND PREPARATION

- A. Verify openings are ready to receive the work of this section.
- B. Clean substrate surfaces of matter which may effect bond of firestopping material.
- C. Install backing materials to arrest liquid material leakage.

3.2 APPLICATION

- A. Apply primer and materials in accordance with manufacturer's instructions.
- B. Apply firestopping material in sufficient thickness to achieve rating
- C. Install material at walls or partition openings which contain penetrating sleeves, piping, duct work, conduit and other items, requiring firestopping.
- D. Remove dam material after firestopping material has cured.
- E/. Fire-Safing Insulation: Install fire-safing insulation to completely fill spaces between floor slab edges and spandrel construction on safing clips spaced no more than 24" on centers. Install and support safing insulation permanently in position to comply with tested fire assembly and applicable Building Code requirements. Seal joints between insulation and adjacent construction with sealant. Install safing insulation at all penetrations of fire-rated floors and walls, including those at pipes, ducts, conduits and wiring. Conform to tested fire assembly and applicable Building Code requirements.

END OF SECTION

SECTION 07 90 00
JOINT PROTECTION

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Work Included: Provide all caulking and sealant shown on the drawings, specified herein, and not specified under other Sections. In general, seal all openings shown on the drawings and at other locations requiring caulking to seal visually and against infiltration from air and water, including but not limited to the following:
1. Expansion joints
 2. Flashing reglets and retainers
 3. Exterior wall joints
 4. Masonry control joints
 5. Isolation joints, between structure and other elements
 6. Joints at penetrations of walls, decks and floors by piping and other service and equipment.
 7. Joints between items of equipment and other construction.
 8. Joints between door and window frames and adjacent materials, exterior and interior.
 9. Bedding for all door thresholds.
 10. Open joints between dissimilar materials as required to close and conceal jointing of the work.
 11. Construction and expansion joints, joints between dissimilar materials; joints around windows, door frames, louvers, and other penetrations and openings in the exterior wall; interior walls as detailed or specified.
 12. Joints between sheet metal coping and masonry.
 13. Other joints as detailed or required by standard construction practices.

1.2 QUALITY ASSURANCE

- A. Applicator Qualifications: All work shall be by a qualified Contractor recognized as such, and in business for at least five years prior to this installation, employing skilled tradesmen for the work.
- B. Manufacturer's Technical Representative: Obtain materials from only manufacturers who will, if required, send a qualified technical representative to Project site, for the purpose of advising the installer of proper procedures and precautions for the use of the materials.
- C. Adhesives must meet or exceed the VOC limits of South Coast Air Quality Management District Rule #1168 by, AND all sealants used as a filler must meet or exceed Bay Area Air Resources Board Reg. 8, Rule 51.

1.3 SUBMITTALS

- A. Color Samples: Submit color chart for each type of caulking.
- B. Product Data: Submit product data for each material intended for use and location of application.

1.4 DELIVERY, STORAGE AND HANDLING

Deliver in original, unopened containers and store in an area not subject to extreme heat or cold.

1.5 JOB CONDITIONS

- A. Environmental Conditions: Do not apply exterior sealants during wet weather or when the outside temperature is below 40 degrees F. Do not apply interior sealants when the inside temperature is below 60 degrees F.

1.6 WARRANTY

Sealant contractor shall furnish a 3-year warranty in writing to replace any or all joints which fail during the warranty period at no cost to the Owner. Submit 2 copies of written guarantee agreeing to repair or replace sealants which fail to perform as air-tight and water-tight joints; or fail in join adhesion, cohesion, abrasion resistance, weather resistance, extrusion resistance, migration resistance, stain resistance, or general durability; or appear to deteriorate in any other manner not clearly specified as an inherent quality of the material by submitted manufacturer's data. Warranty shall date from Acceptance of the Project by the Owner.

PART 2 - PRODUCTS

2.1 JOINT BACKING MATERIAL

- A. General: Size joint backing material for minimum 30% compression when inserted in the joint. Material shall be round rod or semi-circular type.
- B. Acceptable Manufacturers:
 - 1. Dow Chemical Company, Ethafoam
 - 2. Sonneborn, Sonofoam
 - 3. Schlegel Manufacturing Company, Schlegelfoam
 - 4. Denver Foam

2.2 SEALANT MATERIAL

07 90 00.03 Sealant
07 90 00.08 Silicone Joint

- A. Acceptable Manufacturers:
 - 1. Silicone Sealants
 - a. GE Silicones, Silglare II

- b. GE Silicones, Sanitary 1700 at plumbing fixtures
- c. Sonneborn, Scholastic Omniplus
- 2. Exterior Sealants
 - a. Pecora Corp., Dynatrol II
 - b. Sika Corporation., Sikaflex 2C
 - c. Dow Corning., 790
- 3. Acrylic Sealant
 - a. Pecora Corp., AC-20 + Silicone
 - b. Sonneborn, Sonolac

B. Locations:

- 1. Interior Sealants and Caulk and Under Thresholds: Acrylic
- 2. Exterior Sealants: As specified above.
- 3. Primer: As recommended by the Caulking Manufacturer.
- 4. Waterproof Sealants: For joints in walls, slabs, etc. in shower rooms and toilet rooms, and other wet areas: Silicone sealant.

2.3 BOND BREAKER TAPE

Polyethylene tape or other plastic tape as recommended by the 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.

PART 3 - EXECUTION

3.1 INSPECTION

Caulking Contractor shall be responsible for inspecting work of others prior to application of any work under this section. If any joint or space to receive this work is not according to detail and cannot be put into proper condition to receive the work by specified methods. Contractor shall notify the Architect in writing, or assume responsibility for and rectify any unsatisfactory caulking and sealing resulting.

3.2 PREPARATION

A. Preparation of Surfaces:

- 1. Clean all surfaces in accordance with manufacturer's recommendations.
- 2. Mask edges, if required, to protect adjoining surfaces and produce a straight finish line.
- 3. Clean joint surfaces immediately before installation of sealant or caulking compound. Remove dirt, insecure coatings, moisture and other substances which would interfere with bond of sealant or caulking compound.
- 4. Do not proceed with installation of sealant over joint surfaces which have been painted, lacquered, waterproofed or treated with water repellent or other treatment of coating unless a laboratory test for durability (bond-cohesion), in compliance with Paragraph 4.3.9 of FS TT-S-00227 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 joint surfaces before installing sealant.

5. Etch concrete masonry joint surfaces to remove excess alkalinity, unless sealant manufacturer's printed instruction indicates 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.
- B. Priming:
1. RESERVED
 2. If required, prime all surfaces which are to be caulked with manufacturer's recommended or standard primer, after the surfaces have been prepared as specified. Before use, check all primers for discoloration and dirt pick-up on adjacent surfaces. If staining occurs, after exposure, take adequate measures to prevent the primer from being applied over the face of adjacent porous materials by masking or other suitable measures.
- C. Joint Backing: 07 90 00.09 Backer Rod
1. All joints which are to be caulked shall be of depth necessary to provide for the specified allowable thickness of sealant and also the required backing where and as specified. Backing shall be to extent and type as specified and needed to provide for the allowable depth of the sealant.
 2. Back-up materials for sealants shall be non-staining, compatible with the sealant and primer, shall be of a resilient nature and as recommended by the manufacturer of the sealant. Size and shape of the backing shall be as required by the width of the joint and/or specified. Do not use materials impregnated with oil, solvents or bituminous materials.
 3. Compress backing material a minimum of 30% when inserted in the joint. Backing material for the upper portion of joints shall be a round rod or semi-circular in cross-section with the arc in contact with the sealant.
 4. Install bond breaker tape where shown and wherever required by manufacturer's recommendations to ensure that elastomeric sealants will perform properly.

3.3 APPLICATION

- A. Thresholds:
1. Set in full bed of silicone sealant.
- B. Joints:
1. Apply sealants in continuous beads, without open joints, voids or air pockets, using a ratchet hand gun or mechanical powered gun.
 2. Confine sealants to joint areas with masking tapes or other precautions. Apply compounds in concealed compression joints accurately so that excess compound will not extrude from joints.
 3. Remove excess compound or sealant promptly as work progresses, and clean adjoining surfaces.
 4. In rough surfaces or joints of uneven widths, install sealant well back into joint.

(Recess equal to width of joint, or 3/8" minimum at masonry).

5. Anti-tack agent shall be used where necessary to protect freshly-applied sealant from public traffic and dirt.
6. Joints shall be slightly recessed as to facilitate a painter's line. All joints throughout construction shall be hand-tooled and finished.
7. All work shall be done according to manufacturer's printed instructions and specifications.

C. Workmanship:

1. Employ only proven installation techniques, which will ensure that sealants will be deposited in uniform, continuous ribbons without gaps or air pockets with complete "wetting" of the joint bond surfaces 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 cover, so that joint will not trap moisture and dirt.

D. Joint Sizes: Install sealants to depths as shown, or, if not shown, as recommended by the sealant manufacturer but within the following general limitations:

1. For normal moving joints sealed with elastomeric sealants but not subject to traffic, fill joints to depth equal to 50% of joint width but not more than 1/2" deep or less than 1/4" deep.
2. For joints sealed with non-elastomeric sealants and caulking compounds, fill joints to a depth in the range of 75 % to 125% of joint width.

E. Spillage:

1. Do not allow sealants 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/ caulking compound.
2. Remove excess and spillage of compounds promptly as the work progresses. Clean the adjoining surfaces by whatever means may be necessary to eliminate the evidence of spillage. Do not damage the adjoining surfaces or finishes.

F. Compression Seal

1. Joint Design

a. General

- 1) The materials specified are intended to establish approved manufacturers and a type of cover desired. Specific model numbers as they relate to joint widths and movements encountered shall be verified by the Contractor/Supplier based on actual joint widths and temperature conditions encountered at the time of installation. Adjustments which respond to the actual conditions shall be made and reviewed with the Architect prior to installation.

b. Joint Design

- 1) The Contractor shall visit the site and determine actual conditions.
- 2) The Contractor shall propose actual material sizes, based on the actual conditions and projected movements.
- 3) Submit data and criteria to Architect for review, including materials,

anticipated joint widths at time of installation, and other pertinent criteria.

- 4) Joint filler material should not be installed prior to building enclosure and climatization.
2. Install in strict accordance with manufacturer's written instructions.
3. Face of seal shall be recessed so that finish surface (sealant or seal) is recessed 1/2" from face of masonry. The seal shall be bonded in place with Acme Primalube Adhesive. The manufacturer shall furnish certified test reports of all material shipped. Where field splices are required they shall be done in a manner approved by the manufacturer. The joint interfaces shall be thoroughly blown clean with compressed air, and if necessary for proper installation the sides of the joint seal shall be cleaned using toluene solvent.

END OF SECTION

SECTION 08 14 00

METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Rolled steel doors and frames.

1.2 SUBMITTALS

- A. Shop Drawings: Indicate door elevations, and cutout dimensions for glazing.
- B. Product Data: Provide frame configuration, anchor types, location of hardware cutouts, reinforcement, and finish.

1.3 QUALITY ASSURANCE

- A. Conform to the following requirements:
 - 1. SDI-100 - Standard Steel Doors and Frames.
 - 2. SDI-105 - Recommended Erection Instructions for Steel Frames.
 - 3. DHI - Door Hardware Institute - The Installation of Commercial Steel Doors and Steel Frames, Insulated Steel Doors in Wood Frames and Builder's Hardware.
 - 4. Fire Rated Door and Frame Construction: ASTM E152.

PART 2 - PRODUCTS

2.1 DOORS AND FRAMES

- A. 08 14 00.09 Insulated Steel Door
 - 1. Manufacturers
 - a. Steelcraft BW-16
 - b. approved equal
 - 08 14 00.10 Interior Steel Door
 - 1. Manufacturers
 - a. Steelcraft BF18
 - b. Approved equal
 - 08 14 00.11 Interior Steel Door w/Glass cut outs
 - 1. Manufacturers
 - a. Steelcraft B A16 Stile and Rail
 - b. Approved equal
- B. 08 14 00.07 Hollow Metal Door Frame

1. American Steel Products Corp., Double Rabbit F-1
2. Amweld Building Products, Series 400 Labeled
3. Steelcraft, F-Frame F-14-4
4. Approved Equal

C. Core: Expanded Polystyrene - no CFC Blowing Agents. Vertical steel stiffeners.

D. Interior Frames: 16 gage thick material, core thickness.
Exterior Frames: 14 gage thick material, core thickness.

2.2 ACCESSORIES

- A. Bumpers: Resilient rubber.
- B. Glazing Stops: Rolled steel channel shape.

2.3 FABRICATION

- A. Fabricate frames as welded unit type, with hardware reinforcement plates welded in place.
- B. Reinforce frames wider than 48 inches (1200 mm).
- C. Close top edge of exterior door with inverted steel channel closure. Seal joints watertight.

2.4 FINISH

- A. Primer: Baked on for Doors and Frames.
- B. Finish: Refer to Section 09900.

2.5 SECURITY

- A. Refer to Section 28 00 01 and coordinate with Terrence Kane, Frontier Communications frontiercommunications@msn.com for electronic card readers and rough in conduit.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install frames in accordance with SDI-105. Install doors in accordance with DHI.
- B. Coordinate with wall construction for anchor placement.

- C. Coordinate installation of glass and glazing.
- D. Fully grout all frames as shown on drawings.

3.2 TOLERANCES

- A. Maximum Diagonal Distortion: 1/8 inch measured with straight edge, corner to corner.

END OF SECTION

SECTION 08 30 60

OVERHEAD DOORS

PART 1 GENERAL

1. 1.01 Section Includes

A. Sectional overhead doors motor operated with accessories and components.

2. 1.02 Related Work

Opening preparation, miscellaneous or structural steel work, access panels finish or field painting are in the scope of work of other trades and divisions of these specifications.

3. 1.03 Reference Standards

ANSI/DASMA 102 – American National Standards Institute [A216.1] Specifications for sectional overhead doors published by Door & Access Systems Manufacturers Association, International in bulletin 102-1990.

A. ASTM A123 – Zinc [hot-dipped galvanized] coatings on iron and steel products.

B. ASTM A216 Specifications for sectional overhead type doors.

C. ASTM A229 Steel wire, oil-tempered for mechanical springs.

D. ASTM A-653-94 Steel sheet, zinc-coated [galvanized] by the hot-dipped process, commercial quality.

E. ASTM D1929 Ignition temperature test to determine flash and ignition temperature of foamed plastics.

F. ASTM E84-91A Tunnel test for flame spread and smoke developed index.

G. ASTM E330 Structural performance of exterior windows, curtain walls, and doors by uniform static air pressure difference.

H. ASTM E413-87 Sound transmission class. Acoustical performance value = 23

I. ASTM E1332-90 Outdoor-indoor transmission class. Acoustical performance value = 22.

J. ASTM E283 Air infiltration = .07 CFM/FT² at 15 MPH.

4. 1.04 Quality Assurance

Sectional overhead doors and all accessories and components required for complete and secure installations shall be manufactured as a system from one manufacturer.

A. Sectional overhead doors shall be tested and labeled certifying compliance with ASTM D1929 and ASTM E84-91A standards.

5. 1.05 Systems Description

Sectional Overhead Door: Type: Thermospan 200-20

- A. Mounting: Continuous angle mounting for masonry jambs
- B. Operation: motor
- C. Material: Galvanized steel with polyester finish paint
- D. Insulation: Polyurethane
- E. Windows: Provide window kits and glazing as shown on drawings.

6. 1.06 Submittals

Shop Drawings: Clearly indicate the following:

- 1. Design and installation details to withstand standard windload.
- 2. All details required for complete operation and installation.
- 3. Hardware locations.
- 4. Type of steel and finish for door sections.
- 5. Finish for miscellaneous components and accessories.
- A. Product Data: Indicating manufacturer's product data, and installation instructions.

7. 1.07 Delivery, Handling, Storage

Deliver products in manufacturer's original containers, dry, undamaged, seals and labels intact.

- A. Store and protect products in accordance with manufacturers recommendations.

8. 1.08 Warranty

Provide manufacturer's standard seven year warranty against separation/degradation of the polyurethane foam from the steel skin of the panel under provisions of Section 01700. Standard manufacturer's ten year warranty against cracking, splitting or deterioration of steel skin due to rust-through.

PART 2 PRODUCTS

2.01 INSULATED SECTIONAL OVERHEAD DOORS

A. Manufacturers:

Overhead Door: Thermospan 200-20 Wayne Dalton of Colorado.

2.02 Materials

A. Door Sections: Shall be of steel/polyurethane/steel sandwich type construction with thermal break and calculated materials R-value of 17.50, in accordance with industry guidelines.

1. Exterior Skin: Structural quality, hot-dipped galvanized steel, 20 gauge white flush smooth.
2. Interior Skin: Structural quality, hot-dipped galvanized steel, factory finished with a polyester primer and white finish coat. Interior skin shall have two 1 3/4" roll-formed integral struts sealed with polypropylene rib caps per section.
3. Ends of section shall be sealed with 18 or 16 [14 GA.] gauge hot-dipped galvanized steel full height end caps.
4. Insulation: Cavity shall be filled with foamed-in-place CFC free polyurethane core separated by a factory extruded thermal break.
5. Insulated sections shall be tested by an I.C.B.O. certified laboratory in accordance with ASTM E-84-91A and shall achieve a Flamespread Index of 10 or less, and a Smoke Developed Index of 210 or less.
6. Insulation material shall be tested by an I.C.B.O. certified laboratory in accordance with ASTM D-1929 and shall achieve a minimum Flash Ignition temperature of 734 degrees F, and a minimum Self Ignition temperature of 950 degrees F.
7. Insulated sections shall be tested and meet all requirements.

B. Track: Track design shall be standard lift. Vertical mounting angles shall be hot-dipped galvanized. Track size shall be 2". Vertical track shall be graduated to provide wedge type weathertight closing with continuous angle mounting for steel jambs, and shall be fully adjustable to seal door at jambs. Horizontal track shall be reinforced with continuous angle of adequate length and gauge to minimize deflection.

C. Hardware: Hinge and Roller Assembly:

1. Hinges and brackets shall be made from hot-dipped galvanized steel.
2. Track rollers shall be case-hardened inner steel races with 10-ball [2"] [3"] rollers.
3. All factory authorized attachments shall be made at locations indicated and reinforced with backup plates.

D. Counterbalance:

- i. Springs shall be torsion type, low-stress, helical wound, oil-tempered spring wire to provide minimum 25,000 standard cycles of use on continuous steel solid shaft.
- ii. Spring fittings and drums made of die cast, high strength aluminum.
- iii. Pre-formed galvanized steel aircraft cable shall provide a minimum of a 5:1 safety factor.

E. 2.03 Operation

Operation shall be motor:

- Standard Lift with roof pitch less than 2:12 (exception: some 32" Radius applications; consult factory)

2. 2.04 Locks

3. Locks shall engage the right-hand vertical track and utilize an interior side lock.

4. 2.05 Weatherstripping

Doors shall be equipped with top and side seals to seal against header and jambs, co-polymer joint seals between sections, and vinyl "bulb" shaped astragal provided on the bottom section.

5. 2.06 Glazing

See drawings and refer to Section 08 80 00 Glazing.

6. 2.07 Windload

Windload - per DASMA 102-2003 and as required by local codes.

7. 2.08 Operator Controls: Interior, Standard three button (open-close-stop) continuous hold type, separate control for each electric operator; surface mounted for all overhead doors. Exterior: Security key control for each electric operator, surface mounted on exterior column for all overhead doors.

8. 2.09 Safety Edge: At bottom of door panel, full width; electro-mechanical sensitized type, wired to reverse door upon striking object; hollow rubber covered to provide weatherstrip seal.

9. 2.10 Electric Motor Operation: Lift Master Series 2000, Model HT belt driven trolley operator. Provide UL listed electric operator, size and type as recommended by manufacturer to move door in either direction at not less than 2/3 foot nor more than 1 foot per second.

PART 3 - EXECUTION

3.01 PREPARATION

A. Take field dimension and examine conditions of substrates, supports, and other conditions under which this work is to be performed. Do not proceed with work until unsatisfactory conditions are corrected.

3.02 INSTALLATION

A. Strictly comply with manufacturers installation instructions and recommendations. Coordinate installation with adjacent work to ensure proper clearances and allow for maintenance.

B. Instruct Owners personnel in proper operating procedures and maintenance schedule.

3.03 ADJUSTING AND CLEANING

A. Test sectional doors for proper operation and adjust as necessary to provide proper operation without binding or distortion.

B. Touch-up damaged coatings and finishes and repair minor damage. Clean exposed surfaces using non-abrasive materials and methods recommended by manufacturer of material or product being cleaned.

END OF SECTION

SECTION 08 51 13
ALUMINUM WINDOWS

PART 1 GENERAL

1.01 Work Included

- A. Furnish and install aluminum architectural windows complete with hardware and related components as shown on drawings and specified in this section.
- B. All windows shall be EFCO® Series 2700 Thermal AP-AW65 Projected.
- C. Glass and Glazing
 - 1. Reference Section 08 81 00 for Glass and Glazing.
- D. Single Source Requirement
 - 1. All products listed in Section 1.02 shall be by the same manufacturer.
- E. Motorized Control System

1.02 Related Work

- A. Section 08 41 13 – Aluminum – Framed Entrances and Storefronts
- B. Section 16050 Basic Electrical Materials and Method

1.03 Laboratory Testing and Performance Requirements

- A. Test Units
 - 1. Air, water, and structural test unit shall conform to requirements set forth in ANSI/AAMA/NWDA 101/I.S.2/NAFS-02 and manufacturer's standard locking/operating hardware and insulated glazing configuration.
 - 2. Thermal test unit sizes shall be 48" (1219 mm) x 72" (1828 mm). Unit shall consist of a project-out over fixed over project-in window.
- B. Test Procedures and Performances
 - 1. Windows shall conform to all ANSI/AAMA/NWDA 101/I.S.2/NAFS-02 requirements for the window type referenced in 1.01.B. In addition, the following specific performance requirements shall be met.
 - 2. Life Cycle Testing
 - a. Test in accordance with AAMA 910. There shall be no damage to fasteners, hardware parts, support arms, activating mechanisms, or any other damage that would cause the window to be inoperable. Air infiltration and water resistance tests shall not exceed specified requirements.
 - 3. Air Infiltration Test
 - a. With ventilators closed and locked, test unit in accordance with ASTM E 283 at a static air pressure difference of 6.24 psf (299 Pa).
 - b. Air infiltration shall not exceed .10 cfm/SF (.50 l/s•m²) of unit.
 - 4. Water Resistance Test
 - a. With ventilators closed and locked, test unit in accordance with ASTM E 331/ASTM E 547 at a static air pressure difference of 15.0 psf (718 Pa).
 - b. There shall be no uncontrolled water leakage.
 - 5. Uniform Load Deflection Test
 - a. With ventilators closed and locked, test unit in accordance with ASTM E 330 at a static air pressure difference of 65.0 psf (3112 Pa), positive and negative pressure.
 - b. No member shall deflect over L/175 of its span.

6. Uniform Load Structural Test
 - a. With ventilators closed and locked, test unit in accordance with ASTM E 330 at a static air pressure difference of 97.5 psf (4668 Pa), both positive and negative.
 - b. At conclusion of test there shall be no glass breakage, permanent damage to fasteners, hardware parts, support arms or actuating mechanisms, nor any other damage that would cause the window to be inoperable.
7. Forced Entry Resistance
 - a. Windows shall be tested in accordance to ASTM F 588 or AAMA 1302.5 and meet the requirements of performance level 10.
8. Condensation Resistance Test (CRF)
 - a. With ventilators closed and locked, test unit in accordance with AAMA 1503.1.
 - b. Condensation Resistance Factor (CRF) shall not be less than 54 (frame) and 62 (glass) when glazed with 1" (25 mm) insulated – 1/4" (6 mm) clear low emissivity, 1/2" (12 mm) air, 1/4" (6 mm) clear glass.
9. Thermal Transmittance Test (Conductive U-Value)
 - a. With ventilators closed and locked, test unit in accordance with AAMA 1503.1.
 - b. Conductive thermal transmittance (U-Value) shall not be more than 0.46 BTU/hr·ft²·°F (2.61 W/m²·K) when glazed with 1" (25 mm) insulated – 1/4" (6 mm) clear low emissivity, 1/2" (12 mm) air, 1/4" (6 mm) clear glass.
10. Thermal Transmittance Test (Conductive U-Value)
 - a. With ventilators closed and locked, test unit in accordance with NFRC-102.
 - b. Conductive thermal transmittance (U-Value) shall not be more than 0.45 BTU/hr·ft²·°F (2.55 W/m²·K) when glazed with 1" (25 mm) insulated – 1/4" (6 mm) clear low emissivity, 1/2" (12 mm) air, 1/4" (6 mm) clear glass.

1.07 Quality Assurance

- A. Provide test reports from AAMA accredited laboratories certifying the performance as specified in 1.05.
- B. Test reports shall be accompanied by the window manufacturer's letter of certification, stating the tested window meets or exceeds the referenced criteria for the appropriate ANSI/AAMA/NWDA 101/I.S.2/NAFS-02 window type.

1.08 References

1.09 Submittals

- A. Contractor shall submit shop drawings; finish samples, test reports, and warranties.
 1. Samples of materials as may be requested without cost to owner, i.e., metal, glass, fasteners, anchors, frame sections, mullion section, corner section, etc.

1.10 Warranties

- A. Total Window System
 1. The responsible contractor shall assume full responsibility and warrant for one year the satisfactory performance of the total window installation which includes that of the windows, hardware, glass (including insulated units), glazing, anchorage and setting system, sealing, flashing, etc., as it relates to air, water, and structural adequacy as called for in the specifications and approved shop drawings.
 2. Any deficiencies due to such elements not meeting the specifications shall be corrected by the responsible contractor at his expense during the warranty period.

PART 2 PRODUCTS

08 51 00.05 Aluminum Window

EFCO Series 2700 Thermal AP-AW65 Grade Projected Windows

2.01 Materials

- A. Aluminum
 - 1. Extruded aluminum shall be 6063-T6 alloy and tempered.
- B. Hardware
 - 1. Locking handles shall be cam type and manufactured from a white bronze alloy with a US25D brushed finish.
 - 2. Operating hardware shall be 4-bar stainless steel arms or equal.
- C. Weather-Strip
 - 1. All weather-strip shall be Santoprene® or equal.
- D. Thermal Barrier
 - 1. All exterior aluminum shall be separated from interior aluminum by a rigid, structural thermal barrier. For purposes of this specification, a structural thermal barrier is defined as a system that shall transfer shear during bending and, therefore, promote composite action between the exterior and interior extrusions.
 - 2. The perimeter frame thermal barrier shall be 2 thermal struts, consisting of glass reinforced polyamide nylon, mechanically crimped in raceways extruded in the exterior and interior extrusions.
 - 3. The sash and intermediate rails shall be poured and debridged thermal barrier made of two-part polyurethane.
- E. Glass : Refer to Section 08 80 00 Glazing.
- F. 08 51 00.13 Aluminum L Trim: ¼ " Thickness, Alloy and temper for strength and corrosion resistance, clear finish. Install with adhesive at all window sills.

2.02 Fabrication

- A. General
 - 1. All aluminum frame and vent extrusions shall have a minimum wall thickness of .125" (3 mm).
 - 2. Mechanical fasteners, welded components, and hardware items shall not bridge thermal barriers. Thermal barriers shall align at all frame and vent corners.
 - 3. Depth of frame and vent shall not be less than 2" (50 mm).
- B. Frame
 - 1. Frame components shall be mortise and tenon. Other means of mechanically fastening, i.e., screws shall not be permitted.
- C. Ventilator
 - 1. All vent extrusions shall be tubular.
 - 2. Each corner shall be mitered, reinforced with an extruded corner key, hydraulically crimped, and "cold welded" with epoxy adhesive.
 - 3. Each vent shall utilize two rows of weather stripping installed in specifically designed dovetail grooves in the extrusion. The exterior gasket will omitted at the vent bottom rail for project-out vents and at the vent top rail for project-in vents, allowing air to pressure equalize the void between the vents and frame.

- D. Screens
 - 1. Screen frames shall be extruded.
 - 2. Screen mounting holes in the window frame shall be factory drilled.
 - 3. Screen mesh shall be aluminum or fiberglass.
 - E. Glazing
 - 1. All units shall be glazed with the manufacturer's standard sealant process provided the glass is held in place by a removable, extruded aluminum, glazing bead. The glazing bead must be isolated from the glazing material by a gasket.
 - F. Finish
 - 1. Anodic
- 3.03** Finish all exposed areas of aluminum windows and components with electrolytically deposited color in accordance with Aluminum Association Designation AA- AA-M10-C22-A44. Color shall be dark bronze.

3.04 08 51 13.14 Motorized Control System

A. Manufacturer: Clearline Inc. P.O. Box 1368, North Wales, PA 19454-0368

B. Product: 120 VAC Motorized Control System, Surface Mounted.

C. General:

1. Clearline Inc. and the Aluminum Window supplier shall supply fully detailed shop drawings to the architect for review prior to fabrication and delivery of material. Aluminum window supplier shall review and coordinate of all components for compatibility and complete performance.

2. To facilitate installation and reduce installation costs, it shall be the responsibility of the window supplier to properly prepare the vents to accept the operators and to insure the vents are properly hung when connected for finger-tip operation providing free movement to the control system. Vent preparation details shall be shown on the Clearline shop drawings and installation instructions for the erector will be provided at the time of delivery.

3. It shall be the responsibility of the contractor to make the necessary provisions for the installation of the control system as shown on the shop drawings and to finish all surfaces after the system has been installed.

PART 3 EXECUTION

3.01 Inspection

A. Job Conditions

- 1. Verify that openings are dimensionally within allowable tolerances, plumb, level, clean, provide a solid anchoring surface, and are in accordance with approved shop drawings.

3.02 Installation

- A. Use only skilled tradesmen with work done in accordance with approved shop drawings and specifications.
- B. Plumb and align window faces in a single plane for each wall plane, and erect windows and materials square and true. Adequately anchor to maintain positions permanently when subjected to normal thermal movement, specified building movement, and specified wind loads.
- C. Adjust windows for proper operation after installation.
- D. Furnish and apply sealants to provide a weather tight installation at all joints and intersections and at opening perimeters. Wipe off excess material and leave all exposed surfaces and joints clean and smooth.

3.03 Anchorage

- A. Adequately anchor to maintain positions permanently when subjected to normal thermal movement, specified building movement, and specified wind loads.

3.04 Protection and Cleaning

- A. After completion of window installation, windows shall be inspected, adjusted, put into working order and left clean, free of labels, dirt, etc. Protection from this point shall be the responsibility of the general contractor.

END OF SECTION

SECTION 08 80 00

GLAZING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Glass and glazing for Sections referencing this Section for Products and installation.

1.2 SYSTEM DESCRIPTION

- A. Glass and glazing materials of this Section shall provide continuity of building enclosure vapor and air barrier.
- B. Size glass to withstand dead loads and positive and negative live loads acting normal to plane of glass.

1.3 SUBMITTALS

- A. Product Data on Glass Types Specified: Provide physical and environmental characteristics, size limitations, and special installation requirements.
- B. Product Data on Glazing Compounds: Provide chemical characteristics, limitations, special application requirements. Identify available colors.
- C. Samples: Submit two samples 12 x 12 inch in size, illustrating glass units coloration and design.

1.4 QUALITY ASSURANCE

- A. Requirements of Regulatory Agencies:
 - 1. Safety glass and Glazing shall comply with Colorado House Bill no. 1110 and requirements of ANSI Z-97.1 - 1966.
- B. Reference Standards: Conform to current editions of the following Codes, Standards and Specifications relating to work of this section:
 - 1. American National Standards Institute (ANSI) Z-97.1 - 1975 Performance Specifications and Methods of Test for Safety Glazing Material Used in Buildings.
 - 2. Federal Specifications (Fed. Specs.) DD-G-451D Glass, Plate, Sheet, Figures (Float, Flat for Glazing, Corrugated, Mirrors, and Other Uses) DD0G=1403B(1) Glass, Plate (Float), Sheet, Figures, and Spandrel (Heat Strengthened and Full Tempered)
 - 3. Flat Glass Marketing Association (FGMA) Glazing Manual - Latest Edition Glazing Sealing Systems Manual - Latest Edition

4. Sealed Insulating Glass Manufacturers Association (SIGMA) 66-7-72 Specifications per sealed glass insulating units.
5. Uniform Building code - Latest Edition
- C. Grading and Labeling: Grade and label each light, setting forth quality and grade of glass and manufacturer's name and brand designation. Leave labels intact until completion of work or until directed to remove.
- D. Each light with special performance characteristics such as fully tempered shall bear the manufacturer's identification showing the special characteristic and thickness by etching or other permanent identification that shall be visible after the glass is glazed.

1.5 WARRANTY

- A. Provide ten year warranty including coverage for sealed glass units from seal failure, inter-pane dusting or misting, and replacement of same.

PART 2 - PRODUCTS

08 80 00.01 Glazing

2.1 FLAT GLASS MATERIALS

08 80 00.04 Tempered Glass: Type A: 1/4" Clear Tempered Safety Glass
Refer to schedule

08 80 00.15 Insulating glass clear tempered: Type B Insulating Glass Clear Tempered 1" thick
2 sheets of 1/4" thick, tempered glass with 1/2" air space. Outer sheet - solar cool gray tinted. Inner glass clear.

08 80 00.12 Insulating glass: Type C Insulating Glass Clear Float 1" thick
2 sheets of 1/4" thick, float glass with 1/2" air space. Outer sheet - solar cool gray tinted. Inner glass clear.

A. Manufacturers:

1. PPG Industries
2. ASG Industries
3. Interpane

2.2 MIRRORS

Not Used.

2.3 GLAZING ACCESSORIES

- A. Elastic Glazing Compound: Comply with Federal Specification TT-P-781a, Type 1 or TT-G-410e. Glazing compound shall be paintable variety.
- B. Setting Blocks, Shims, and Glazing Clips: Size and type as recommended by glass manufacturer.

2.4 GLAZING SEALANTS AND TAPES

A. General

- 1. Provide black exposed glazing materials, unless another color is indicated, or unless another color is selected by Architect from manufacturer's standard colors.
- 2. Provide hardness of materials as recommended by the manufacturer for the required application and condition of installation in each case. Provide only sealants and tapes which are known (proven) to be fully compatible with surfaces contacted, including glass products, seals of insulating glass units and glazing channel surfaces.

B. 1-Part Non Acid Curing Medium Modulus Silicone (Use for exterior hollow metal)

- 1. Type S, Grade S, Class 25, Uses NT, G, A, and as applicable to uses indicated, O; and complying with tensile strength of not less than 45 nor more than 75 psi at 100% elongation when tested per ASTM D412 after 14 days at 77° F and 50% relative humidity.
- 2. Products: Provide one of the following or an approved equal:
 - a. Dow Corning 795; Dow Corning Corporation
 - b. Silpruf; General Electric Corporation
 - c. Gesil; General Electric Corporation
 - d. Spectrum 2; Tremco, Inc.

C. 1 Part Acrylic Glazing Sealant (Use for interior glazing of hollow metal or woodwork.)

- 1. Water-based, acrylic emulsion sealant; nonsag, mildew resistant, paintable; comply with ASTM C834.

D. Preformed Butyl Rubber Glazing Tape

- 1. Extruded tape (coiled on release paper) of solvent-free butyl-polyisobutylene formulation with 100% solids, complying with AAMA A804.1, non-staining and non-migrating in contact with porous surfaces, with or without continuous spacer rod as required for proper glazing installation.

2.5 MISCELLANEOUS GLAZING MATERIALS

- A. Compatibility: Provide materials compatible with surfaces and sealants contacted in installation.

- B. Setting Blocks: Neoprene, EPDM or silicone 80-90 Shore A durometer hardness, with proven compatibility with sealants used.
- C. Edge Blocks: Neoprene, EPDM or silicone with proven compatibility with sealants used, of size, shape and hardness as recommended by glass and sealant manufacturers. Provide edge blocks to limit lateral movement of glass.
- D. Cleaners, Primers, Sealants: Type recommended by sealant or gasket manufacturer.
- E. Mirror Mastic: Type recommended by mirror manufacturer for spot-application system, with less than 25% coverage and 0.125" to 0.5" thickness of setting bed, with mirror supported only at lower edge.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Refer to Section 01040 for examination of substrate and job conditions.
- B. Verify that framing and glazing channel surface, backing and removable stop design are acceptable, that weep system is functioning and for effective sealing of joinery.

3.2 INSTALLATION

- A. Performance
 - 1. Watertight and air tight installation of each piece of glass is required, except as otherwise shown. Each installation must withstand normal temperature changes, wind loading, impact loading (for operating sash and doors) without failure of any kind including loss or breakage of glass, failure of sealants or gaskets to remain watertight and airtight, deterioration of glazing materials and other defects in the work.
- B. General
 - 1. Protect glass from edge damage at all times during handling, installation and operation of the building.
 - 2. Glazing channel dimensions as shown are intended to provide for necessary minimum bite on the glass, minimum edge clearance and adequate sealant thicknesses with reasonable tolerances. The glazier is responsible for correct glass size for each opening within the tolerance and necessary dimensions established.
 - 3. Comply with combined recommendations of glass manufacturer and manufacturer of sealants and other materials used in glazing, except where more stringent requirements are shown or specified, and except where manufacturer's technical representatives direct otherwise.

4. Comply with *Glazing Manual* and other applicable publications by Flat Glass Marketing Association except as shown and specified otherwise, and except as specifically recommended otherwise by the manufacturers of the glass and glazing materials.
5. Inspect each piece of glass immediately before installation, and discard any which have observable edge damage or face imperfections.
6. Unify appearance of each series of lights by setting each piece to match others as nearly as possible. Set with pattern, draw and bow oriented in the same direction as other pieces.
7. Cut and install colored (tinted) and heat absorbing glass as recommended in TSR No. 130, *Installation Recommendations Tinted and Reflective Glass*, by PPG Industries or similar reports by other manufacturers.
8. Install insulating glass units to comply with recommendations by SIGMA and TSR No. 230, *Installation Recommendations Window* by PPG Industries, Inc., except as otherwise specifically indicated or recommended by glass and sealant manufacturers.

3.3 PREPARATION

- A. Clean the glazing channel or other framing members to receive glass, immediately before glazing. Remove coatings which are not firmly bonded to the substrate. Remove lacquer from metal surfaces wherever elastomeric sealants are used.
- B. Apply primer or sealer to joint surfaces wherever recommended by sealant manufacturer.

3.4 GLAZING

- A. General
 1. Install setting blocks of proper size at quarter points of sill rabbet but not less than 6" from corner of glass to edge of setting block. Set blocks in thin course of the heel-based compound, if any.
 2. Force sealants into channel to eliminate voids and to ensure complete "wetting" or bond of sealant to glass and channel surfaces.
 3. Clean and trim excess glazing materials from the glass and stops or frames promptly after installation, and eliminate stains and discoloration.
- B. Tape and Sealant Glazing
 1. Cut glazing tape to length and set against permanent stop 3/16" below sight line. Butt tape at corners and daub joint with butyl sealant.
 2. Place setting blocks and rest glass pane on blocks and push against tape to attain full contact with glass perimeter.
 3. Place glazing tape on glass and install removable stop.

4. Apply cap bead of medium modulus silicone sealant along exterior and interior void to uniform line and with "wash" away from glass. Tool or wipe sealant with solvent for smooth appearance.

C. Gasket Glazing

1. Where wedge-shaped gaskets are driven into one side of the channel to pressurize the sealant or gasket on the opposite side, provide adequate anchorage to ensure that gasket will not "walk" out when installation is subjected to dynamic movement.
2. Miter cut wedge-shaped gaskets at corners and install gasket as recommended by gasket manufacturer to prevent pull away at corners. Seal corner and butt joints with sealant as recommended by gasket manufacturer.

D. Adhesive Installation of Mirrors

1. Apply one additional coat of moisture-resistant paint, of type recommended by mirror manufacturer, to back of mirror, and allow to dry. Apply mirror mastic to cover not more than 25% of back of mirror. Set mirror in support on setting blocks or continuous gasket, and press against substrate to ensure bond of adhesive. Leave open ventilation space, 0.125" or more in thickness between mirror and substrate, over 75% of mirror area (wherever there is no adhesive). Do not seal off ventilation space at edges of mirror.

3.5 CURE, PROTECTION AND CLEANING

- A. Cure glazing sealant and compounds in compliance with manufacturer's instructions and recommendations, to obtain high early bond strength, internal cohesive strength and surface durability.
- B. Protect exterior glass from breakage immediately upon installation, by attachment of crossed streamers to framing held away from glass. Do not apply markers of any type to surface of glass.
- C. Remove non-permanent markers and clean surfaces.
- D. Remove and replace glass which is broken, chipped, cracked, abraded, or damaged in other ways during the construction period, including natural causes, accidents and vandalism.
- E. Washing of glass is specified in Section 01710.

END OF SECTION

SECTION 09 20 00

PLASTER AND GYPSUM BOARD

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Metal stud wall framing
- B. Metal channel ceiling framing.
- C. Acoustic insulation.
- D. Gypsum board with taped and sanded joint treatment.
- E. Textured surfacing.

1.2 SYSTEM DESCRIPTION

09 20 00.79 Acoustic Batt Insulation

- A. Acoustic Attenuation for Identified Interior Partitions: 55 STC in accordance with ANSI/ASTM E90. Refer to Section 07210 Building Insulation for product descriptions
- B. Conform to applicable code for fire rated assemblies.

1.4 QUALITY ASSURANCE

- A. Perform Work in accordance with GA201 - Gypsum Board for Walls and Ceilings and GA216 - Recommended Specifications for the Application and Finishing of Gypsum Board.

PART 2 PRODUCTS

2.1 GYPSUM BOARD SYSTEM
FRAMING

- 09 20 00.06 3 5/8" Metal Stud
- 09 20 00.09 3 5/8" Metal Stud Track
- 09 20 00.14 6" Metal Stud
- 09 20 00.016 6" Metal Stud Track
- 09 20 00.19 7/8" Metal Furring Channel
- 09 20 00.21 1-1/2" Metal Furring Channel
- 09 20 00.22 2" Metal Furring Channel

SECTION 09 20 00
PLASTER AND GYPSUM BOARD

Page 2

- 09 20 00.62 2-1/2" Steel C-H Stud
- 09 20 00.63 2-1/2" Steel J Runner

09 20 00.77 Slip Track

- A. Manufacturers
 - 1. National Gypsum Co./Gold Bond - Drywall Steel Studs
 - 2. United States Gypsum Co. - Drywall Steel Studs
- B. Studs and Tracks: ANSI/ASTM C645, galvanized sheet steel, 26 gauge, or 18-gauge as shown on drawings, C shape unless otherwise shown.
- C. Ceiling Framing System
 - 1. 09 20 00.26 1-1/2" cold rolled channel
 - 2. 09 20 00.72 7/8" RC-1 metal furring channel

WALLBOARD

09 20 00.33 5/8" Gypsum Wall Board

- A. Manufacturers
 - Fire Rated
 - 1. National Gypsum Co./Gold Bond - Fire Shield 9 Wall Board
 - 2. United States Gypsum Co. - Fire Code C Core.
 - Non-Fire Rated
 - 1. National Gypsum.
 - 2. United States Gypsum Co.
- B. Furring, Framing, and Accessories: ANSI/ASTM C645.
- C. Fasteners: ANSI/ASTM C646 hardened screws.

SHAFT LINER

09 20 00.75 1" Gypsum Shaft Liner

- A. Manufacturers:
 - 1. Nation Gypsum Co./Gold Bond - Fire Shield & Shaft Liner.
 - 2. United States Gypsum Co. - Gypsum Liner Panels.

MOISTURE RESISTANT GYPSUM WALL BOARD

09 20 00.36 5/8" Moisture-Resistant Gypsum Wall Board

- A. Manufacturers
 - 1. National Gypsum Co./Gold Bond - MR Board (FSW-9)
 - 2. United States Gypsum Co. - Water-resistant with Fire Code C Core.
- B. Furring, Framing, and Accessories: ANSI/ASTM C645.
- C. Fasteners: ANSI/ASTM C646 hardened screws.

2.2 ACCESSORIES

- A. Acoustical Insulation: ASTM C665, preformed mineral wool, friction fit type without integral vapor barrier membrane.
- B. Acoustical Sealant: Non-hardening, non-skinning, for use in conjunction with gypsum board.
- C. L Trim Molding: Fry Reglet - DRML-625
- D. Corner Trim: Fry Reglet - DMBC-75.
- E. Corner Beads 09 20 00.45 Corner Bead: Metal.
- F. Edge Trim 09 20 00.46 Casing Bead: U-shape exposed reveal bead.
- G. Not Used
- H. Not Used
- I. Joint Materials: ANSI/ASTM C475, reinforcing tape, joint compound, adhesive, and water.
- J. Adhesive: ANSI/ASTM C557.
- K. Textured Surfacing: Heavy Knockdown Finish.

PART 3 - EXECUTION

3.1 INSTALLATION - METAL STUDS

- A. Install studding in accordance with manufacturer's instructions.

- B. Metal stud spacing: 16 inches
- C. Partition Heights: Refer to drawings.

3.2 INSTALLATION - WALL FURRING

- A. Erect wall furring channels for direct attachment to walls. Erect vertically. Secure to alternate channel flanges.
- B. Space furring maximum 24 inches oc, not more than 4 inches from floor and ceiling lines.
- C. Install insulation between furring attached to concrete walls in accordance with manufacturer's instructions.
- D. Install furring as required for fire resistance ratings indicated.

3.3 INSTALLATION - CEILING FRAMING

- A. Install in accordance with manufacturer's instructions.
- B. Coordinate location of hangers with other work. Install ceiling framing independent of walls, columns, and above ceiling work.
- C. Reinforce openings in ceiling suspension system which interrupt main carrying channels or furring channels, with lateral channel bracing.
- D. Laterally brace entire suspension system.
- E. Construct light fixture boxes of gypsum board above light fixtures in all ceiling systems with UL assembly requirements.

3.4 INSTALLATION - ACOUSTICAL ACCESSORIES

- A. Install resilient channels at maximum 12 inches oc.
- B. Install acoustical sealant within partitions in accordance with manufacturer's instructions.

3.5 INSTALLATION - GYPSUM BOARD

- A. Install gypsum board in accordance with manufacturer's instructions.
- B. Fasten gypsum board to furring or framing with screws.
- C. Place control joints consistent with lines of building spaces as directed.
- D. Place corner beads at external corners. Use longest practical length. Place edge trim where gypsum board abuts dissimilar materials.

3.6 JOINT TREATMENT

- A. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.
- B. Feather coats onto adjoining surfaces so that camber is maximum 1/16 inch.
- C. Taping, filling, and sanding is not required at surfaces behind adhesive applied ceramic tile or FRP panels.

3.7 TOLERANCES

- A. Maximum Variation from True Flatness: 1/8 inch in 10 ft in any direction.

3.8 GYPSUM BOARD FINISH LEVELS: Finish panels to levels indicated below according to ASTM C 840, for locations indicated:

- A. Level 1: Embed tape at joints and ceiling plenum areas, concealed areas and where indicated.
- B. Level 2: Embed tape and apply separate first coat of joint compound to tape, fasteners, and trim flanges where panels are substrate for tile and polymer modified Portland cement plaster.
- C. Level 4: Embed tape and apply separate first, fill, and finish coats of joint compound to tape, fasteners, and trim flanges at panel surfaces that will be exposed to view.

END OF SECTION

SECTION 09 50 00

CEILINGS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Suspended metal grid ceiling system.
- B. Acoustical panels.

1.2 SYSTEM DESCRIPTION

- A. Install system capable of supporting imposed loads to a deflection of 1/360 maximum.
- B. Installed System: Conform to UL rating for ceiling and floor assembly as shown on drawings.
- C. Conform to applicable code for fire rated assembly.

PART 2 - PRODUCTS

2.1 SUSPENSION SYSTEM

09 50 00.02 Suspended Ceiling Grid

- A. Manufacturers: (2 x 4 Grid)
Non-Rated Ceilings:
 - 1. Chicago Metallic Corp. - 1200 Snap Grid 2 x 4
 - 2. USG Interiors, Inc. - DX System 2 x 4.
 - 3. Approved Equal
- B. Grid: ASTM C635, fire rated to one hour assembly, exposed T configuration; components die cut and interlocking.
- C. Accessories: Stabilizer bars, clips, splices, hold down clips and edge moldings required for suspended grid system.
- D. Grid Finish: White color.
- E. Support Channels and Hangers: Galvanized steel, size and type to suit application.

2.2 ACOUSTIC UNITS

09 50 00.07 Acoustical Panel

A. Manufacturers:

1. Armstrong World Industries, Cortega Second Look, Pattern C (perforated, small holes), E (lightly textured) Color White
2. Approved Equal

B. Acoustic Panels: Conforming to the following:

1. Size: 24 x 48 inches.
2. Thickness: 3/4 inches.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that layout of hangers will not interfere with other work.

3.2 INSTALLATION - SUSPENSION SYSTEM

- A. Install system in accordance with manufacturer's instructions and coordinate with Architect for final lay out.
- B. Coordinate the location of hangers with other work. Where components prevent the regular spacing of hangers, reinforce the system to span the extra distance.
- C. Hang system independent of walls, columns, ducts, pipes and conduit.
- D. Center system on room axis leaving equal border units.
- E. Install edge molding at intersection of ceiling and vertical surfaces, using longest practical lengths.

3.3 INSTALLATION - ACOUSTIC UNITS

- A. Install acoustic units level, free from damage, twist, warp or dents.
- B. Lay acoustic insulation above acoustic units for distance indicated.
- C. Install hold down clips to retain panels tight to grid system within 20 ft of an exterior door.
- D. Construct light fixture boxes of gypsum board above light fixtures in accordance with UL assembly requirements.

3.4 TOLERANCES

SECTION 09 50 00
CEILINGS

Page 3

A. Variation from Flat and Level Surface: 1/8 inch in 10 feet .

END OF SECTION

SECTION 09 90 00

PAINTING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Surface preparation and finishing.

1.2 SYSTEM DESCRIPTION

- A. Finish Materials: Conform to applicable code for flame/fuel/smoke rating requirements.

1.3 ENVIRONMENTAL REQUIREMENTS

- A. Store and apply materials in environmental conditions required by manufacturer's instructions.

1.4 SUMMARY

Section Includes:

- A. Painting work as shown on the drawings and scheduled, and as follows:
 - 1. Surface preparation, priming and finish coats of paint specified are in addition to shop priming and surface treatment specified in other sections.
 - 2. Painting and finishing of interior and exterior exposed items and surfaces throughout the project, except as otherwise indicated.
 - 3. Painting of exposed bare and covered pipes and ducts, and of hangers, exposed steel and iron work, and primed metal surfaces of equipment installed under the mechanical and electrical work, except as otherwise indicated. Coordinate with Division 15 and 16 Installers for color coding, if any.
 - 4. Painting of mechanical grilles, registers, louvers (except aluminum), an exposed duct work and panel covers and frames for electrical work and systems.
 - 5. "Paint" as used herein means all coating systems materials, including primers, emulsions, enamels, stains, sealers and fillers, and other applied materials whether used as prime, intermediate or finish coats.
 - 6. Painting all exposed surfaces whether or not colors are designated in "schedules," except where the natural finish of the material is specifically noted as a surface not to be painted.
- B. Where items or surfaces are not specifically mentioned, paint these the same as adjacent similar materials or areas. If color or finish is not designated, the Architect will select these from standard colors or finishes.

1.5 QUALITY ASSURANCE

- A. Single Source Responsibility: Provide primers and other undercoat paint produced by same manufacturer as finish coats. Use only thinners approved by paint manufacturer, and use only within recommended limits.
- B. Coordination of Work: Review other sections of these specifications in which prime paints are to be provided to ensure compatibility of total coatings system for various substrates. Upon request from other trades, furnish information or characteristics of finish materials provided for use, to ensure compatible prime coats are used.

1.6 MAINTENANCE

- A. Maintenance Materials: Leave on premises, where directed by Owner's Representative, not less than one gallon of each color and type used. Containers to be tightly sealed and clearly labeled for identification.

PART 2 - PRODUCTS

2.1 MATERIALS

09 90 00.01 Paint

- A. Manufacturers:
 - 1. Sherwin Williams
 - 2. Benjamin Moore
 - 3. Devoe Paint

09 90 00.02 Stain

- 1. CMU Sealer/Stain:
 - a. Manufacturer: Sherwin Williams
 - b. Product: H&C Silicone Acrylic Concrete Sealer
- 2. Wood Stain:
 - a. Not Used

PART 3 - EXECUTION

3.1 EXAMINATION AND PREPARATION

- A. Verify that substrate conditions are ready to receive Work.
- B. Measure moisture content of porous surfaces using an electronic moisture meter. Do not apply finishes unless moisture content is less than 12 percent.
- C. Correct minor defects and clean surfaces which affect Work of this Section.
- D. Gypsum Board Surfaces: Latex fill minor defects. Spot prime defects after repair.

- E. Galvanized Surfaces: Remove surface contamination and oils and wash with solvent. Apply coat of etching primer.
- F. Concrete and Unit Masonry Surfaces Scheduled to Receive Paint Finish: Remove foreign matter. Remove oil stains as recommended by manufacturer of stain, rinse well and allow to dry.
- G. Un-coated Ferrous Surfaces: Remove scale by wire brushing or sandblasting; wash clean with solvent. Apply treatment of phosphoric acid solution. Prime paint after repairs.
- H. Shop Primed Steel Surfaces: Sand and scrape to remove loose primer and rust, feather edges; clean surfaces with solvent. Prime bare steel surfaces.
- I. Interior Wood Items Scheduled to Receive Paint Finish: Wipe surface clean; seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after primer has dried; sand between coats.
- J. Apply surface texture at drywall areas as shown on schedule.
- K. Clean and prepare all concrete floors for floor coatings as recommended by manufacturer of floor coating systems.

3.2 APPLICATION

- A. Apply products in accordance with manufacturer's instructions.
- B. Sand transparent finishes lightly between coats to achieve required finish.
- C. Where clear finishes are required, tint fillers to match wood.
- D. Back prime interior and exterior woodwork scheduled to receive paint finish with primer paint.

3.3 FINISHING MECHANICAL AND ELECTRICAL EQUIPMENT

- A. Color code items in accordance with requirements indicated. Color band and identify with flow arrows, names and numbering.
- B. Paint shop primed equipment.
- C. Remove unfinished louvers, grilles, covers, and access panels and paint separately. Paint dampers exposed behind louvers, grilles, convactor and baseboard cabinets to match face panels.
- D. Prime and paint insulated and exposed pipes, insulated and exposed ducts, hangers, brackets, collars and supports, except where items are pre-finished.
- E. Paint interior surfaces of air ducts, convectors, and baseboard heating cabinets that are visible through grilles and louvers with one coat of flat black paint, to limit of sight line.
- F. Paint exposed conduit and electrical equipment occurring in finished areas, except pre-finished surfaces.
- G. Paint both sides and edges of plywood backboards.
- H. Replace electrical plates, hardware, light fixture trim, and fittings removed prior to finishing.

3.4 CLEANING

- A. As work proceeds, promptly remove spilled, splashed, or spattered finishes.

3.5 SHOP PRIMED ITEMS FOR SITE FINISHING

- A. Metal Fabrications (Section 05500): Handrails and Guardrails

3.6 SCHEDULE - INTERIOR SURFACES (specified products based on Sherwin Williams)

A. Concrete and Masonry

- 1. Exterior Concrete and Concrete Masonry (All exposed exterior surfaces)
 - a. One coat of H&C 150
 - b. Two coats of H&C penetrating sealer
- 2. Interior Concrete Masonry – All other interior exposed surfaces
 - a. One coat Heavy Duty Block filler as recommended by paint manufacturer.
 - b. Two coats EPO-Plex Multi-Mil Water Based Epoxy Finish.

B. Plaster, Gypsum Board Dry Areas

- 1. One coat acrylic primer prior to texturing.
- 2. Spray texture – Orange Peel.
- 3. Two coats acrylic latex semi-gloss ProGreen 200

C. Gypsum Board Wet Areas

- 1. One coat glaze pigmented sealer prior to texturing.
- 2. Light orange-peel texture with roller.
- 3. Two coats alkyd semi-gloss enamel.

D. Steel - Unprimed

- 1. One coat zinc chromate primer
- 2. Two coats alkyd enamel semi-gloss

E. Wood - Painted

- 1. One coat alkyd primer sealer.
- 2. Two coats latex, semi-gloss.

F. Wood

- 1. Transparent
 - a. Filler coat (for open grained wood only).
 - b. One coat sealer.
 - c. One coat polyurethane satin.

G. Steel - Primed

- 1. Touch up with original primer

2. Two coats alkyd enamel semi-gloss

H. Steel - Galvanized

1. One coat zinc chromate primer
2. Two coats alkyd enamel semi-gloss

J. Concrete Floors: Rooms 116- Crew Foreman, 104-Shared Office, 106-Electrical, 107-Women's RR, 109-Men's RR.

1. Concrete Sealer , apply as per manufacturer
2. Floor Coating, ArmorSeal 1000 HS, 2 Coats w/ Broadcast/Rejection clean silica sand for slip resistance.

K. Concrete Floors: All other areas of concrete slab replacement:

1. Concrete Sealer , apply as per manufacturer

L. New Interior Steel Deck and Structural System

- a. One coat Waterborne Acrylic Dryfall
- b. One coat Waterborne Acrylic Dryfall

3.7 SCHEDULE - COLORS

- A. Colors to be selected by Architect.

END OF SECTION

SECTION 09 96 00
ABRASION RESISTANT COATINGS

PART 1 - GENERAL

1.01 Summary

A. A high performance coating system that consists of a three-component epoxy primer and a proprietary three-component moisture-cure urethane with superior abrasion resistance. Complies with VOC/VOS Rules and Regulations, and L.A. Rule 66.

1.02 Performance Requirements

A. See manufacturer's technical data bulletin for specific material, cured coatings and a complete list of chemical resistant properties.

1. Chemical Resistance: Excellent chemical resistance to Jet Fuel (JP-4), Xylene, Brake Fluid, Skydrol® 500B and Skydrol® LD4 with no adverse effects, based on 7 day spot testing on concrete.

1.03 Submittals

A. Product Data: Submit manufacturer's product data, including physical properties, chemical resistance, surface preparation and application instructions.

B. Submit manufacturer's standard warranty and applicator's warranty.

1.04 Quality Assurance

A. Applicator Qualifications:

1. A minimum of three years' experience in the application of coatings or resurfacers to concrete floors.

B. Pre-Application Meeting: Convene a pre-application meeting 2 weeks before the start of application of floor coating system. Require attendance of parties directly affecting work of this section, including the Contractor, Architect, Applicator and Manufacturer's Representative. Review the surface preparation, application, cleaning, protection and coordination with other work.

1.05 Delivery, Storage and Handling

A. Delivery: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.

B. Store materials in accordance with manufacturer's instructions.

1.06 Warranty

A. Written manufacturer's warranty covering materials only. Applicator to provide

application warranty.

Eco-HTS™

PART 2 - PRODUCTS

ECO-HTS High Traffic System
Manufactured by Tennant Co.
1-800-553-8033

2.01 Materials

A. Primer: Tennant Eco-Shield™. A three-component epoxy.

1. Percent Solids, ASTM D2369
 1. Part A - 94.35%
 2. Part B - 99.82%
2. Volatile Organic Compound (VOC), ASTM D3960
 1. 0.41 lb/gal or 50 g/L
3. Tensile Strength, ASTM D2370
 1. 8,000 psi or 55,200 kPa
4. Percent Elongation, ASTM D2370
 1. 5%

B. Coating: Tennant Eco-HTS™ - High Traffic System. A three-component moisture cure urethane.

1. Volatile Organic Compound (VOC), ASTM D3960
 1. <1.1 lb/gal or 130 g/L
 2. Abrasion Resistance, ASTM D4060
 1. 20-30 mg loss @ 1000 revolutions
 2. 120-130 mg loss @ 5000 revolutions
 3. Tensile Strength, ASTM D2370
 1. 9,500 psi or 65,550 kPa
 4. Percent Elongation, ASTM D2370
 1. 10%
 5. Sward Hardness, ASTM D2134
 1. 35-40 (1 mil film)
- C. Colorant: Tennant Colorants
1. Canada Gray

D. Traction Grit

1. Tennant 291 Grit (60 mesh) - white aluminum oxide

E. Cleaners and Related Products:

1. Industrial Grease Remover: Tennant Detergent
2. Cleaner/Remover: Tennant 531/528 Cleaner/Remover
 1. High flash naphtha solvent, curing membrane remover
3. Cleaner/Etchant: Tennant 409 Pre-Kote Cleaner or equivalent Tennant etchant for use by Tennant Authorized Contractor.
 1. Blend of buffered acids and emulsifiers.

PART 3 - EXECUTION

3.01 Examination

A. Examine concrete surface to receive floor coating system. Notify the Architect if surface is not acceptable. Do not begin surface preparation or application until unacceptable conditions have been corrected.

B. Allow concrete substrate to cure a minimum of 30 days.

C. Use a Delmhorst moisture meter to check the moisture content of concrete. An unacceptably high reading is 22 or above on a wood scale.

3.02 Preparation

A. Prepare surface in accordance with manufacturer's instructions.

1. Cleaning: Scrub with Tennant detergent and rinse with clean water to remove surface dirt, grease and oil.

2. Removing: Remove coatings and curing membranes with one of the following methods:

1. Mechanical - Sand floors.

2. Chemical - Remove curing membranes with Tennant 531/528.

3. Conditioning:

1. Apply Tennant 409 Pre-Kote Cleaner and ensure solution reacts with the concrete in a general and equal fashion over all areas.

2. Do not use unbuffered muriatic acid to condition the concrete.

3.03 Application

A. Apply floor coating system in accordance with manufacturer's instructions.

1. Assemble squeegees and rollers; clean rollers to remove residual lint.

2. Primer: Eco-Shield™.

1. Mix components together.

2. Mix only enough material which can be applied within 20 minutes.

3. Apply Eco-Shield™ primer at the rate of 321-535 ft²/gal.

4. Allow primer to cure 8 hours at 75 degrees F (24 degrees C) and 50% relative humidity.

5. Sand with 80 grit sandpaper, detergent scrub and rinse with clean water to ensure adequate adhesion between coats.

3. Coating: Eco-HTS™ -- High Traffic System.

1. Open and mix only enough material which can be applied in a 2 hour period.

2. Apply Eco-HTS™ at the rate of 500-600 ft²/gal.

3. Allow coating to dry 24 hours at 75 degrees F (24 degrees C) and 50% relative humidity.

3.04 Protection

A. Close job site to traffic for a period of 24 hours after coating application

END OF SECTION

SECTION 10 20 00

INTERIOR SPECIALTIES

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Metal toilet compartments.

1.2 SYSTEM DESCRIPTION

- A. Partition Type: Floor mounted.

1.3 REGULATORY REQUIREMENTS

- A. Conform to ANSI A117.1 and applicable ADA code for provisions for the physically handicapped.

1.4 SUBMITTALS

- A. Shop Drawings: Indicate partition plan and elevation views, dimensions, details of wall and floor supports, and door swings.

PART 2 - PRODUCTS

10 20 00.01 Toilet Partitions

2.1 MATERIALS

- A. Manufacturers:
 - 1. Global - Powder Coated; Floor and Ceiling Anchored
 - 2. Ampco – Metal, Powder Coated Baked Enamel; Floor to Ceiling Supported
- B. Panel Construction: Honeycomb Core with Steel panels. Color to match existing toilet partitions
- C. Attachments and Bolts: Steel, with heavy duty aluminum brackets.

2.2 HARDWARE

- A. Hinges: Cast pivot hinges, gravity type, nylon bearings.
- B. Latch and Keeper: Thumb turn latch, door strike and keeper with rubber bumper.
- C. Coat Hook: Cast alloy, with rubber bumper tip.

2.3 FABRICATION

- A. Fabricate components with plastic laminate finish to faces and edges of core material.
- B. Doors and Panels: One inch thick, face pressure bonded to core.
- C. Pilasters: 1-1/4 inch thick, constructed same as doors.
- D. Pilaster Shoes: Formed chromed steel.
- E. Internal Reinforcement: Provide for attached hardware and fittings.

2.4 FINISHING

- A. Clean panels.

PART 3 - EXECUTION

3.1 EXAMINATION AND PREPARATION

- A. Verify that opening dimensions and plumbing fixture and rough-in locations are as indicated on shop drawings.

3.2 INSTALLATION

- A. Install partition components secure, plumb, and level in accordance with manufacturer's instructions.
- B. Attach panel brackets securely using anchor devices.
- C. Provide adjustment for height variations with threaded rods through steel saddles. Conceal fastenings with pilaster shoes.
- D. Equip each door with two hinges, one door latch, and one coat hook and bumper.
- E. Adjust and align door hardware so that free movement is attained.

END OF SECTION

SECTION 10 28 00

TOILET AND BATH SPECIALTIES

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Toilet and washroom accessories.

1.2 SYSTEM DESCRIPTION

- A. Conform to applicable code for installing work in conformance with ANSI A117.1. and Americans with Disabilities Act Accessibility Guidelines.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Not Used
- B. 10 28 00.05 Grab Bar

Manufacturers:

1. A & J Washroom Accessories Inc. - UG3 Type G, 1-1/2" Dia., stainless steel, snap on cover.
2. Bobrick - B-68137, continuous bar, 36" x 54" with snap flange, satin stainless steel, 1-1/2" diameter.
3. Bradley Corp. - 812-0593654, continuous bar, concealed mounting, 1-1/2" diameter, satin chrome.

- C. 10 20 00.08 Paper Towel Dispenser

Paper Towel Dispenser

Manufacturers:

1. Provided by Owner

10 20 00.10 Build In Waste Receptacle (Semi- Recessed)

Manufacturers:

SECTION 10 28 00
TOILET AND BATH ACCESSORIES

Page 2

1. Provided by Owner

D. Not Used

E. 10 28 00.12 Sanitary Napkin Dispenser

Manufacturers:

1. Provided by Owner

F. 10 28 00.13 Sanitary Napkin Disposal

Manufacturers:

1. Bobrick - B-270, Stainless Steel

2. Bradley Corp.- 4781-15, Stainless Steel

G. 10 28 00.11 Toilet Paper Holder

Manufacturers:

1. Provided by Owner

H. 10 28 00.06 Metal Framed Lavatory Mirror

Manufacturer:

1. Bradley Corp. Model 780 sizes show on drawings.

I. 10 28 00.02 Wall Mounted Soap Dispenser

Manufacturer: Provided by Owner

J. 10 28 00.18 Robe/Towel Hook

Manufacturer:

1. Bradley Corp. Model 9119

K. Adhesive: Two component epoxy type, waterproof.

L. Fasteners, Screws, and Bolts: Hot-dipped galvanized steel, tamper-proof type.

2.2 FABRICATION

- A. Form surfaces flat without distortion. Weld and grind joints smooth.
- B. Shop assemble components and package with anchors and fittings.
- C. Back paint components to prevent electrolysis.
- D. Provide steel anchor plates, adapters, and anchor components for installation.
- E. Hot dip galvanize exposed and painted ferrous metal and fastening devices.

PART 3 - EXECUTION

3.1 EXAMINATION AND PREPARATION

- A. Verify exact location of accessories for installation.
- B. Deliver inserts and rough-in frames to site. Provide templates and rough-in measurements as required.

3.2 INSTALLATION

- A. Install fixtures, accessories and items in accordance with manufacturers' instructions.
- B. Install plumb and level, securely and rigidly anchored to substrate.

END OF SECTION

SECTION 12 30 00

CASEWORK

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Provide all coordination, preparation and mounting blocking for the complete installation of factory fabricated pre-finished cabinet work

General Contractor to coordinate and schedule all preparation for installation of cabinets and accessories. General Contractor to provide rubber base as specified in Section 09650 and shall provide protection of work as required in Article 3.4c and 3.4d.

1.2 RELATED WORK

- A. Section 06 20 00 Finish Carpentry
- B. Building service outlets for connection of all electrical and plumbing lines, within the confined floor or wall areas of case work: Divisions 22,23 and 26
- C. General millwork and wood trim items: Section 06200 Finish Carpentry

1.3 SUBMITTALS

- A. Submit shop drawings in accordance with General Conditions. Show materials, dimensions, sinks, fittings hardware and other accessories.
 - 1. Locate sink center lines for guidance of other trades.
 - 2. Show connections of cases to each other and to adjacent work whether or not all materials are furnished by factory fabricator.
 - 3. Submit catalog data cross referenced to the shop drawings for easy use.
- B. Samples: Submit samples of counter top covering and facing material for approval and color selection.
- C. Colors (Plastic Laminate): Architect shall have the option of selecting any color made by the plastic laminate manufacturer being used. The cabinet manufacturer shall offer at least one of the following manufacturers for selection purposes:
 - 1. Formica
 - 2. Wilson Art
 - 3. Nevamar

1.4 JOB DIMENSIONS

- A. Verify dimensions of all cabinet locations in building before fabrication.
- B. Fabricate cabinet counter tops for scribe fit.

PART 2 - PRODUCTS

2.1 COUNTER TOPS

12 30 00.08 Counter Top

- A. Except as otherwise indicated, provide separate plastic laminate counter tops (installed on casework furnished in this section as indicated) to comply with the requirements for casework for plastic laminate finish.
- B. Particle Board: Minimum density (37 to 50 lbs./cu. ft.) wood chip and phenolic resin binders, compressed board, 3/4" thickness unless otherwise indicated.
- C. Plastic Laminate: Comply with NEMA LD3; type, thickness, color, pattern and finish as indicated, use NEMA Type 2, .050" thickness, colors, patterns, finishes, refer to section 06 20 00 and drawings.

2.2 ACCESSORIES

06 20 00.41 Steel Angle Counter Support

- A. 1/8" Steel Work Station Counter Support Brackets, size compatible with countertop profile – Support Brackets .com. 1-888-647-0200

PART 3 - EXECUTION

3.1 INSPECTION

- A. The installer must examine the substrate and the conditions under which the work under this section is to be performed, and notify the contractor in writing of unsatisfactory conditions. Do not proceed with work under this section until unsatisfactory conditions have been corrected in a manner acceptable to the installer.

3.2 PREPARATION

- A. Condition plastic faced casework to average prevailing humidity conditions in installation areas prior to installing.

3.3 INSTALLATION

- A. Install plumb, level, true and straight with no distortions. Shim as required, using concealed shims. Where plastic faced casework abuts other finished work, scribe and cut for accurate fit. Before making cutouts, drill pilot holes at corners.

- B. Trim and Molding: Install in single un-jointed lengths for openings and for runs less than maximum length of material available. For longer runs, use only one piece less than maximum length available in any straight run. Stagger joints in adjacent members.
- C. Adjust casework and hardware so that doors and drawers operate smoothly without warp or bind. Lubricate operating hardware as recommended by manufacturer.
- D. Counter tops: Anchor securely to base units as indicated. Scribe back splash to wall.
- E. Verify proper blocking and backing for all wall cabinet units before installation.

3.4 CLEANING AND PROTECTION

- A. Repair or remove and replace defective work as directed upon completion of installation.
- B. Clean plastic surfaces, repair minor damage per plastic laminate manufacturer's recommendations. Replace other damaged parts or units.
- C. Protection: Advise Contractor of procedures and precautions for protection of materials and installed plastic faced case work from damage by work of other trades until acceptance of the work by the Owner. Advise Contractor of the required temperature/humidity conditions which must be maintained during the remainder of the construction period.

SECTION 12 30 00
CASEWORK

- D. Cover casework with 4-mil polyethylene film, for protection against soiling and deterioration during remainder of construction period.

END OF SECTION

Section 12 52 03

Motorized Roller Shades

1.0 General

1.1 Related sections:

- 1.1.1 Section 06 10 00 Rough Carpentry
- 1.1.2 Section 08 51 13 Aluminum Windows
- 1.1.3 Section 09 20 00 Plaster and Gypsum Board
- 1.1.4 Section 09 50 00 Ceilings
- 1.1.5 Section 26 00 00 Electrical

Products Supplied by this section but installed by other trades

- 1.1.6 Aluminum or steel shade pockets recessed into either gypsum or system ceilings.
- 1.1.7 Aluminum, ceiling closure or housing trim profiles.
- 1.1.8 Electrical control components to enable control functions as specified in this section.

1.2 Summary:

- 1.2.1 Provide electrically operated interior roller shade dual motor shade system, with related hardware to complete the installation to the following locations: Specifier to provide scope of work.
- 1.2.2 Roller shades shall be mounted: In a metal pocket provided in this section or a recessed housing in the ceiling.

1.3 Quality Assurance

- 1.3.1 All bidders submitting bids on the work of this section shall meet or exceed the quality of materials, components and assemblies specified herein Bidders who do not comply with these performance specifications shall refrain from submitting a bid.
- 1.3.2 Alternate Bids, Alternative Products shall be submitted as per Section 01630 Substitutions and Product Options.
- 1.3.3 All work specified under this section supplied and installed entirely by one Subcontractor using his own forces.
- 1.3.4 Shades to be installed by a firm, with a minimum of ten (10) years experience, specializing in the installation of shading systems.
- 1.3.5 Conform to applicable Building Code and Local Authority having jurisdiction and all other standards noted.
- 1.3.6 Install one complete operating sample with accessories on site. Review the installation before proceeding with the remainder of the work. Adjust sample installation to gain acceptance. Accepted work may form part of the final installation.

1.4 Submittals and Test Reports

- 1.4.1 Submit duplicate samples of the specified fabric / shade cloth of each color and texture minimum size 8.5@ x 11@ (215mm x 280mm) for review.

1.5 Inspection / Preparation

- 1.5.1 Verify that all blocking and framing necessary to carry shade assembly hardware is properly installed and secure.

- 1.5.2 Verify that electrical and control wiring is completed (refer to Division 16).
- 1.5.3 Notify Architect in writing of any deficiencies in the work of other trades that would affect the window treatment system.
- 1.5.4 Make accurate measurements at the site before fabrication. Check layout of glazing framing sections, spans, and loading capabilities.

1.6 Delivery Storage and Handling:

- 1.6.1 Do not deliver to site until areas to receive shades are completely finished, all walls and ceilings completed and painted.
- 1.6.2 Deliver materials in original protective wrappings or containers, with manufacturers labels and sealed intact.
- 1.6.3 Handle and store materials according to manufacturers recommendations protecting materials and finishes from damages, marring of finishes or soiling.

1.7 Warrantee

- 1.7.1 Provide a limited manufacturers warrantee from the Date of Substantial Completion, covering the following:
 - A. Shade Hardware including electric motors: Ten (10) years
 - B. Electronic Control Equipment: Five (5) Years
 - C. Fabrics / Shade Cloth: Ten (10) Years
 - D. Aluminum and steel coatings: Ten (10) Years
- 1.7.2 Provide a limited installation warranty from Date of Substantial Completion, covering a period of one (1) year.
- 1.7.3 Submit standard manufacturers maintenance contract for review by Owner.

2.0 Products : Nysan Dual Motor/Shade System

2.1 Manufacturer:

- 2.1.1 Nysan Shading Systems Ltd. - #1, 115 - 28th Street S.E. Calgary AB T2A 5K4 Phone: 403.204.8675 Fax: 403.204.8676 Email: sales@nysan.com Website: <http://www.nysan.com>

2.2 Hardware:

2.2.1 Shade Mounting Brackets

- A. Mounting assembly
 - a. 1.5"x 1/8" thick aluminum mounting plate. Length was required by manufacturer.
 - b. Mounting plates shall be attached to 4", 5" or 6", depending upon system size, square HDPE plates.
 - c. All shade brackets shall be shipped completely assembled from the factory.
 - d. Motor coupling and end assemblies shall be as per the above angle and plate with an adjustable (Alan key) setscrew, to ensure proper leveling of the system.
 - e. Multiple shade panels (bands) being driven by a single motor may be coupled to a maximum angle of 90°
- B. Mounting assembly shall allow for continuous front or back-roll fascia across multiple shades without exposed fasteners.
- C. Shade roller tube shall be removable from mounting assembly without hardware removal.
- D. All non-metal components shall be self-lubricating.

- E. Shade hardware system shall provide for field adjustment or component replacement without removal of brackets, regardless of mounting location.
- F. Shade hardware shall allow for a bottom-up or a sideways roller tube installation and removal without removing brackets

2.2.2 Electrical Shade Motors

- A. Shade motor located inside the extruded aluminum roller tube with appropriate adaptors to allow for a smooth operation. Lifting capacity with a 30% safety ratio and not exceeding 30DB.
- B. Shade motor shall be an asynchronous unit, start and run, single phase type *125V - 60 Hz* thermally protected, brush-less motor, permanently lubricated bearings and gearbox manufactured from non corrosive metal gears containing a 3 phase planetary gear reducer. Non-metal planetary gearboxes will not be acceptable.
- C. Shade motor shall contain a conical steel disk brake allowing no slippage under high torque
- D. Shade motor shall be fitted with solid steel adjustable drive extensions, rectangular bar shaped for drive and torque transfer to single or multiple coupled extruded roller tubes.
- E. Motor speed shall range from 12 to 30 RPM and draw 1.1 to 3.4 Amps as selected by the shade manufacturer for proper system operation. Motor lead shall be plenum rated quality.
- F. Shade motor shall be equipped with externally located control wheels which allow exact control of shade limits in raised and lowered positions, preventing over winding of the fabric/shade cloth.
- G. Include all components for proper unit operation.

2.2.3 Motor Control System:

2.2.3 Roller Tube assembly:

- A. Top roller tube of one piece extruded aluminum tube, with 10 micron thick clear anodised coating, at the manufacturers recommended engineered diameter and wall thickness for maximum allowable deflection of $L/700$; Mill finish tubes will not be acceptable
- B. The roller tube shall be extruded with provision made for mechanical engagement with the operator and drive assembly.
- C. The extrusion shall have various channels to accept fabric attachment spline. The spline and slot reinforces the tube and retains the fabric and operating system.
- D. The spline will be an extruded vinyl profile, welded to the fabric band or panel, such that removal and re-installation of the fabric panels can occur without removing the roller tube and hardware. Fabric panels must be replaceable on site. Attachment of the fabric to the tube with double sided adhesive tapes, adhesives, staples, or rivets is not acceptable.

2.2.4 Hembars and Hembar Pockets:

- A. Custom A shaped Flat steel profile, 1.5"high, wall thickness engineered for weight requirements and adaptation to uneven surfaces, in welded hembar pocket with closed ends, to maintain bottom of shade fabric straight, and flat.

2.2.5 Fasteners:

- A. Non-corrosive to manufacturers recommendations.

2.2.6 Fabrics: SuperScreen 300 – Charcoal Pewter

A Shade #1: 5% openness

B. Shade #2: 0% openness

2.2.7 Optional Accessories:

A.

Pockets and Closures: Type and sizes recommended by manufacturer for project application.

2.3 Aluminum Finishes:

2.3.5 All exposed aluminum shall be or coloured to match window framing.

2.3.6 Unexposed aluminum unless otherwise specified: mill finish.

3.0 Execution:

3.1 Fabrication:

3.1.1 Shading system components manufactured and assembled allowing for installation techniques to suit project requirements.

3.1.2 Finished assemblies shall be, square, true to size and free from distortion, twist, or other defects that could affect their strength, operation or appearance. Factory applied finish shall be uniform, smooth and without blemishes.

3.1.3 The fabric shall be colourfast, retain its shape, not be affected by moisture or heat, and shall be non-flammable. Cut fabric to eliminate glare and reflection from shining surfaces while maintaining exterior view. The top of the fabric is retained in recessed spline of the shade roller and the bottom of the fabric is retained by the selected hem.

3.2 Installation:

3.2.1 Install work by manufacturer's skilled tradesmen and installed in strict accordance with manufacturers recommendations.

3.2.2 All items installed, plumbed, squared, rigidly coupled and adequately anchored, maintaining uniformed clearances, accurate alignment levels, and parallel with the window plane. Fabric shall not travel more than 3 mm (0.125") in either direction within channels after installation.

3.2.3 The solar screen and / or blackout fabric shall be pre-measured and manufactured off-site

3.3 Adjusting and Cleaning:

3.3.1 Adjust shades and operating components as required to ensure smooth and trouble free operation without binding.

3.3.2 Adjust shade and shade-cloth to hang flat without buckling or distortion.

3.3.3 Clean shades and exposed components.

3.3.4 Replace work, which cannot be satisfactorily repaired, adjusted, or cleaned.

END

SECTION 220513 - COMMON MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on ac power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.2 COORDINATION

- A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:
 - 1. Motor controllers.
 - 2. Torque, speed, and horsepower requirements of the load.
 - 3. Ratings and characteristics of supply circuit and required control sequence.
 - 4. Ambient and environmental conditions of installation location.

PART 2 - PRODUCTS

2.1 GENERAL MOTOR REQUIREMENTS

- A. Comply with requirements in this Section except when stricter requirements are specified in plumbing equipment schedules or Sections.
- B. Comply with NEMA MG 1 unless otherwise indicated.

2.2 MOTOR CHARACTERISTICS

- A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet above sea level.
- B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

2.3 POLYPHASE MOTORS

- A. Description: NEMA MG 1, Design B, medium induction motor.
- B. Efficiency: Energy efficient, as defined in NEMA MG 1.
- C. Service Factor: 1.15.
- D. Multispeed Motors: Variable torque.
 - 1. For motors with 2:1 speed ratio, consequent pole, single winding.

2. For motors with other than 2:1 speed ratio, separate winding for each speed.
- E. Rotor: Random-wound, squirrel cage.
 - F. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.
 - G. Temperature Rise: Match insulation rating.
 - H. Insulation: Class F.
 - I. Code Letter Designation:
 1. Motors 15 HP and Larger: NEMA starting Code F or Code G.
 2. Motors Smaller than 15 HP: Manufacturer's standard starting characteristic.
 - J. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

2.4 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS

- A. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.
- B. Motors Used with Variable Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.
 1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width modulated inverters.
 2. Energy- and Premium-Efficient Motors: Class B temperature rise; Class F insulation.
 3. Inverter-Duty Motors: Class F temperature rise; Class H insulation.
 4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.

2.5 SINGLE-PHASE MOTORS

- A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:
 1. Permanent-split capacitor.
 2. Split phase.
 3. Capacitor start, inductor run.
 4. Capacitor start, capacitor run.
- B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.
- C. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.
- D. Motors 1/20 HP and Smaller: Shaded-pole type.

- E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 15057

SECTION 220529 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Metal pipe hangers and supports.
 - 2. Trapeze pipe hangers.
 - 3. Thermal-hanger shield inserts.
 - 4. Fastener systems.
 - 5. Pipe positioning systems.
 - 6. Equipment supports.

1.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Structural Performance: Hangers and supports for plumbing piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASME B31.9.
 - 1. Design supports for multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.
 - 2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Show fabrication and installation details and include calculations for the following; include Product Data for components:
 - 1. Trapeze pipe hangers.
 - 2. Equipment supports.
- C. Delegated-Design Submittal: For trapeze hangers indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- D. Welding certificates.

1.4 QUALITY ASSURANCE

- A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

PART 2 - PRODUCTS

2.1 METAL PIPE HANGERS AND SUPPORTS

- A. Carbon-Steel Pipe Hangers and Supports:
 - 1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
 - 2. Galvanized Metallic Coatings: Pregalvanized or hot dipped.
 - 3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
 - 4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
 - 5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

2.2 TRAPEZE PIPE HANGERS

- A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.3 THERMAL-HANGER SHIELD INSERTS

- A. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with 100-psig or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength and vapor barrier.
- B. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate with 100-psig or ASTM C 552, Type II cellular glass with 100-psig or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength.
- C. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.
- D. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.
- E. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.4 FASTENER SYSTEMS

- A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

- B. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.5 PIPE POSITIONING SYSTEMS

- A. Description: IAPMO PS 42, positioning system of metal brackets, clips, and straps for positioning piping in pipe spaces; for plumbing fixtures in commercial applications.

2.6 EQUIPMENT SUPPORTS

- A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

2.7 MISCELLANEOUS MATERIALS

- A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.
- B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
 - 1. Properties: Nonstaining, noncorrosive, and nongaseous.
 - 2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT INSTALLATION

- A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.
- B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.
 - 1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
 - 2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.
- C. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.
- D. Fastener System Installation:
 - 1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
 - 2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

- E. Pipe Positioning-System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture. See Division 22 plumbing fixture Sections for requirements for pipe positioning systems for plumbing fixtures.
- F. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
- G. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- H. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- I. Install lateral bracing with pipe hangers and supports to prevent swaying.
- J. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.
- K. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- L. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.
- M. Insulated Piping:
 - 1. Attach clamps and spacers to piping.
 - a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
 - b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
 - c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.
 - 2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
 - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
 - 3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
 - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
 - 4. Shield Dimensions for Pipe: Not less than the following:
 - a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
 - b. NPS 4: 12 inches long and 0.06 inch thick.
 - c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
 - d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
 - e. NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.

5. Pipes NPS 8 and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.
6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.2 EQUIPMENT SUPPORTS

- A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.
- B. Grouting: Place grout under supports for equipment and make bearing surface smooth.
- C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.3 METAL FABRICATIONS

- A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.
- B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
- C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:
 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 2. Obtain fusion without undercut or overlap.
 3. Remove welding flux immediately.
 4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.4 ADJUSTING

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.5 PAINTING

- A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
 1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.
- B. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Division 9 painting Sections.
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

3.6 HANGER AND SUPPORT SCHEDULE

- A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.
- B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.
- C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.
- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- E. Use carbon-steel pipe hangers and supports and metal trapeze pipe hangers and attachments for general service applications.
- F. Use stainless-steel pipe hangers and stainless-steel or corrosion-resistant attachments for hostile environment applications.
- G. Use copper-plated pipe hangers and copper or stainless-steel attachments for copper piping and tubing.
- H. Use padded hangers for piping that is subject to scratching.
- I. Use thermal-hanger shield inserts for insulated piping and tubing.
- J. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.
 - 2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F, pipes NPS 4 to NPS 24, requiring up to 4 inches of insulation.
 - 3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36, requiring clamp flexibility and up to 4 inches of insulation.
 - 4. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
 - 5. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.
 - 6. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
 - 7. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
 - 8. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30, from two rods if longitudinal movement caused by expansion and contraction might occur.
 - 9. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
- K. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.
 - 2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.

- L. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
 2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
- M. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
 2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
 3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
 4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
 5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
 6. C-Clamps (MSS Type 23): For structural shapes.
 7. Welded-Steel Brackets: For support of pipes from below, or for suspending from above by using clip and rod. Use one of the following for indicated loads:
 - a. Light (MSS Type 31): 750 lb.
 - b. Medium (MSS Type 32): 1500 lb.
 - c. Heavy (MSS Type 33): 3000 lb.
 8. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
 9. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
- N. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
 2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
 3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.
- O. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
 2. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.
 3. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.
- P. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.
- Q. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.
- R. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

END OF SECTION 220529

SECTION 220553 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Equipment labels.
 2. Warning signs and labels.
 3. Pipe labels.

1.2 SUBMITTAL

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

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

- A. Metal Labels for Equipment:
1. Material and Thickness: Brass, 0.032-inch or anodized aluminum, 0.032-inch 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 by 3/4 inch.
 3. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, 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. Plastic Labels for Equipment:
1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.
 2. Letter Color: Black.
 3. Background Color: White.
 4. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
 5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
 6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
 7. Fasteners: Stainless-steel rivets or self-tapping screws.
 8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

- C. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified.
- D. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch 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.

2.2 WARNING SIGNS AND LABELS

- A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.
- B. Letter Color: White.
- C. Background Color: Red.
- D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
- E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
- F. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
- G. Fasteners: Stainless-steel rivets or self-tapping screws.
- H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- I. Label Content: Include caution and warning information, plus emergency notification instructions.

2.3 PIPE LABELS

- A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.
- B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.
- C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.
- D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.
 - 1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.
 - 2. Lettering Size: At least 1-1/2 inches high.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 EQUIPMENT LABEL INSTALLATION

- A. Install or permanently fasten labels on each major item of mechanical equipment.
- B. Locate equipment labels where accessible and visible.

3.3 PIPE LABEL INSTALLATION

- A. Piping Color-Coding: Painting of piping is specified in Division 9 Section "Interior Painting."
- B. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
 - 1. Near each valve and control device.
 - 2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
 - 3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
 - 4. At access doors, manholes, and similar access points that permit view of concealed piping.
 - 5. Near major equipment items and other points of origination and termination.
 - 6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
 - 7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.
- C. Pipe Label Color Schedule:
 - 1. Domestic Water Piping:
 - a. Background Color: Blue.
 - b. Letter Color: White.

END OF SECTION 220553

SECTION 220700 - PLUMBING INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Insulation Materials:
 - a. Cellular glass.
 - b. Flexible elastomeric.
 - c. Mineral fiber.
 - d. Polyolefin.
 - e. Polystyrene.
2. Insulating cements.
3. Adhesives.
4. Mastics.
5. Sealants.
6. Factory-applied jackets.
7. Field-applied fabric-reinforcing mesh.
8. Field-applied jackets.
9. Tapes.
10. Securements.
11. Corner angles.

B. Related Sections include the following:

1. Division 23 Section "HVAC Insulation."

1.2 SUBMITTALS

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

B. Shop Drawings:

1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
2. Detail attachment and covering of heat tracing inside insulation.
3. Detail insulation application at pipe expansion joints for each type of insulation.
4. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
5. Detail removable insulation at piping specialties, equipment connections, and access panels.
6. Detail application of field-applied jackets.
7. Detail application at linkages of control devices.
8. Detail field application for each equipment type.

C. Field quality-control reports.

1.3 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: Insulation and related materials shall have fire-test-response characteristics indicated, as determined by testing identical products per ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing and inspecting agency.
 - 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
 - 2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

- A. Comply with requirements in Part 3 schedule articles for where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.
- D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
- E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- F. Cellular Glass: Inorganic, incombustible, foamed or cellulated glass with annealed, rigid, hermetically sealed cells. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Cell-U-Foam Corporation; Ultra-CUF.
 - b. Pittsburgh Corning Corporation; Foamglas Super K.
 - 2. Block Insulation: ASTM C 552, Type I.
 - 3. Special-Shaped Insulation: ASTM C 552, Type III.
 - 4. Board Insulation: ASTM C 552, Type IV.
 - 5. Preformed Pipe Insulation without Jacket: Comply with ASTM C 552, Type II, Class 1.
 - 6. Preformed Pipe Insulation with Factory-Applied ASJ: Comply with ASTM C 552, Type II, Class 2.
 - 7. Factory fabricate shapes according to ASTM C 450 and ASTM C 585.
- G. Flexible Elastomeric: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Aeroflex USA Inc.; Aerocel.
 - b. Armacell LLC; AP Armaflex.
 - c. RBX Corporation; Insul-Sheet 1800 and Insul-Tube 180.

- d. Pipe and tank insulation is used for large-diameter piping and vessels. ASJ is commonly used.

2.2 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.
- B. Cellular-Glass Polystyrene Adhesive: Solvent-based resin adhesive, with a service temperature range of minus 75 to plus 300 deg F.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Products, Division of ITW; CP-96.
 - b. Foster Products Corporation, H. B. Fuller Company; 81-33.
 - 2. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- C. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Aeroflex USA Inc.; Aeroseal.
 - b. Armacell LCC; 520 Adhesive.
 - c. Foster Products Corporation, H. B. Fuller Company; 85-75.
 - d. RBX Corporation; Rubatex Contact Adhesive.
 - 2. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- D. ASJ Adhesive, and FSK and PVDC Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Products, Division of ITW; CP-82.
 - b. Foster Products Corporation, H. B. Fuller Company; 85-20.
 - c. ITW TACC, Division of Illinois Tool Works; S-90/80.
 - d. Marathon Industries, Inc.; 225.
 - e. Mon-Eco Industries, Inc.; 22-25.
 - 2. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- E. PVC Jacket Adhesive: Compatible with PVC jacket.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Dow Chemical Company (The); 739, Dow Silicone.
 - b. Johns-Manville; Zeston Perma-Weld, CEEL-TITE Solvent Welding Adhesive.
 - c. P.I.C. Plastics, Inc.; Welding Adhesive.
 - d. Speedline Corporation; Speedline Vinyl Adhesive.

2. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.3 MASTICS

- A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-C-19565C, Type II.

- B. Vapor-Barrier Mastic: Water based; suitable for indoor and outdoor use on below ambient services.

1. Products: Subject to compliance with requirements, provide one of the following:

- a. Childers Products, Division of ITW; CP-35.
- b. Foster Products Corporation, H. B. Fuller Company; 30-90.
- c. ITW TACC, Division of Illinois Tool Works; CB-50.
- d. Marathon Industries, Inc.; 590.
- e. Mon-Eco Industries, Inc.; 55-40.
- f. Vimasco Corporation; 749.

2. Water-Vapor Permeance: ASTM E 96, Procedure B, 0.013 perm at 43-mil dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F.
4. Solids Content: ASTM D 1644, 59 percent by volume and 71 percent by weight.
5. Color: White.

- C. Breather Mastic: Water based; suitable for indoor and outdoor use on above ambient services.

1. Products: Subject to compliance with requirements, provide one of the following:

- a. Childers Products, Division of ITW; CP-10.
- b. Foster Products Corporation, H. B. Fuller Company; 35-00.
- c. ITW TACC, Division of Illinois Tool Works; CB-05/15.
- d. Marathon Industries, Inc.; 550.
- e. Mon-Eco Industries, Inc.; 55-50.
- f. Vimasco Corporation; WC-1/WC-5.

2. Water-Vapor Permeance: ASTM F 1249, 3 perms at 0.0625-inch dry film thickness.
3. Service Temperature Range: Minus 20 to plus 200 deg F.
4. Solids Content: 63 percent by volume and 73 percent by weight.
5. Color: White.

2.4 SEALANTS

- A. Joint Sealants:

1. Joint Sealants for Cellular-Glass Products: Subject to compliance with requirements, provide one of the following:

- a. Childers Products, Division of ITW; CP-76.
- b. Foster Products Corporation, H. B. Fuller Company; 30-45.
- c. Marathon Industries, Inc.; 405.
- d. Mon-Eco Industries, Inc.; 44-05.
- e. Pittsburgh Corning Corporation; Pittseal 444.
- f. Vimasco Corporation; 750.

2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Permanently flexible, elastomeric sealant.
4. Service Temperature Range: Minus 100 to plus 300 deg F.
5. Color: White or gray.
6. For indoor applications, use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. FSK and Metal Jacket Flashing Sealants:

1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Products, Division of ITW; CP-76-8.
 - b. Foster Products Corporation, H. B. Fuller Company; 95-44.
 - c. Marathon Industries, Inc.; 405.
 - d. Mon-Eco Industries, Inc.; 44-05.
 - e. Vimasco Corporation; 750.
2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: Aluminum.
6. For indoor applications, use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:

1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Products, Division of ITW; CP-76.
2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: White.
6. For indoor applications, use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.5 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.
4. PVDC Jacket for Indoor Applications: 4-mil- thick, white PVDC biaxially oriented barrier film with a permeance at 0.02 perms when tested according to ASTM E 96 and with a flame-spread index of 5 and a smoke-developed index of 20 when tested according to ASTM E 84.
 - a. Products: Subject to compliance with requirements, provide one of the following:

- 1) Dow Chemical Company (The); Saran 540 Vapor Retarder Film and Saran 560 Vapor Retarder Film.
5. PVDC Jacket for Outdoor Applications: 6-mil- thick, white PVDC biaxially oriented barrier film with a permeance at 0.01 perms when tested according to ASTM E 96 and with a flame-spread index of 5 and a smoke-developed index of 25 when tested according to ASTM E 84.
 - a. Products: Subject to compliance with requirements, provide one of the following:
 - 1) Dow Chemical Company (The); Saran 540 Vapor Retarder Film and Saran 560 Vapor Retarder Film.
 6. PVDC-SSL Jacket: PVDC jacket with a self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip.
 - a. Products: Subject to compliance with requirements, provide one of the following:
 - 1) Dow Chemical Company (The); Saran 540 Vapor Retarder Film and Saran 560 Vapor Retarder Film.

2.6 FIELD-APPLIED JACKETS

- A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.
- B. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Johns Manville; Zeston.
 - b. P.I.C. Plastics, Inc.; FG Series.
 - c. Proto PVC Corporation; LoSmoke.
 - d. Speedline Corporation; SmokeSafe.
 2. Adhesive: As recommended by jacket material manufacturer.
 3. Color: White.
 4. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.
 - a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.
 5. Factory-fabricated tank heads and tank side panels.

2.7 TAPES

- A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0835.

- b. Compac Corp.; 104 and 105.
 - c. Ideal Tape Co., Inc., an American Biltrite Company; 428 AWF ASJ.
 - d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.
 - 2. Width: 3 inches.
 - 3. Thickness: 11.5 mils.
 - 4. Adhesion: 90 ounces force/inch in width.
 - 5. Elongation: 2 percent.
 - 6. Tensile Strength: 40 lbf/inch in width.
 - 7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.
- B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.
- 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0827.
 - b. Compac Corp.; 110 and 111.
 - c. Ideal Tape Co., Inc., an American Biltrite Company; 491 AWF FSK.
 - d. Venture Tape; 1525 CW, 1528 CW, and 1528 CW/SQ.
 - 2. Width: 3 inches.
 - 3. Thickness: 6.5 mils.
 - 4. Adhesion: 90 ounces force/inch in width.
 - 5. Elongation: 2 percent.
 - 6. Tensile Strength: 40 lbf/inch in width.
 - 7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.
- C. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive. Suitable for indoor and outdoor applications.
- 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0555.
 - b. Compac Corp.; 130.
 - c. Ideal Tape Co., Inc., an American Biltrite Company; 370 White PVC tape.
 - d. Venture Tape; 1506 CW NS.
 - 2. Width: 2 inches.
 - 3. Thickness: 6 mils.
 - 4. Adhesion: 64 ounces force/inch in width.
 - 5. Elongation: 500 percent.
 - 6. Tensile Strength: 18 lbf/inch in width.
- D. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.
- 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0800.
 - b. Compac Corp.; 120.
 - c. Ideal Tape Co., Inc., an American Biltrite Company; 488 AWF.
 - d. Venture Tape; 3520 CW.
 - 2. Width: 2 inches.
 - 3. Thickness: 3.7 mils.

4. Adhesion: 100 ounces force/inch in width.
5. Elongation: 5 percent.
6. Tensile Strength: 34 lbf/inch in width.

E. PVDC Tape: White vapor-retarder PVDC tape with acrylic adhesive.

1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Dow Chemical Company (The); Saran 540 Vapor Retarder Tape.
2. Width: 3 inches.
3. Film Thickness: 4 mils.
4. Adhesive Thickness: 1.5 mils.
5. Elongation at Break: 145 percent.
6. Tensile Strength: 55 lbf/inch in width.

2.8 SECUREMENTS

A. Aluminum Bands: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch wide with wing or closed seal.

1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Products; Bands.
 - b. PABCO Metals Corporation; Bands.
 - c. RPR Products, Inc.; Bands.

B. Insulation Pins and Hangers:

1. Metal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
 - a. Products: Subject to compliance with requirements, provide one of the following:
 - 1) AGM Industries, Inc.; Tactoo Insul-Hangers, Series T.
 - 2) GEMCO; Perforated Base.
 - 3) Midwest Fasteners, Inc.; Spindle.
 - b. Baseplate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
 - c. Spindle: Copper- or zinc-coated, low carbon steel, fully annealed, 0.106-inch- diameter shank, length to suit depth of insulation indicated.
 - d. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.
2. Nonmetal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate fastened to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
 - a. Products: Subject to compliance with requirements, provide one of the following:
 - 1) GEMCO; Nylon Hangers.
 - 2) Midwest Fasteners, Inc.; Nylon Insulation Hangers.

- b. Baseplate: Perforated, nylon sheet, 0.030 inch thick by 1-1/2 inches in diameter.
 - c. Spindle: Nylon, 0.106-inch- diameter shank, length to suit depth of insulation indicated, up to 2-1/2 inches.
 - d. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.
3. Self-Sticking-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
- a. Products: Subject to compliance with requirements, provide one of the following:
 - 1) AGM Industries, Inc.; Tactoo Insul-Hangers, Series TSA.
 - 2) GEMCO; Press and Peel.
 - 3) Midwest Fasteners, Inc.; Self Stick.
 - b. Baseplate: Galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
 - c. Spindle: Copper- or zinc-coated, low carbon steel, fully annealed, 0.106-inch- diameter shank, length to suit depth of insulation indicated.
 - d. Adhesive-backed base with a peel-off protective cover.
4. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- thick, galvanized-steel sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.
- a. Products: Subject to compliance with requirements, provide one of the following:
 - 1) AGM Industries, Inc.; RC-150.
 - 2) GEMCO; R-150.
 - 3) Midwest Fasteners, Inc.; WA-150.
 - 4) Nelson Stud Welding; Speed Clips.
 - b. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.
5. Nonmetal Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- thick nylon sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.
- a. Products: Subject to compliance with requirements, provide one of the following:
 - 1) GEMCO.
 - 2) Midwest Fasteners, Inc.
- C. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.
- D. Wire: 0.080-inch nickel-copper alloy.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- a. C & F Wire.
 - b. Childers Products.
 - c. PABCO Metals Corporation.

- d. RPR Products, Inc.

2.9 CORNER ANGLES

- A. PVC Corner Angles: 30 mils thick, minimum 1 by 1 inch, PVC according to ASTM D 1784, Class 16354-C. White or color-coded to match adjacent surface.
- B. Aluminum Corner Angles: 0.040 inch thick, minimum 1 by 1 inch, aluminum according to ASTM B 209, Alloy 3003, 3005, 3105 or 5005; Temper H-14.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
- B. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.
- C. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.2 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment and piping including fittings, valves, and specialties.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment and pipe system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- G. Keep insulation materials dry during application and finishing.
- H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- I. Install insulation with least number of joints practical.
- J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
 - 1. Install insulation continuously through hangers and around anchor attachments.

2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- L. Install insulation with factory-applied jackets as follows:
1. Draw jacket tight and smooth.
 2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
 3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.
 - a. For below ambient services, apply vapor-barrier mastic over staples.
 4. Cover joints and seams with tape as recommended by insulation material manufacturer to maintain vapor seal.
 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.
- M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.
- P. For above ambient services, do not install insulation to the following:
1. Vibration-control devices.
 2. Testing agency labels and stamps.
 3. Nameplates and data plates.
 4. Manholes.
 5. Handholes.
 6. Cleanouts.

3.3 PENETRATIONS

- A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
1. Seal penetrations with flashing sealant.
 2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.

4. Seal jacket to roof flashing with flashing sealant.
- B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.
- C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
1. Seal penetrations with flashing sealant.
 2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
 4. Seal jacket to wall flashing with flashing sealant.
- D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.
1. Comply with requirements in Division 7 Section "Through-Penetration Firestop Systems" for firestopping and fire-resistive joint sealers.
- F. Insulation Installation at Floor Penetrations:
1. Pipe: Install insulation continuously through floor penetrations.
 2. Seal penetrations through fire-rated assemblies. Comply with requirements in Division 7 Section "Through-Penetration Firestop Systems."

3.4 GENERAL PIPE INSULATION INSTALLATION

- A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.
- B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:
1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity, unless otherwise indicated.
 2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
 3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
 4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.

5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below ambient services, provide a design that maintains vapor barrier.
 6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
 7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below ambient services and a breather mastic for above ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
 8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
 9. Stencil or label the outside insulation jacket of each union with the word "UNION." Match size and color of pipe labels.
- C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes, vessels, and equipment. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.
- D. Install removable insulation covers at locations indicated. Installation shall conform to the following:
1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
 2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
 3. Construct removable valve insulation covers in same manner as for flanges except divide the two-part section on the vertical center line of valve body.
 4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
 5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.5 CELLULAR-GLASS INSULATION INSTALLATION

- A. Insulation Installation on Straight Pipes and Tubes:
1. Secure each layer of insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
 2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
 3. For insulation with factory-applied jackets on above ambient services, secure laps with outward clinched staples at 6 inches o.c.

4. For insulation with factory-applied jackets on below ambient services, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of cellular-glass block insulation of same thickness as pipe insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
2. When preformed sections of insulation are not available, install mitered sections of cellular-glass insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of cellular-glass insulation to valve body.
2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.

3.6 FLEXIBLE ELASTOMERIC INSULATION INSTALLATION

- A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:

1. Install pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install mitered sections of pipe insulation.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed valve covers manufactured of same material as pipe insulation when available.

2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.
4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.7 FIELD-APPLIED JACKET INSTALLATION

- A. Where FSK jackets are indicated, install as follows:
 1. Draw jacket material smooth and tight.
 2. Install lap or joint strips with same material as jacket.
 3. Secure jacket to insulation with manufacturer's recommended adhesive.
 4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch- wide joint strips at end joints.
 5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.
- B. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints; for horizontal applications, install with longitudinal seams along top and bottom of tanks and vessels. Seal with manufacturer's recommended adhesive.
 1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.
- C. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.
- D. Where PVDC jackets are indicated, install as follows:
 1. Apply three separate wraps of filament tape per insulation section to secure pipe insulation to pipe prior to installation of PVDC jacket.
 2. Wrap factory-presize jackets around individual pipe insulation sections with one end overlapping the previously installed sheet. Install presize jacket with an approximate overlap at butt joint of 2 inches over the previous section. Adhere lap seal using adhesive or SSL, and then apply 1-1/4 circumferences of appropriate PVDC tape around overlapped butt joint.
 3. Continuous jacket can be spiral wrapped around a length of pipe insulation. Apply adhesive or PVDC tape at overlapped spiral edge. When electing to use adhesives, refer to manufacturer's written instructions for application of adhesives along this spiral edge to maintain a permanent bond.
 4. Jacket can be wrapped in cigarette fashion along length of roll for insulation systems with an outer circumference of 33-1/2 inches or less. The 33-1/2-inch- circumference limit allows for 2-inch-overlap seal. Using the length of roll allows for longer sections of jacket to be installed at one time. Use adhesive on the lap seal. Visually inspect lap seal for "fishmouthing," and use PVDC tape along lap seal to secure joint.
 5. Repair holes or tears in PVDC jacket by placing PVDC tape over the hole or tear and wrapping a minimum of 1-1/4 circumferences to avoid damage to tape edges.

3.8 FINISHES

- A. Equipment and Pipe Insulation with ASJ or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Division 9 painting Sections.
 - 1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.
 - a. Finish Coat Material: Interior, flat, latex-emulsion size.
- B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.
- C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.
- D. Do not field paint aluminum or stainless-steel jackets.

3.9 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:
 - 1. Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe, three locations of threaded fittings, three locations of welded fittings, two locations of threaded strainers, two locations of welded strainers, three locations of threaded valves, and three locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.
- C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.10 PIPING INSULATION SCHEDULE, GENERAL

- A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.
- B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
 - 1. Drainage piping located in crawl spaces.
 - 2. Underground piping.
 - 3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.11 INDOOR PIPING INSULATION SCHEDULE

- A. Domestic Cold, Hot, and Recirculated Hot Water: Insulation shall be one of the following:
 - 1. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch thick.

- B. Stormwater and Overflow: Insulation shall be one of the following:
 - 1. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
 - 2. Polyolefin: 1 inch thick.
- C. Roof Drain and Overflow Drain Bodies: Insulation shall be one of the following:
 - 1. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
 - 2. Polyolefin: 1 inch thick.
- D. Exposed Sanitary Drains, Domestic Water, Domestic Hot Water, and Stops for Plumbing Fixtures for People with Disabilities: Insulation shall be one of the following:
 - 1. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch thick.
 - 2. Polyolefin: 1/2 inch thick.
- E. Sanitary Waste Piping Where Heat Tracing Is Installed: Insulation shall be one of the following:
 - 1. Cellular Glass: 2 inches thick.
 - 2. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1-1/2 inches thick.

3.12 OUTDOOR, UNDERGROUND PIPING INSULATION SCHEDULE

- A. Loose-fill insulation, for belowground piping, is specified in Division 2 piping distribution Sections.
- B. Sanitary Waste Piping, All Sizes, Where Heat Tracing Is Installed: Cellular glass, 2 inches thick.

3.13 INDOOR, FIELD-APPLIED JACKET SCHEDULE

- A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
- B. If more than one material is listed, selection from materials listed is Contractor's option.
- C. Piping, Concealed:
 - 1. None.
 - 2. PVC: 20 mils thick.
 - 3. Aluminum, Smooth: 0.016 inch thick.
- D. Piping, Exposed:
 - 1. None.
 - 2. PVC: 20 mils thick.
 - 3. Aluminum, Smooth: 0.016 inch thick.

END OF SECTION 220700

SECTION 221116 - DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Under-building slab and aboveground domestic water pipes, tubes, fittings, and specialties inside the building.
2. Specialty valves.
3. Flexible connectors.
4. Water meters furnished by utility company for installation by Contractor.
5. Water meters.

B. Related Section:

1. Division 2 Section "Water Distribution" for water-service piping and water meters outside the building from source to the point where water-service piping enters the building.

1.2 SUBMITTALS

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

B. Field quality-control reports.

1.3 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF 61 for potable domestic water piping and components.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.2 COPPER TUBE AND FITTINGS

A. Hard Copper Tube: ASTM B 88, Type K water tube, drawn temper.

1. Cast-Copper Solder-Joint Fittings: ASME B16.18, pressure fittings.
2. Wrought-Copper Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.
3. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.

4. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.
5. Copper Pressure-Seal-Joint Fittings:
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Elkhart Products Corporation; Industrial Division.
 - 2) NIBCO INC.
 - 3) Viega; Plumbing and Heating Systems.
 - b. NPS 2 and Smaller: Wrought-copper fitting with EPDM-rubber O-ring seal in each end.
 - c. NPS 2-1/2 to NPS 4: Cast-bronze or wrought-copper fitting with EPDM-rubber O-ring seal in each end.

6. Copper Push-on-Joint Fittings:

- a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) NVent LLC.
- b. Description: Cast-copper fitting complying with ASME B16.18 or wrought-copper fitting complying with ASME B 16.22; with stainless-steel teeth and EPDM-rubber O-ring seal in each end instead of solder-joint ends.

B. Soft Copper Tube: ASTM B 88, Type K water tube, annealed temper.

1. Copper Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.
2. Copper Pressure-Seal-Joint Fittings:
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Elkhart Products Corporation; Industrial Division.
 - 2) NIBCO INC.
 - 3) Viega; Plumbing and Heating Systems.
 - b. NPS 2 and Smaller: Wrought-copper fitting with EPDM-rubber O-ring seal in each end.
 - c. NPS 3 and NPS 4: Cast-bronze or wrought-copper fitting with EPDM-rubber O-ring seal in each end.

2.3 PIPING JOINING MATERIALS

- A. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
- B. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.

2.4 SPECIALTY VALVES

- A. Comply with requirements in Division 22 Section "General-Duty Valves for Plumbing Piping" for general-duty metal valves.
- B. Comply with requirements in Division 22 Section "Domestic Water Piping Specialties" for balancing valves, drain valves, backflow preventers, and vacuum breakers.

2.5 DIELECTRIC FITTINGS

- A. General Requirements: Assembly of copper alloy and ferrous materials or ferrous material body with separating nonconductive insulating material suitable for system fluid, pressure, and temperature.
- B. Dielectric Unions:
 - 1. Description:
 - a. Pressure Rating: 150 psig at 180 deg F.
 - b. End Connections: Solder-joint copper alloy and threaded ferrous.
- C. Dielectric Flanges:
 - 1. Description:
 - a. Factory-fabricated, bolted, companion-flange assembly.
 - b. Pressure Rating: 150 psig.
 - c. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.
- D. Dielectric-Flange Kits:
 - 1. Description:
 - a. Nonconducting materials for field assembly of companion flanges.
 - b. Pressure Rating: 150 psig.
 - c. Gasket: Neoprene or phenolic.
 - d. Bolt Sleeves: Phenolic or polyethylene.
 - e. Washers: Phenolic with steel backing washers.
- E. Dielectric Couplings:
 - 1. Description:
 - a. Galvanized-steel coupling.
 - b. Pressure Rating: 300 psig at 225 deg F.
 - c. End Connections: Female threaded.
 - d. Lining: Inert and noncorrosive, thermoplastic.
- F. Dielectric Nipples:
 - 1. Description:
 - a. Electroplated steel nipple complying with ASTM F 1545.
 - b. Pressure Rating: 300 psig at 225 deg F.

- c. End Connections: Male threaded or grooved.
- d. Lining: Inert and noncorrosive, propylene.

2.6 FLEXIBLE CONNECTORS

- A. Bronze-Hose Flexible Connectors: Corrugated-bronze tubing with bronze wire-braid covering and ends brazed to inner tubing.
 - 1. Working-Pressure Rating: Minimum 200 psig.
 - 2. End Connections NPS 2 and Smaller: Threaded copper pipe or plain-end copper tube.
 - 3. End Connections NPS 2-1/2 and Larger: Flanged copper alloy.
- B. Stainless-Steel-Hose Flexible Connectors: Corrugated-stainless-steel tubing with stainless-steel wire-braid covering and ends welded to inner tubing.
 - 1. Working-Pressure Rating: Minimum 200 psig.
 - 2. End Connections NPS 2 and Smaller: Threaded steel-pipe nipple.
 - 3. End Connections NPS 2-1/2 and Larger: Flanged steel nipple.

PART 3 - EXECUTION

3.1 EARTHWORK

- A. Comply with requirements in Division 2 Section "Earthwork" for excavating, trenching, and backfilling.

3.2 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- B. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."
- C. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve, inside the building at each domestic water service entrance.
- D. Install shutoff valve immediately upstream of each dielectric fitting.
- E. Install water-pressure-reducing valves downstream from shutoff valves.
- F. Install domestic water piping level without pitch and plumb.
- G. Rough-in domestic water piping for water-meter installation according to utility company's requirements.
- H. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.
- I. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

- J. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.
- K. Install piping adjacent to equipment and specialties to allow service and maintenance.
- L. Install piping to permit valve servicing.
- M. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than system pressure rating used in applications below unless otherwise indicated.
- N. Install piping free of sags and bends.
- O. Install fittings for changes in direction and branch connections.
- P. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.
- Q. Install pressure gages on suction and discharge piping from each plumbing pump and packaged booster pump.
- R. Install thermostats in hot-water circulation piping.
- S. Install thermometers on outlet piping from each water heater.
- T. Install sleeves for piping penetrations of walls, ceilings, and floors.
- U. Install sleeve seals for piping penetrations of concrete walls and slabs.
- V. Install escutcheons for piping penetrations of walls, ceilings, and floors

3.3 JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.
- C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 1. Apply appropriate tape or thread compound to external pipe threads.
 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
- D. Brazed Joints: Join copper tube and fittings according to CDA's "Copper Tube Handbook," "Brazed Joints" Chapter.
- E. Soldered Joints: Apply ASTM B 813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook."
- F. Pressure-Sealed Joints: Join copper tube and pressure-seal fittings with tools recommended by fitting manufacturer.
- G. Copper-Tubing, Push-on Joints: Clean end of tube. Measure insertion depth with manufacturer's depth gage. Join copper tube and push-on-joint fittings by inserting tube to measured depth.

- H. Flanged Joints: Select appropriate asbestos-free, nonmetallic gasket material in size, type, and thickness suitable for domestic water service. Join flanges with gasket and bolts according to ASME B31.9.
- I. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

3.4 VALVE INSTALLATION

- A. Install shutoff valve close to water main on each branch and riser serving plumbing fixtures or equipment, on each water supply to equipment, and on each water supply to plumbing fixtures that do not have supply stops. Use ball or gate valves for piping NPS 2 and smaller. Use butterfly or gate valves for piping NPS 2-1/2 and larger.
- B. Install drain valves for equipment at base of each water riser, at low points in horizontal piping, and where required to drain water piping.
 - 1. Hose-End Drain Valves: At low points in water mains, risers, and branches.
 - 2. Stop-and-Waste Drain Valves: Instead of hose-end drain valves where indicated.
- C. Install balancing valve in each hot-water circulation return branch and discharge side of each pump and circulator. Set balancing valves partly open to restrict but not stop flow. Use ball valves for piping NPS 2 and smaller and butterfly valves for piping NPS 2-1/2 and larger.

3.5 TRANSITION FITTING INSTALLATION

- A. Install transition couplings at joints of dissimilar piping.
- B. Transition Fittings in Underground Domestic Water Piping:
 - 1. NPS 1-1/2 and Smaller: Fitting-type coupling.
 - 2. NPS 2 and Larger: Sleeve-type coupling.

3.6 DIELECTRIC FITTING INSTALLATION

- A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
- B. Dielectric Fittings for NPS 2 and Smaller: Use dielectric couplings or nipples.
- C. Dielectric Fittings for NPS 2-1/2 to NPS 4: Use dielectric flange kits.
- D. Dielectric Fittings for NPS 5 to NPS 6: Use dielectric flange kits.

3.7 FLEXIBLE CONNECTOR INSTALLATION

- A. Install flexible connectors in suction and discharge piping connections to each domestic water pump.
- B. Install bronze-hose flexible connectors in copper domestic water tubing.
- C. Install stainless-steel-hose flexible connectors in steel domestic water piping.

3.8 WATER METER INSTALLATION

- A. Rough-in domestic water piping for water meter installation , and install water meters according to utility company's requirements.
- B. Water meters will be furnished and installed by utility company.
- C. Install water meters according to AWWA M6, utility company's requirements, and the following:
- D. Install displacement-type water meters with shutoff valve on water-meter inlet. Install valve on water-meter outlet and valved bypass around meter unless prohibited by authorities having jurisdiction.
- E. Install compound-type water meters with shutoff valves on water-meter inlet and outlet and on valved bypass around meter. Support meters, valves, and piping on brick or concrete piers.
- F. Install remote registration system according to standards of utility company and of authorities having jurisdiction.

3.9 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment" for pipe hanger and support products and installation.
 - 1. Vertical Piping: MSS Type 8 or 42, clamps.
 - 2. Individual, Straight, Horizontal Piping Runs:
 - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
 - b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
 - 3. Base of Vertical Piping: MSS Type 52, spring hangers.
- B. Support vertical piping and tubing at base and at each floor.
- C. Rod diameter may be reduced one size for double-rod hangers, to a minimum of 3/8 inch.
- D. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 3/4 and Smaller: 60 inches with 3/8-inch rod.
 - 2. NPS 1 and NPS 1-1/4: 72 inches with 3/8-inch rod.
 - 3. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
 - 4. NPS 2-1/2: 108 inches with 1/2-inch rod.
 - 5. NPS 3 to NPS 5: 10 feet with 1/2-inch rod.
 - 6. NPS 6: 10 feet with 5/8-inch rod.
- E. Install supports for vertical copper tubing every 10 feet.
- F. Install hangers for steel piping with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 1-1/4 and Smaller: 84 inches with 3/8-inch rod.
 - 2. NPS 1-1/2: 108 inches with 3/8-inch rod.
 - 3. NPS 2: 10 feet with 3/8-inch rod.
 - 4. NPS 2-1/2: 11 feet with 1/2-inch rod.

5. NPS 3 and NPS 3-1/2: 12 feet with 1/2-inch rod.
6. NPS 4 and NPS 5: 12 feet with 5/8-inch rod.
7. NPS 6: 12 feet with 3/4-inch rod.

- G. Install supports for vertical steel piping every 15 feet.
- H. Support piping and tubing not listed in this article according to MSS SP-69 and manufacturer's written instructions.

3.10 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment and machines to allow service and maintenance.
- C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.
- D. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:
1. Domestic Water Booster Pumps: Cold-water suction and discharge piping.
 2. Water Heaters: Cold-water inlet and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
 3. Plumbing Fixtures: Cold- and hot-water supply piping in sizes indicated, but not smaller than required by plumbing code. Comply with requirements in Division 15 plumbing fixture Sections for connection sizes.
 4. Equipment: Cold- and hot-water supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 and larger.

3.11 IDENTIFICATION

- A. Identify system components. Comply with requirements in Division 22 Section "Identification for Plumbing Piping and Equipment" for identification materials and installation.
- B. Label pressure piping with system operating pressure.

3.12 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Piping Inspections:
1. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
 2. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:
 - a. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.

- b. Final Inspection: Arrange final inspection for authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
 3. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
 4. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- C. Piping Tests:
1. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
 2. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
 3. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
 4. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
 5. Repair leaks and defects with new materials and retest piping or portion thereof until satisfactory results are obtained.
 6. Prepare reports for tests and for corrective action required.
- D. Domestic water piping will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.

3.13 CLEANING

- A. Clean and disinfect potable domestic water piping as follows:
1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
 2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:
 - a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
 - b. Fill and isolate system according to either of the following:
 - 1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.
 - 2) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours.
 - c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
 - d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.
- B. Prepare and submit reports of purging and disinfecting activities.
- C. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

3.14 PIPING SCHEDULE

- A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.
- B. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.
- C. Under-building-slab, domestic water, building service piping, NPS 3 and smaller, shall be the following:
 - 1. Soft copper tube, ASTM B 88, Type K; wrought-copper solder-joint fittings; and brazed joints.
- D. Under-building-slab, domestic water, building-service piping, NPS 4 to NPS 6, shall be the following:
 - 1. Push-on-joint, ductile-iron pipe; standard-pattern push-on-joint fittings; and gasketed joints.
- E. Aboveground domestic water piping, NPS 2 and smaller, shall be one of the following:
 - 1. Hard copper tube, ASTM B 88, Type K; cast- or wrought- copper solder-joint fittings; and soldered joints.
 - 2. Hard copper tube, ASTM B 88, Type K; copper pressure-seal-joint fittings; and pressure-sealed joints.
 - 3. Hard copper tube, ASTM B 88, Type K; copper push-on-joint fittings; and push-on joints.
- F. Aboveground domestic water piping, NPS 2-1/2 to NPS 4, shall be one of the following:
 - 1. Hard copper tube, ASTM B 88, Type K; cast- or wrought- copper solder-joint fittings; and soldered joints.
 - 2. Hard copper tube, ASTM B 88, Type K; copper pressure-seal-joint fittings; and pressure-sealed joints.
- G. Aboveground domestic water piping, NPS 5 and NPS 6, shall be the following:
 - 1. Hard copper tube, ASTM B 88, Type K; cast- or wrought- copper solder-joint fittings; and soldered joints.

3.15 VALVE SCHEDULE

- A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
 - 1. Shutoff Duty: Use ball or gate valves for piping NPS 2 and smaller. Use butterfly, ball, or gate valves with flanged ends for piping NPS 2-1/2 and larger.
 - 2. Throttling Duty: Use ball or globe valves for piping NPS 2 and smaller. Use butterfly or ball valves with flanged ends for piping NPS 2-1/2 and larger.
 - 3. Hot-Water Circulation Piping, Balancing Duty: Memory-stop balancing valves.
 - 4. Drain Duty: Hose-end drain valves.
- B. Use check valves to maintain correct direction of domestic water flow to and from equipment.
- C. Iron grooved-end valves may be used with grooved-end piping.

END OF SECTION 221116

SECTION 221316 - SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Pipe, tube, and fittings.
2. Specialty pipe fittings.

B. Related Section:

1. Division 33 Section "Sanitary Sewerage" for sanitary sewerage piping and structures outside the building.

1.2 SUBMITTALS

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

B. Field quality-control reports.

1.3 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF/ANSI 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping and "NSF-sewer" for plastic sewer piping.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.2 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 74, Service class.

B. Gaskets: ASTM C 564, rubber.

2.3 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 888 or CISPI 301.

B. CISPI, Hubless-Piping Couplings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ANACO-Husky.
 - b. Dallas Specialty & Mfg. Co.
 - c. Fernco Inc.
 - d. Matco-Norca, Inc.
 - e. MIFAB, Inc.
 - f. Mission Rubber Company; a division of MCP Industries, Inc.
 - g. Stant.
 - h. Tyler Pipe.
2. Standards: ASTM C 1277 and CISPI 310.
3. Description: Stainless-steel corrugated shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

C. Heavy-Duty, Hubless-Piping Couplings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ANACO-Husky.
 - b. Clamp-All Corp.
 - c. Dallas Specialty & Mfg. Co.
 - d. MIFAB, Inc.
 - e. Mission Rubber Company; a division of MCP Industries, Inc.
 - f. Stant.
 - g. Tyler Pipe.
2. Standards: ASTM C 1277 and ASTM C 1540.
3. Description: Stainless-steel shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

2.4 COPPER TUBE AND FITTINGS

- A. Copper DWV Tube: ASTM B 306, drainage tube, drawn temper.
- B. Copper Drainage Fittings: ASME B16.23, cast copper or ASME B16.29, wrought copper, solder-joint fittings.
- C. Copper Flanges: ASME B16.24, Class 150, cast copper with solder-joint end.
 1. Flange Gasket Materials: ASME B16.21, full-face, flat, nonmetallic, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.
 2. Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.
- D. Solder: ASTM B 32, lead free with ASTM B 813, water-flushable flux.

2.5 PVC PIPE AND FITTINGS

- A. Solid-Wall PVC Pipe: ASTM D 2665, drain, waste, and vent.

- B. Cellular-Core PVC Pipe: ASTM F 891, Schedule 40.
- C. PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311, drain, waste, and vent patterns and to fit Schedule 40 pipe.
- D. Adhesive Primer: ASTM F 656.
 - 1. Use adhesive primer that has a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- E. Solvent Cement: ASTM D 2564.
 - 1. Use PVC solvent cement that has a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.6 SPECIALTY PIPE FITTINGS

A. Transition Couplings:

- 1. General Requirements: Fitting or device for joining piping with small differences in OD's or of different materials. Include end connections same size as and compatible with pipes to be joined.
- 2. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.
- 3. Unshielded, Nonpressure Transition Couplings:
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Dallas Specialty & Mfg. Co.
 - 2) Fernco Inc.
 - 3) Mission Rubber Company; a division of MCP Industries, Inc.
 - 4) Plastic Oddities; a division of Diverse Corporate Technologies, Inc.
 - b. Standard: ASTM C 1173.
 - c. Description: Elastomeric, sleeve-type, reducing or transition pattern. Include shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.
 - d. Sleeve Materials:
 - 1) For Cast-Iron Soil Pipes: ASTM C 564, rubber.
 - 2) For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
 - 3) For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.
- 4. Shielded, Nonpressure Transition Couplings:
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Cascade Waterworks Mfg. Co.
 - 2) Mission Rubber Company; a division of MCP Industries, Inc.
 - b. Standard: ASTM C 1460.
 - c. Description: Elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.

PART 3 - EXECUTION

3.1 EARTH MOVING

- A. Comply with requirements for excavating, trenching, and backfilling specified in Division 2 Section "Earthwork."

3.2 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.
- B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- E. Install piping at indicated slopes.
- F. Install piping free of sags and bends.
- G. Install fittings for changes in direction and branch connections.
- H. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if two fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.
- I. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.
- J. Install soil and waste drainage and vent piping at the following minimum slopes unless otherwise indicated:
 - 1. Building Sanitary Drain: 2 percent downward in direction of flow for piping NPS 3 and smaller; 1 percent downward in direction of flow for piping NPS 4 and larger.
 - 2. Horizontal Sanitary Drainage Piping: 2 percent downward in direction of flow.
 - 3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.
- K. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
- L. Install aboveground copper tubing according to CDA's "Copper Tube Handbook."

- M. Install aboveground PVC piping according to ASTM D 2665.
- N. Install underground PVC piping according to ASTM D 2321.
- O. Plumbing Specialties:
 - 1. Install backwater valves in sanitary waste gravity-flow piping. Comply with requirements for backwater valves specified in Division 22 Section "Sanitary Waste Piping Specialties."
 - 2. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers in sanitary drainage gravity-flow piping. Comply with requirements for cleanouts specified in Division 22 Section "Sanitary Waste Piping Specialties."
 - 3. Install drains in sanitary drainage gravity-flow piping. Comply with requirements for drains specified in Division 22 Section "Sanitary Waste Piping Specialties."
- P. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.
- Q. Install sleeves for piping penetrations of walls, ceilings, and floors.
- R. Install sleeve seals for piping penetrations of concrete walls and slabs.
- S. Install escutcheons for piping penetrations of walls, ceilings, and floors.

3.3 JOINT CONSTRUCTION

- A. Join hub-and-spigot, cast-iron soil piping with gasket joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.
- B. Join hubless, cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-piping coupling joints.
- C. Join copper tube and fittings with soldered joints according to ASTM B 828. Use ASTM B 813, water-flushable, lead-free flux and ASTM B 32, lead-free-alloy solder.
- D. Flanged Joints: Align bolt holes. Select appropriate gasket material, size, type, and thickness. Install gasket concentrically positioned. Use suitable lubricants on bolt threads. Torque bolts in cross pattern.
- E. Plastic, Nonpressure-Piping, Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
 - 1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
 - 2. ABS Piping: Join according to ASTM D 2235 and ASTM D 2661 Appendixes.
 - 3. PVC Piping: Join according to ASTM D 2855 and ASTM D 2665 Appendixes.

3.4 SPECIALTY PIPE FITTING INSTALLATION

- A. Transition Couplings:
 - 1. Install transition couplings at joints of piping with small differences in OD's.
 - 2. In Drainage Piping: Unshielded, nonpressure transition couplings.

3.5 VALVE INSTALLATION

- A. Backwater Valves: Install backwater valves in piping subject to backflow.
1. Horizontal Piping: Horizontal backwater valves. Use normally closed type unless otherwise indicated.
 2. Floor Drains: Drain outlet backwater valves unless drain has integral backwater valve.
 3. Install backwater valves in accessible locations.
 4. Comply with requirements for backwater valve specified in Division 22 Section "Sanitary Waste Piping Specialties."

3.6 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements for seismic-restraint devices specified in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment."
- B. Comply with requirements for pipe hanger and support devices and installation specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."
1. Install carbon-steel pipe hangers for horizontal piping in noncorrosive environments.
 2. Install stainless-steel pipe hangers for horizontal piping in corrosive environments.
 3. Install carbon-steel pipe support clamps for vertical piping in noncorrosive environments.
 4. Install stainless-steel pipe support clamps for vertical piping in corrosive environments.
 5. Vertical Piping: MSS Type 8 or Type 42, clamps.
 6. Install individual, straight, horizontal piping runs:
 - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
 - b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
 - c. Longer Than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.
 7. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
 8. Base of Vertical Piping: MSS Type 52, spring hangers.
- C. Support horizontal piping and tubing within 12 inches of each fitting, valve, and coupling.
- D. Support vertical piping and tubing at base and at each floor.
- E. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch minimum rods.
- F. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:
1. NPS 1-1/2 and NPS 2: 60 inches with 3/8-inch rod.
 2. NPS 3: 60 inches with 1/2-inch rod.
 3. NPS 4 and NPS 5: 60 inches with 5/8-inch rod.
 4. NPS 6 and NPS 8: 60 inches with 3/4-inch rod.
 5. Spacing for 10-foot lengths may be increased to 10 feet. Spacing for fittings is limited to 60 inches.
- G. Install supports for vertical cast-iron soil piping every 15 feet.
- H. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/4: 72 inches with 3/8-inch rod.
 2. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
 3. NPS 2-1/2: 108 inches with 1/2-inch rod.
 4. NPS 3 and NPS 5: 10 feet with 1/2-inch rod.
 5. NPS 6: 10 feet with 5/8-inch rod.
 6. NPS 8: 10 feet with 3/4-inch rod.
- I. Install supports for vertical copper tubing every 10 feet.
- J. Install hangers for PVC piping with the following maximum horizontal spacing and minimum rod diameters:
1. NPS 1-1/2 and NPS 2: 48 inches with 3/8-inch rod.
 2. NPS 3: 48 inches with 1/2-inch rod.
 3. NPS 4 and NPS 5: 48 inches with 5/8-inch rod.
 4. NPS 6 and NPS 8: 48 inches with 3/4-inch rod.
- K. Install supports for vertical PVC piping every 48 inches.
- L. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.7 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.
- C. Connect drainage and vent piping to the following:
1. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code.
 2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
 3. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code.
 4. Install test tees (wall cleanouts) in conductors near floor and floor cleanouts with cover flush with floor.
 5. Install horizontal backwater valves with cleanout cover flush with floor.
 6. Equipment: Connect drainage piping as indicated. Provide shutoff valve if indicated and union for each connection. Use flanges instead of unions for connections NPS 2-1/2 and larger.
- D. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.
- E. Make connections according to the following unless otherwise indicated:
1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
 2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.

3.8 IDENTIFICATION

- A. Identify exposed sanitary waste and vent piping. Comply with requirements for identification specified in Division 22 Section "Identification for Plumbing Piping and Equipment."

3.9 FIELD QUALITY CONTROL

- A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
 - 1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
 - 2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
- B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
- C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- D. Test sanitary drainage and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
 - 1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
 - 2. Leave uncovered and unconcealed new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
 - 3. Roughing-in Plumbing Test Procedure: Test drainage and vent piping except outside leaders on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water. From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.
 - 4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg. Use U-tube or manometer inserted in trap of water closet to measure this pressure. Air pressure must remain constant without introducing additional air throughout period of inspection. Inspect plumbing fixture connections for gas and water leaks.
 - 5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
 - 6. Prepare reports for tests and required corrective action.

3.10 CLEANING AND PROTECTION

- A. Clean interior of piping. Remove dirt and debris as work progresses.
- B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
- C. Place plugs in ends of uncompleted piping at end of day and when work stops.

- D. Exposed PVC Piping: Protect plumbing vents exposed to sunlight with two coats of water-based latex paint.

3.11 PIPING SCHEDULE

- A. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.
- B. Aboveground, soil and waste piping NPS 4 and smaller shall be any of the following:
 - 1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
 - 2. Hubless, cast-iron soil pipe and fittings; CISPI hubless-piping couplings; and coupled joints.
 - 3. Copper DWV tube, copper drainage fittings, and soldered joints.
 - 4. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
 - 5. Dissimilar Pipe-Material Couplings: Unshielded, nonpressure transition couplings.
- C. Aboveground, soil and waste piping NPS 5 and larger shall be any of the following:
 - 1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
 - 2. Hubless, cast-iron soil pipe and fittings; CISPI hubless-piping couplings; and coupled joints.
 - 3. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
 - 4. Dissimilar Pipe-Material Couplings: Unshielded, nonpressure transition couplings.
- D. Aboveground, vent piping NPS 4 and smaller shall be any of the following:
 - 1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
 - 2. Hubless, cast-iron soil pipe and fittings; CISPI hubless-piping couplings; and coupled joints.
 - 3. Copper DWV tube, copper drainage fittings, and soldered joints.
 - 4. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
 - 5. Dissimilar Pipe-Material Couplings: Unshielded, nonpressure transition couplings.
- E. Aboveground, vent piping NPS 5 and larger shall be any of the following:
 - 1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
 - 2. Hubless, cast-iron soil pipe and fittings; CISPI hubless-piping couplings; and coupled joints.
 - 3. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
 - 4. Dissimilar Pipe-Material Couplings: Unshielded, nonpressure transition couplings.
- F. Underground, soil, waste, and vent piping NPS 4 and smaller shall be any of the following:
 - 1. Service class, cast-iron soil piping; gaskets; and gasketed joints.
 - 2. Hubless, cast-iron soil pipe and fittings; CISPI cast-iron hubless-piping couplings; and coupled joints.
 - 3. Solid wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
 - 4. Dissimilar Pipe-Material Couplings: Unshielded, nonpressure transition couplings.
- G. Underground, soil and waste piping NPS 5 and larger shall be any of the following:
 - 1. Service class, cast-iron soil piping; gaskets; and gasketed joints.
 - 2. Hubless, cast-iron soil pipe and fittings; CISPI cast-iron hubless-piping couplings; coupled joints.
 - 3. Solid-wall PVC pipe; PVC socket fittings; and solvent-cemented joints.
 - 4. Dissimilar Pipe-Material Couplings: Unshielded, nonpressure transition couplings.

END OF SECTION 221316

SECTION 221413 - STORM DRAINAGE PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Pipe, tube, and fittings.
2. Specialty pipe fittings.

B. Related Section:

1. Division 33 Section "Storm Drainage" for storm drainage piping outside the building.

1.2 SUBMITTALS

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

B. Seismic Qualification Certificates: For storm drainage piping, accessories, and components, from manufacturer.

C. Field quality-control reports.

1.3 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF/ANSI 14, "Plastics Piping System Components and Related Materials," for plastic piping components. Include marking with "NSF-drain" for plastic drain piping and "NSF-sewer" for plastic sewer piping.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.2 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 74, Service class.

B. Gaskets: ASTM C 564, rubber.

2.3 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS

- A. Pipe and Fittings: ASTM A 888 or CISPI 301.
- B. CISPI, Hubless-Piping Couplings:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ANACO-Husky.
 - b. Dallas Specialty & Mfg. Co.
 - c. Fernco Inc.
 - d. Matco-Norca, Inc.
 - e. MIFAB, Inc.
 - f. Mission Rubber Company; a division of MCP Industries, Inc.
 - g. Stant.
 - h. Tyler Pipe.
 - 2. Standards: ASTM C 1277 and CISPI 310.
 - 3. Description: Stainless-steel corrugated shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.
- C. Heavy-Duty, Hubless-Piping Couplings:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ANACO-Husky.
 - b. Clamp-All Corp.
 - c. Dallas Specialty & Mfg. Co.
 - d. MIFAB, Inc.
 - e. Mission Rubber Company; a division of MCP Industries, Inc.
 - f. Stant.
 - g. Tyler Pipe.
 - 2. Standards: ASTM C 1277 and ASTM C 1540.
 - 3. Description: Stainless-steel shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

2.4 COPPER TUBE AND FITTINGS

- A. Copper DWV Tube: ASTM B 306, drainage tube, drawn temper.
- B. Copper Drainage Fittings: ASME B16.23, cast-copper fittings or ASME B16.29, wrought-copper, solder-joint fittings.
- C. Copper Flanges: ASME B16.24, Class 150, cast copper with solder-joint end.
 - 1. Flange Gasket Materials: ASME B16.21, full-face, flat, nonmetallic, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.
 - 2. Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.
- D. Solder: ASTM B 32, lead free with ASTM B 813, water-flushable flux.

2.5 SPECIALTY PIPE FITTINGS

A. Transition Couplings:

1. General Requirements: Fitting or device for joining piping with small differences in OD's or of different materials. Include end connections same size as and compatible with pipes to be joined.
2. Fitting-Type Transition Couplings: Manufactured piping coupling or specified-piping-system fitting.
3. Unshielded, Nonpressure Transition Couplings:
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Dallas Specialty & Mfg. Co.
 - 2) Fernco Inc.
 - 3) Mission Rubber Company; a division of MCP Industries, Inc.
 - 4) Plastic Oddities; a division of Diverse Corporate Technologies, Inc.
 - b. Standard: ASTM C 1173.
 - c. Description: Elastomeric, sleeve-type, reducing or transition pattern. Include shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.
 - d. Sleeve Materials:
 - 1) For Cast-Iron Soil Pipes: ASTM C 564, rubber.
 - 2) For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
 - 3) For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.
4. Shielded, Nonpressure Transition Couplings:
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Cascade Waterworks Mfg. Co.
 - 2) Mission Rubber Company; a division of MCP Industries, Inc.
 - b. Standard: ASTM C 1460.
 - c. Description: Elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.

PART 3 - EXECUTION

3.1 EARTH MOVING

- A. Comply with requirements for excavating, trenching, and backfilling specified in Division 31 Section "Earthwork."

3.2 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump

sizing, and other design considerations. Install piping as indicated unless deviations from layout are approved on coordination drawings.

- B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- E. Install piping at indicated slopes.
- F. Install piping free of sags and bends.
- G. Install fittings for changes in direction and branch connections.
- H. Install seismic restraints on piping. Comply with requirements for seismic-restraint devices specified in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment."
- I. Make changes in direction for storm drainage piping using appropriate branches, bends, and long-sweep bends. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.
- J. Lay buried building storm drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.
- K. Install storm drainage piping at the following minimum slopes unless otherwise indicated:
 - 1. Building Storm Drain: 2 percent downward in direction of flow for piping NPS 3 and smaller; 1 percent downward in direction of flow for piping NPS 4 and larger.
 - 2. Horizontal Storm-Drainage Piping: 2 percent downward in direction of flow.
- L. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
 - 1. Install encasement on underground piping according to ASTM A 674 or AWWA C105.
- M. Install aboveground copper tubing according to CDA's "Copper Tube Handbook."
- N. Plumbing Specialties:
 - 1. Install backwater valves in storm drainage gravity-flow piping. Comply with requirements for backwater valves specified in Division 22 Section "Storm Drainage Piping Specialties."
 - 2. Install cleanouts at grade and extend to where building storm drains connect to building storm sewers in storm drainage gravity-flow piping. Install cleanout fitting with closure plug inside the building in storm drainage force-main piping. Comply with requirements for cleanouts specified in Division 22 Section "Storm Drainage Piping Specialties."
 - 3. Install drains in storm drainage gravity-flow piping. Comply with requirements for drains specified in Division 22 Section "Storm Drainage Piping Specialties."

- O. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.
- P. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Division 22 Section "Sleeves and Sleeve Seals for Plumbing Piping."
- Q. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Division 22 Section "Sleeves and Sleeve Seals for Plumbing Piping."
- R. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Division 22 Section "Escutcheons for Plumbing Piping."

3.3 JOINT CONSTRUCTION

- A. Join hub-and-spigot, cast-iron soil piping with gasketed joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.
- B. Join hubless, cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-piping coupling joints.
- C. Join copper tube and fittings with soldered joints according to ASTM B 828 procedure. Use ASTM B 813, water-flushable, lead-free flux and ASTM B 32, lead-free-alloy solder.
- D. Flanged Joints: Align bolt holes. Select appropriate gasket material, size, type, and thickness. Install gasket concentrically positioned. Use suitable lubricants on bolt threads. Torque bolts in cross pattern.

3.4 SPECIALTY PIPE FITTING INSTALLATION

- A. Transition Couplings:
 1. Install transition couplings at joints of piping with small differences in OD's.
 2. In Drainage Piping: Unshielded, nonpressure transition couplings.

3.5 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements for seismic-restraint devices specified in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment."
- B. Comply with requirements for pipe hanger and support devices and installation specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."
 1. Install carbon-steel pipe hangers for horizontal piping in noncorrosive environments.
 2. Install stainless-steel pipe hangers for horizontal piping in corrosive environments.
 3. Install carbon-steel pipe support clamps for vertical piping in noncorrosive environments.
 4. Install stainless-steel pipe support clamps for vertical piping in corrosive environments.
 5. Vertical Piping: MSS Type 8 or Type 42, clamps.
 6. Individual, Straight, Horizontal Piping Runs:
 - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
 - b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
 - c. Longer Than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.

7. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
 8. Base of Vertical Piping: MSS Type 52, spring hangers.
- C. Support horizontal piping and tubing within 12 inches of each fitting and coupling.
- D. Support vertical piping and tubing at base and at each floor.
- E. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch minimum rods.
- F. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:
1. NPS 1-1/2 and NPS 2: 60 inches with 3/8-inch rod.
 2. NPS 3: 60 inches with 1/2-inch rod.
 3. NPS 4 and NPS 5: 60 inches with 5/8-inch rod.
 4. NPS 6 and NPS 8: 60 inches with 3/4-inch rod.
 5. NPS 10 and NPS 12: 60 inches with 7/8-inch rod.
 6. Spacing for 10-foot pipe lengths may be increased to 10 feet. Spacing for fittings is limited to 60 inches.
- G. Install supports for vertical cast-iron soil piping every 15 feet.
- H. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
1. NPS 1-1/4: 72 inches with 3/8-inch rod.
 2. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
 3. NPS 2-1/2: 108 inches with 1/2-inch rod.
 4. NPS 3 to NPS 5: 10 feet with 1/2-inch rod.
 5. NPS 6: 10 feet with 5/8-inch rod.
 6. NPS 8: 10 feet with 3/4-inch rod.
- I. Install supports for vertical copper tubing every 10 feet.
- J. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.6 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect interior storm drainage piping to exterior storm drainage piping. Use transition fitting to join dissimilar piping materials.
- C. Connect storm drainage piping to roof drains and storm drainage specialties.
1. Install test tees (wall cleanouts) in conductors near floor, and floor cleanouts with cover flush with floor.
- D. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.

3.7 IDENTIFICATION

- A. Identify exposed storm drainage piping. Comply with requirements for identification specified in Division 22 Section "Identification for Plumbing Piping and Equipment."

3.8 FIELD QUALITY CONTROL

- A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
 - 1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in.
 - 2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
- B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
- C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- D. Test storm drainage piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
 - 1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
 - 2. Leave uncovered and unconcealed new, altered, extended, or replaced storm drainage piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
 - 3. Test Procedure: Test storm drainage piping on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water. From 15 minutes before inspection starts until completion of inspection, water level must not drop. Inspect joints for leaks.
 - 4. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
 - 5. Prepare reports for tests and required corrective action.

3.9 CLEANING

- A. Clean interior of piping. Remove dirt and debris as work progresses.
- B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
- C. Place plugs in ends of uncompleted piping at end of day and when work stops.

3.10 PIPING SCHEDULE

- A. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.
- B. Aboveground storm drainage piping NPS 6 and smaller shall be any of the following:
 - 1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.

2. Hubless, cast-iron soil pipe and fittings; CISPI, hubless-piping couplings; and coupled joints.
 3. Copper DWV tube, copper drainage fittings, and soldered joints.
 4. Dissimilar Pipe-Material Couplings: Unshielded, nonpressure transition couplings.
- C. Aboveground, storm drainage piping NPS 8 and larger shall be any of the following:
1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
 2. Hubless, cast-iron soil pipe and fittings; CISPI, hubless-piping couplings; and coupled joints.
 3. Copper DWV tube, copper drainage fittings, and soldered joints.
 4. Dissimilar Pipe-Material Couplings: Unshielded, nonpressure transition couplings.
- D. Underground storm drainage piping NPS 6 and smaller shall be any of the following:
1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
 2. Hubless, cast-iron soil pipe and fittings; CISPI, hubless-piping couplings; and coupled joints.
 3. Dissimilar Pipe-Material Couplings: Unshielded, nonpressure transition couplings.
- E. Underground, storm drainage piping NPS 8 and larger shall be any of the following:
1. Service class, cast-iron soil pipe and fittings; calking materials; and calked joints.
 2. Hubless, cast-iron soil pipe and fittings; CISPI, cast-iron, hubless-piping couplings; and coupled joints.
 3. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.

END OF SECTION 221413

SECTION 224000 - PLUMBING FIXTURES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Faucets for lavatories, showers and sinks.
 - 2. Flushometers.
 - 3. Toilet seats.
 - 4. Protective shielding guards.
 - 5. Fixture supports.
 - 6. Water closets.
 - 7. Lavatories.

1.2 DEFINITIONS

- A. ABS: Acrylonitrile-butadiene-styrene plastic.
- B. Accessible Fixture: Plumbing fixture that can be approached, entered, and used by people with disabilities.
- C. FRP: Fiberglass-reinforced plastic.
- D. PMMA: Polymethyl methacrylate (acrylic) plastic.
- E. PVC: Polyvinyl chloride plastic.
- F. Solid Surface: Nonporous, homogeneous, cast-polymer-plastic material with heat-, impact-, scratch-, and stain-resistance qualities.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. LEED Submittal:
 - 1. Product Data for Credit WE 2, 3.1, and 3.2: Documentation indicating flow and water consumption requirements.
- C. Shop Drawings: Diagram power, signal, and control wiring.
- D. Operation and maintenance data.

D. Urinal Supports:

1. Description: Type I, urinal carrier with fixture support plates and coupling with seal and fixture bolts and hardware matching fixture for wall-mounting, urinal-type fixture. Include steel uprights with feet.
2. Accessible-Fixture Support: Include rectangular steel uprights.

E. Lavatory Supports:

1. Description: Type I, lavatory carrier with exposed arms and tie rods for wall-mounting, lavatory-type fixture. Include steel uprights with feet.
2. Accessible-Fixture Support: Include rectangular steel uprights.

F. Sink Supports:

1. Description: Type I, sink carrier with exposed arms and tie rods for sink-type fixture. Include steel uprights with feet.

2.6 WATER CLOSETS

A. Water Closets:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
3. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
 - a. American Standard Companies, Inc.
 - b. Kohler
 - c. Briggs Plumbing Products, Inc.
 - d. Crane Plumbing, L.L.C./Fiat Products.
4. Description: Accessible, floor-mounting, floor-outlet, vitreous-china fixture designed for flushometer valve operation.
5. Style: Flushometer valve.
 - a. Bowl Type: Elongated with siphon-jet design. Include bolt caps matching fixture.
 - b. Height: Standard, Accessible, Juvenile, or Child as indicated on schedule.
 - c. Design Consumption: 1.6 gal./flush.
 - d. Color: White.
6. Flushometer: See above.
7. Toilet Seat: See above.

2.7 LAVATORIES

A. Lavatories:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
3. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
 - a. American Standard Companies, Inc.
 - b. Eljer.
 - c. Kohler Co.
4. Description: Accessible, wall-mounting, vitreous-china fixture.
 - a. Type: With back.
 - b. Size: 18 by 15 inches rectangular.
 - c. Faucet Hole Punching: Three holes, 4-inch centers.
 - d. Faucet Hole Location: Top.
 - e. Pedestal: Not required.
 - f. Color: White.
 - g. Faucet: Lavatory for separate drain.
 - h. Supplies: NPS 3/8 chrome-plated copper with stops.
 - i. Drain: Grid with offset waste.
 - j. Drain Piping: NPS 1-1/4 chrome-plated, cast-brass P-trap; NPS 1-1/4, thick tubular brass waste to wall; and wall escutcheon.
 - k. Drain Piping: Schedule 40 ABS or PVC, NPS 1-1/4 P-trap,, tubular waste to wall; and wall escutcheon.
 - 1) Exception: Omit P-trap if hair interceptor is required.
 - l. Hair Interceptor: Not required
 - m. Protective Shielding Guard(s): As listed above.
 - n. Fixture Support: Lavatory support as listed above.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Assemble plumbing fixtures, trim, fittings, and other components according to manufacturers' written instructions.
- B. Install off-floor supports, affixed to building substrate, for wall-mounting fixtures.
 1. Use carrier supports with waste fitting and seal for back-outlet fixtures.
 2. Use carrier supports without waste fitting for fixtures with tubular waste piping.
 3. Use chair-type carrier supports with rectangular steel uprights for accessible fixtures.
- C. Install back-outlet, wall-mounting fixtures onto waste fitting seals and attach to supports.
- D. Install floor-mounting fixtures on closet flanges or other attachments to piping or building substrate.
- E. Install wall-mounting fixtures with tubular waste piping attached to supports.
- F. Install fixtures level and plumb according to roughing-in drawings.

- G. Install water-supply piping with stop on each supply to each fixture to be connected to water distribution piping. Attach supplies to supports or substrate within pipe spaces behind fixtures. Install stops in locations where they can be easily reached for operation.
- H. Install trap and tubular waste piping on drain outlet of each fixture to be directly connected to sanitary drainage system.
- I. Install tubular waste piping on drain outlet of each fixture to be indirectly connected to drainage system.
- J. Install flushometer valves for accessible water closets and urinals with handle mounted on wide side of compartment. Install other actuators in locations that are easy for people with disabilities to reach.
- K. Install tanks for accessible, tank-type water closets with lever handle mounted on wide side of compartment.
- L. Install toilet seats on water closets.
- M. Install faucet-spout fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.
- N. Install water-supply flow-control fittings with specified flow rates in fixture supplies at stop valves.
- O. Install faucet flow-control fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.
- P. Install shower flow-control fittings with specified maximum flow rates in shower arms.
- Q. Install traps on fixture outlets.
 - 1. Exception: Omit trap on fixtures with integral traps.
 - 2. Exception: Omit trap on indirect wastes, unless otherwise indicated.
- R. Install disposer in outlet of each sink indicated to have disposer. Install switch where indicated or in wall adjacent to sink if location is not indicated.
- S. Install hot-water dispensers in back top surface of sink or in countertop with spout over sink.
- T. Install escutcheons at piping wall and ceiling penetrations in exposed, finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding fittings. Escutcheons are specified in Division 22 Section "Escutcheons for Plumbing Piping."
- U. Set bathtubs and showers in leveling bed of cement grout.
- V. Seal joints between fixtures and walls, floors, and countertops using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color.

3.2 CONNECTIONS

- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

3.3 FIELD QUALITY CONTROL

- A. Verify that installed plumbing fixtures are categories and types specified for locations where installed.
- B. Check that plumbing fixtures are complete with trim, faucets, fittings, and other specified components.
- C. Inspect installed plumbing fixtures for damage. Replace damaged fixtures and components.
- D. Test installed fixtures after water systems are pressurized for proper operation. Replace malfunctioning fixtures and components, then retest. Repeat procedure until units operate properly.
- E. Install fresh batteries in sensor-operated mechanisms.

3.4 PROTECTION

- A. Provide protective covering for installed fixtures and fittings.
- B. Do not allow use of plumbing fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION 224000

SECTION 230512-COMMON WORK RESULTS FOR HVAC

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Submittals and substitutions
 2. Identification for HVAC Piping and Equipment.
 3. Sleeves.
 4. Mechanical sleeve seals.
 5. Formed steel channel.

1.2 SUBMITTALS

- A. Shop Drawings: Submit for piping and equipment identification list of wording, symbols, letter size, and color coding for pipe identification and valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.
- B. Product Data for Pipe and Equipment Identification: Submit for mechanical identification manufacturers catalog literature for each product required.
- C. Product Data: Submit for mechanical approval the manufacturers catalog literature for each product required. Submit information showing capacities, dimensions and installation and operating procedures. Submittal information shall be bound in clearly identified 3-ring binders that are indexed and tabbed for the project. Number of submittals shall be as required in the General Conditions or a minimum of five (5) copies.
- D. Maintenance Data and Operating Instructions: Submit for approval three (3) copies of operation and maintenance manuals for the owners use. Manuals shall include manufacturer's installation and operation procedures for each piece of equipment. Manuals shall also include a copy of the Testing and Balancing report. Provide a listing of recommended replacement parts for keeping in stock supply, including sources of supply, for equipment. Include in the listing belts for equipment: Belt manufacturer, model number, size and style, and distinguished whether of multiple belt sets. Contractor shall provide scheduled training to the owner for all equipment provided and installed.

1.3 SUBSTITUTIONS

- A. Substitutions: Substitution of specified equipment will be allowed through a prior approval process initiated by the contractor. Contractor shall submit intended substitution at least five days prior to bid for approval from Engineer. Submittal shall include capacities, dimensions and operating instructions for each piece of equipment. Substitution shall occur at no cost to the owner. Contractor is responsible for coordination of approved substitution and shall incur all costs associated with the substitution including structural modifications, space layout and redesign costs.

1.4 EXAMINATION OF SITE, DRAWINGS, SPECIFICATIONS

- A. Examine carefully the site and conditions of the site. Provide all necessary equipment and labor to install a complete working system within the site conditions.
- B. Examine the drawings and specifications and 5 days prior to bidding report any errors, omissions, inconsistencies, and conflicts to the engineer to be remedied in an addendum to the project prior to bid time.

- C. Drawings are diagrammatic and catalog numbers given are for reference only. The contractor shall be responsible for verifying the capacity of the equipment meets the drawing requirements and shall not dimension from the mechanical, plumbing, or piping drawings.
- D. The latest adopted versions of the International Building codes shall be used as required. This will also include the latest adopted versions of the Mechanical, Plumbing and Energy Conservation Codes. All methods and materials required by these codes shall be required by these specifications unless indicated otherwise. Other applicable local codes and ordinances shall be as required and it shall be the contractor's responsibility to be knowledgeable of these requirements.
- E. Where installation procedures or any part thereof are required to be in accordance with the recommendations of the manufacturer of the material being installed, printed copies of these recommendations shall be furnished to the Engineer prior to installation. Installation of the item will not be allowed to proceed until the recommendations are received. Failure to furnish these recommendations can be cause for rejection of the material.

2PART PRODUCTS

2.1 IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

- A. Plastic Nameplates: Laminated three-layer plastic with engraved black letters on light background color.
- B. Plastic Tags: Laminated three-layer plastic with engraved black letters on light background color, minimum 1-1/2 inches diameter.
- C. Plastic Pipe Markers: Factory fabricated, flexible, semi-rigid plastic, preformed to fit around pipe or pipe covering. Larger sizes may have maximum sheet size with spring fastener. Color and Lettering: Conform to ASME A13.1.
- D. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings. Color and Lettering: Conform to ASME A13.1.
- E. Plastic Underground Pipe Markers: Bright colored continuously printed plastic ribbon tape, minimum 6 inches wide by 4 mil thick, manufactured for direct burial service.

2.2 SLEEVES

- A. Sleeves for Pipes Through Non-fire Rated Floors: 18 gage thick galvanized steel.
- B. Sleeves for Pipes Through Non-fire Rated Beams, Walls, Footings, and Potentially Wet Floors: Steel pipe or 18 gage thick galvanized steel.
- C. Sleeves for Round Ductwork: Galvanized steel.
- D. Sleeves for Rectangular Ductwork: Galvanized steel or wood.
- E. Sealant: Acrylic

2.3 MECHANICAL SLEEVE SEALS

- A. Product Description: Modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between object and sleeve, connected with bolts and pressure

plates causing rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation.

2.4 FORMED STEEL CHANNEL

A. Product Description: Galvanized 12 gage thick steel. With holes 1-1/2 inches on center.

2.5 MOTORS, STARTERS, WIRING

A. Furnish and set in place motors, controls and wiring necessary to operate mechanical equipment in accordance with the following schedule. Starters shall have Hand-Off-Auto, two N.O. contacts and two N.C. contacts. 480 volt starters shall have a 120 volt control transformer sized for the auxiliary equipment provided. Enclosures shall be NEMA 1 unless otherwise indicated. Fuses for the disconnect switches shall be provided under the electrical division.

RESPONSIBLE DIVISION

ITEM	FURNISHED	SET	POWER-WIRED	CONTROL WIRED
Equipment	15	15	16	—
Mag Motor Starters	15	16	16	15
Disconnect Switches	16(1)	16(1)	16	—
Switches, Manual and Multi-speed	15	16	16	—
Controls, Relays, Transformers	15	15	16	15
T'Stats and Time Switches	15	15	16	15
Line Voltage T'Stats	15	15	16	16
T.C. Control Panels	15	15	16	15
Motor and Solenoid Valves Damper Motors	15	15(2)	—	15(2)
Push Buttons and Pilot Lights	15	15(2)	—	15(2)
HVAC Controls	15	15	16	15
Exhaust Fan Switches	15	16	16	15(2)
Fire Protection Controls	16	16	16	16
Fire and Smoke Detectors	16(3)	16(3)	16	16(3)

(1) Under Division 15 if furnished factory-wired as part of equipment or if furnished with combination starters.

(2) If item is for line voltage, set in place and connect under Division 26. Where factory mounted on equipment or attached to piping or ducts and using line voltage furnish and set under Division 23, connect under Division 26.

(3) For units factory mounted in or on mechanical equipment or ducts, fan stop connections shall be under Division 23, all other connections under Division 26.

3PART EXECUTION

3.1 EXAMINATION

- A. Verify openings are ready to receive sleeves.

3.2 INSTALLATION - PIPING AND EQUIPMENT IDENTIFICATION

- A. Install plastic nameplates with adhesive.
- B. Install plastic tags with corrosion resistant metal chain.

3.3 INSTALLATION - SLEEVES

- A. Exterior watertight entries: Seal with mechanical sleeve seals.
- B. Set sleeves in position in forms. Provide reinforcing around sleeves.
- C. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.
- D. Extend sleeves through floors 1 inch above finished floor level. Caulk sleeves.
- E. Where piping or ductwork penetrates floor, ceiling, or wall, close off space between pipe or duct and adjacent work with stuffing insulation and caulk airtight. Provide close fitting metal collar or escutcheon covers at both sides of penetration.
- F. Install chrome plated steel escutcheons at finished surfaces.

END OF 230512

SECTION 230513 - COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on ac power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.2 COORDINATION

- A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:
 - 1. Motor controllers.
 - 2. Torque, speed, and horsepower requirements of the load.
 - 3. Ratings and characteristics of supply circuit and required control sequence.
 - 4. Ambient and environmental conditions of installation location.

PART 2 - PRODUCTS

2.1 GENERAL MOTOR REQUIREMENTS

- A. Comply with requirements in this Section except when stricter requirements are specified in HVAC equipment schedules or Sections.
- B. Comply with NEMA MG 1 unless otherwise indicated.

2.2 MOTOR CHARACTERISTICS

- A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet above sea level.
- B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

2.3 POLYPHASE MOTORS

- A. Description: NEMA MG 1, Design B, medium induction motor.
- B. Efficiency: Energy efficient, as defined in NEMA MG 1.
- C. Service Factor: 1.15.
- D. Multispeed Motors: Variable torque.
 - 1. For motors with 2:1 speed ratio, consequent pole, single winding.

- 2. For motors with other than 2:1 speed ratio, separate winding for each speed.
- E. Rotor: Random-wound, squirrel cage.
- F. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.
- G. Temperature Rise: Match insulation rating.
- H. Insulation: Class F.
- I. Code Letter Designation:
 - 1. Motors 15 HP and Larger: NEMA starting Code F or Code G.
 - 2. Motors Smaller than 15 HP: Manufacturer's standard starting characteristic.
- J. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

2.4 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS

- A. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.
- B. Motors Used with Variable Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.
 - 1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width modulated inverters.
 - 2. Energy- and Premium-Efficient Motors: Class B temperature rise; Class F insulation.
 - 3. Inverter-Duty Motors: Class F temperature rise; Class H insulation.
 - 4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.

2.5 SINGLE-PHASE MOTORS

- A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:
 - 1. Permanent-split capacitor.
 - 2. Split phase.
 - 3. Capacitor start, inductor run.
 - 4. Capacitor start, capacitor run.
- B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.
- C. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.
- D. Motors 1/20 HP and Smaller: Shaded-pole type.

- E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 230513

SECTION 230529 - HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Metal pipe hangers and supports.
 2. Trapeze pipe hangers.
 3. Thermal-hanger shield inserts.
 4. Fastener systems.
 5. Equipment supports.

1.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Structural Performance: Hangers and supports for HVAC piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASME B31.9.
1. Design supports for multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.
 2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Show fabrication and installation details and include calculations for the following; include Product Data for components:
1. Trapeze pipe hangers.
 2. Equipment supports.
- C. Delegated-Design Submittal: For trapeze hangers indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- D. Welding certificates.

1.4 QUALITY ASSURANCE

- A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

- B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

PART 2 - PRODUCTS

2.1 METAL PIPE HANGERS AND SUPPORTS

- A. Carbon-Steel Pipe Hangers and Supports:
 - 1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
 - 2. Galvanized Metallic Coatings: Pregalvanized or hot dipped.
 - 3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
 - 4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
 - 5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

2.2 TRAPEZE PIPE HANGERS

- A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.3 THERMAL-HANGER SHIELD INSERTS

- A. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with 100-psig or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength and vapor barrier.
- B. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate with 100-psig or ASTM C 552, Type II cellular glass with 100-psig or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength.
- C. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.
- D. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.
- E. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.4 FASTENER SYSTEMS

- A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
- B. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.5 EQUIPMENT SUPPORTS

- A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

2.6 MISCELLANEOUS MATERIALS

- A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.
- B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
 - 1. Properties: Nonstaining, noncorrosive, and nongaseous.
 - 2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT INSTALLATION

- A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.
- B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.
 - 1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
 - 2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.
- C. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.
- D. Fastener System Installation:
 - 1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
 - 2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- E. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
- F. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- G. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- H. Install lateral bracing with pipe hangers and supports to prevent swaying.

- I. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.
- J. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- K. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.
- L. Insulated Piping:
 - 1. Attach clamps and spacers to piping.
 - a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
 - b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
 - c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.
 - 2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
 - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
 - 3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
 - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
 - 4. Shield Dimensions for Pipe: Not less than the following:
 - a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
 - b. NPS 4: 12 inches long and 0.06 inch thick.
 - c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
 - d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
 - e. NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.
 - 5. Pipes NPS 8 and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.
 - 6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.2 EQUIPMENT SUPPORTS

- A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.
- B. Grouting: Place grout under supports for equipment and make bearing surface smooth.
- C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.3 METAL FABRICATIONS

- A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.
- B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
- C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.4 ADJUSTING

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.5 PAINTING

- A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
 - 1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.
- B. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Division 9 painting Sections.
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

3.6 HANGER AND SUPPORT SCHEDULE

- A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.
- B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.
- C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.
- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

- E. Use carbon-steel pipe hangers and supports and metal trapeze pipe hangers and attachments for general service applications.
- F. Use stainless-steel pipe hangers and stainless-steel or corrosion-resistant attachments for hostile environment applications.
- G. Use copper-plated pipe hangers and copper or stainless-steel attachments for copper piping and tubing.
- H. Use padded hangers for piping that is subject to scratching.
- I. Use thermal-hanger shield inserts for insulated piping and tubing.
- J. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.
 - 2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F, pipes NPS 4 to NPS 24, requiring up to 4 inches of insulation.
 - 3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36, requiring clamp flexibility and up to 4 inches of insulation.
 - 4. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
 - 5. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.
 - 6. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
 - 7. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
 - 8. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30, from two rods if longitudinal movement caused by expansion and contraction might occur.
 - 9. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
- K. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.
 - 2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.
- L. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
 - 2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
- M. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
 - 2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joint construction, to attach to top flange of structural shape.

3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
 4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
 5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
 6. C-Clamps (MSS Type 23): For structural shapes.
 7. Welded-Steel Brackets: For support of pipes from below, or for suspending from above by using clip and rod. Use one of the following for indicated loads:
 - a. Light (MSS Type 31): 750 lb.
 - b. Medium (MSS Type 32): 1500 lb.
 - c. Heavy (MSS Type 33): 3000 lb.
 8. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
 9. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
- N. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
 2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
 3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.
- O. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
 2. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.
 3. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.
- P. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.
- Q. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

END OF SECTION 230529

SECTION 230553 - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Equipment labels.
 - 2. Warning signs and labels.
 - 3. Pipe labels.
 - 4. Duct labels.

1.2 SUBMITTAL

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

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

- A. Metal Labels for Equipment:
 - 1. Material and Thickness: Brass, 0.032-inch 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 by 3/4 inch.
 - 3. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, 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. Plastic Labels for Equipment:
 - 1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.
 - 2. Letter Color: White.
 - 3. Background Color: Blue.
 - 4. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
 - 5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
 - 6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
 - 7. Fasteners: Stainless-steel rivets or self-tapping screws.
 - 8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

- C. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified.
- D. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch 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.

2.2 WARNING SIGNS AND LABELS

- A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.
- B. Letter Color: Black.
- C. Background Color: Red.
- D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
- E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
- F. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
- G. Fasteners: Stainless-steel rivets or self-tapping screws.
- H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- I. Label Content: Include caution and warning information, plus emergency notification instructions.

2.3 PIPE LABELS

- A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.
- B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.
- C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.
- D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.
 - 1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.
 - 2. Lettering Size: At least 1-1/2 inches high.

2.4 DUCT LABELS

- A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.
- B. Letter Color: Black.
- C. Background Color: White.
- D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
- E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
- F. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
- G. Fasteners: Stainless-steel rivets or self-tapping screws.
- H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- I. Duct Label Contents: Include identification of duct service using same designations or abbreviations as used on Drawings, duct size, and an arrow indicating flow direction.
 - 1. Flow-Direction Arrows: Integral with duct system service lettering to accommodate both directions, or as separate unit on each duct label to indicate flow direction.
 - 2. Lettering Size: At least 1-1/2 inches high.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 EQUIPMENT LABEL INSTALLATION

- A. Install or permanently fasten labels on each major item of mechanical equipment.
- B. Locate equipment labels where accessible and visible.

3.3 PIPE LABEL INSTALLATION

- A. Piping Color-Coding: Painting of piping is specified in Division 9 Section "Interior Painting."
- B. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
 - 1. Near each valve and control device.

2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
4. At access doors, manholes, and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

C. Pipe Label Color Schedule:

1. Heating Water Piping:
 - a. Background Color: Green.
 - b. Letter Color: Black.
2. Refrigerant Piping:
 - a. Background Color: Blue.
 - b. Letter Color: White.

3.4 DUCT LABEL INSTALLATION

- A. Install self-adhesive duct labels with permanent adhesive on air ducts in the following color codes:
 1. Blue: For cold-air supply ducts.
 2. Yellow: For hot-air supply ducts.
 3. Green: For exhaust-, outside-, relief-, return-, and mixed-air ducts.
- B. Locate labels near points where ducts enter into concealed spaces and at maximum intervals of 50 feet in each space where ducts are exposed or concealed by removable ceiling system.

END OF SECTION 230553

SECTION 230700 - HVAC INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Insulation Materials:
 - a. Cellular glass.
 - b. Flexible elastomeric.
 - c. Mineral fiber.
 - d. Polyolefin.
2. Fire-rated insulation systems.
3. Insulating cements.
4. Adhesives.
5. Mastics.
6. Sealants.
7. Factory-applied jackets.
8. Field-applied fabric-reinforcing mesh.
9. Field-applied jackets.
10. Tapes.
11. Securements.
12. Corner angles.

B. Related Sections:

1. Division 22 Section "Plumbing Insulation."
2. Division 23 Section "Metal Ducts" for duct liners.

1.2 SUBMITTALS

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

B. Shop Drawings:

1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
2. Detail attachment and covering of heat tracing inside insulation.
3. Detail insulation application at pipe expansion joints for each type of insulation.
4. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
5. Detail removable insulation at piping specialties, equipment connections, and access panels.
6. Detail application of field-applied jackets.
7. Detail application at linkages of control devices.
8. Detail field application for each equipment type.

C. Field quality-control reports.

1.3 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: Insulation and related materials shall have fire-test-response characteristics indicated, as determined by testing identical products per ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing and inspecting agency.
 - 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
 - 2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

- A. Comply with requirements in Part 3 schedule articles for where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.
- D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
- E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- F. Cellular Glass: Inorganic, incombustible, foamed or cellulated glass with annealed, rigid, hermetically sealed cells. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Cell-U-Foam Corporation; Ultra-CUF.
 - b. Pittsburgh Corning Corporation; Foamglas Super K.
 - 2. Block Insulation: ASTM C 552, Type I.
 - 3. Special-Shaped Insulation: ASTM C 552, Type III.
 - 4. Board Insulation: ASTM C 552, Type IV.
 - 5. Preformed Pipe Insulation without Jacket: Comply with ASTM C 552, Type II, Class 1.
 - 6. Preformed Pipe Insulation with Factory-Applied ASJ: Comply with ASTM C 552, Type II, Class 2.
 - 7. Factory fabricate shapes according to ASTM C 450 and ASTM C 585.
- G. Flexible Elastomeric: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Aeroflex USA Inc.; Aerocel.
 - b. Armacell LLC; AP Armaflex.
 - c. RBX Corporation; Insul-Sheet 1800 and Insul-Tube 180.

H. Polyolefin: Unicellular, polyethylene thermal plastic insulation. Comply with ASTM C 534 or ASTM C 1427, Type I, Grade 1 for tubular materials and Type II, Grade 1 for sheet materials.

1. Products: Subject to compliance with requirements, provide one of the following:

- a. Armacell LLC; Tubolit.
- b. Nomaco Inc.; IMCOLOCK, IMCOSHEET, NOMALOCK, and NOMAPLY.
- c. RBX Corporation; Therma-cell.

2.2 FIRE-RATED INSULATION SYSTEMS

A. Fire-Rated Blanket: High-temperature, flexible, blanket insulation with FSK jacket that is tested and certified to provide a 1-hour fire rating by a NRTL acceptable to authority having jurisdiction.

1. Products: Subject to compliance with requirements, provide one of the following:

- a. CertainTeed Corp.; FlameChek.
- b. Johns Manville; Firetemp Wrap.
- c. Nelson Firestop Products; Nelson FSB Flameshield Blanket.
- d. Thermal Ceramics; FireMaster Duct Wrap.
- e. 3M; Fire Barrier Wrap Products.
- f. Unifrax Corporation; FyreWrap.
- g. Vesuvius; PYROSCAT FP FASTR Duct Wrap.

2.3 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.

B. Cellular-Glass, Phenolic, Polyisocyanurate, and Polystyrene Adhesive: Solvent-based resin adhesive, with a service temperature range of minus 75 to plus 300 deg F.

1. Products: Subject to compliance with requirements, provide one of the following:

- a. Childers Products, Division of ITW; CP-96.
- b. Foster Products Corporation, H. B. Fuller Company; 81-33.

2. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

- a. Aeroflex USA Inc.; AeroSeal.
- b. Armacell LCC; 520 Adhesive.
- c. Foster Products Corporation, H. B. Fuller Company; 85-75.
- d. RBX Corporation; Rubatex Contact Adhesive.

2. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

D. ASJ Adhesive, and FSK and PVDC Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Products, Division of ITW; CP-82.
 - b. Foster Products Corporation, H. B. Fuller Company; 85-20.
 - c. ITW TACC, Division of Illinois Tool Works; S-90/80.
 - d. Marathon Industries, Inc.; 225.
 - e. Mon-Eco Industries, Inc.; 22-25.
2. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

E. PVC Jacket Adhesive: Compatible with PVC jacket.

1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Dow Chemical Company (The); 739, Dow Silicone.
 - b. Johns-Manville; Zeston Perma-Weld, CEEL-TITE Solvent Welding Adhesive.
 - c. P.I.C. Plastics, Inc.; Welding Adhesive.
 - d. Speedline Corporation; Speedline Vinyl Adhesive.
2. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.4 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-C-19565C, Type II.

B. Vapor-Barrier Mastic: Water based; suitable for indoor and outdoor use on below ambient services.

1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Products, Division of ITW; CP-35.
 - b. Foster Products Corporation, H. B. Fuller Company; 30-90.
 - c. ITW TACC, Division of Illinois Tool Works; CB-50.
 - d. Marathon Industries, Inc.; 590.
 - e. Mon-Eco Industries, Inc.; 55-40.
 - f. Vimasco Corporation; 749.
2. Water-Vapor Permeance: ASTM E 96, Procedure B, 0.013 perm at 43-mil dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F.
4. Solids Content: ASTM D 1644, 59 percent by volume and 71 percent by weight.
5. Color: White.

C. Breather Mastic: Water based; suitable for indoor and outdoor use on above ambient services.

1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Products, Division of ITW; CP-10.
 - b. Foster Products Corporation, H. B. Fuller Company; 35-00.
 - c. ITW TACC, Division of Illinois Tool Works; CB-05/15.

- d. Marathon Industries, Inc.; 550.
 - e. Mon-Eco Industries, Inc.; 55-50.
 - f. Vimasco Corporation; WC-1/WC-5.
2. Water-Vapor Permeance: ASTM F 1249, 3 perms at 0.0625-inch dry film thickness.
 3. Service Temperature Range: Minus 20 to plus 200 deg F.
 4. Solids Content: 63 percent by volume and 73 percent by weight.
 5. Color: White.

2.5 SEALANTS

A. Joint Sealants:

1. Joint Sealants for Cellular-Glass Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Products, Division of ITW; CP-76.
 - b. Foster Products Corporation, H. B. Fuller Company; 30-45.
 - c. Marathon Industries, Inc.; 405.
 - d. Mon-Eco Industries, Inc.; 44-05.
 - e. Pittsburgh Corning Corporation; Pittseal 444.
 - f. Vimasco Corporation; 750.
2. Joint Sealants for Polystyrene Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Products, Division of ITW; CP-70.
 - b. Foster Products Corporation, H. B. Fuller Company; 30-45/30-46.
 - c. Marathon Industries, Inc.; 405.
 - d. Mon-Eco Industries, Inc.; 44-05.
 - e. Vimasco Corporation; 750.
3. Materials shall be compatible with insulation materials, jackets, and substrates.
4. Permanently flexible, elastomeric sealant.
5. Service Temperature Range: Minus 100 to plus 300 deg F.
6. Color: White or gray.
7. For indoor applications, use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. FSK and Metal Jacket Flashing Sealants:

1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Products, Division of ITW; CP-76-8.
 - b. Foster Products Corporation, H. B. Fuller Company; 95-44.
 - c. Marathon Industries, Inc.; 405.
 - d. Mon-Eco Industries, Inc.; 44-05.
 - e. Vimasco Corporation; 750.
2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: Aluminum.

6. For indoor applications, use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:

1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Products, Division of ITW; CP-76.
2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: White.
6. For indoor applications, use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.6 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.
4. FSP Jacket: Aluminum-foil, fiberglass-reinforced scrim with polyethylene backing; complying with ASTM C 1136, Type II.
5. PVDC Jacket for Indoor Applications: 4-mil- thick, white PVDC biaxially oriented barrier film with a permeance at 0.02 perms when tested according to ASTM E 96 and with a flame-spread index of 5 and a smoke-developed index of 20 when tested according to ASTM E 84.
 - a. Products: Subject to compliance with requirements, provide one of the following:
 - 1) Dow Chemical Company (The); Saran 540 Vapor Retarder Film and Saran 560 Vapor Retarder Film.
6. PVDC Jacket for Outdoor Applications: 6-mil- thick, white PVDC biaxially oriented barrier film with a permeance at 0.01 perms when tested according to ASTM E 96 and with a flame-spread index of 5 and a smoke-developed index of 25 when tested according to ASTM E 84.
 - a. Products: Subject to compliance with requirements, provide one of the following:
 - 1) Dow Chemical Company (The); Saran 540 Vapor Retarder Film and Saran 560 Vapor Retarder Film.
7. PVDC-SSL Jacket: PVDC jacket with a self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip.
 - a. Products: Subject to compliance with requirements, provide one of the following:
 - 1) Dow Chemical Company (The); Saran 540 Vapor Retarder Film and Saran 560 Vapor Retarder Film.

8. Vinyl Jacket: White vinyl with a permeance of 1.3 perms when tested according to ASTM E 96, Procedure A, and complying with NFPA 90A and NFPA 90B.

2.7 FIELD-APPLIED FABRIC-REINFORCING MESH

- A. Woven Polyester Fabric: Approximately 1 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. inch, in a Leno weave, for duct, equipment, and pipe.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Foster Products Corporation, H. B. Fuller Company; Mast-A-Fab.
 - b. Vimasco Corporation; Elastafab 894.

2.8 FIELD-APPLIED JACKETS

- A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.
- B. FSK Jacket: Aluminum-foil-face, fiberglass-reinforced scrim with kraft-paper backing.
- C. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Johns Manville; Zeston.
 - b. P.I.C. Plastics, Inc.; FG Series.
 - c. Proto PVC Corporation; LoSmoke.
 - d. Speedline Corporation; SmokeSafe.
 2. Adhesive: As recommended by jacket material manufacturer.
 3. Color: White.
 4. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.
 - a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.
 5. Factory-fabricated tank heads and tank side panels.
- D. Aluminum Jacket: Comply with ASTM B 209, Alloy 3003, 3005, 3105 or 5005, Temper H-14.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Products, Division of ITW; Metal Jacketing Systems.
 - b. PABCO Metals Corporation; Surefit.
 - c. RPR Products, Inc.; Insul-Mate.
 2. Sheet and roll stock ready for shop or field sizing.
 3. Finish and thickness are indicated in field-applied jacket schedules.
 4. Moisture Barrier for Indoor Applications: 1-mil- thick, heat-bonded polyethylene and kraft paper.

5. Moisture Barrier for Outdoor Applications: 3-mil- thick, heat-bonded polyethylene and kraft paper.
6. Factory-Fabricated Fitting Covers:
 - a. Same material, finish, and thickness as jacket.
 - b. Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
 - c. Tee covers.
 - d. Flange and union covers.
 - e. End caps.
 - f. Beveled collars.
 - g. Valve covers.
 - h. Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

E. Self-Adhesive Outdoor Jacket: 60-mil- thick, laminated vapor barrier and waterproofing membrane for installation over insulation located aboveground outdoors; consisting of a rubberized bituminous resin on a crosslaminated polyethylene film covered with white aluminum-foil facing.

1. Products: Subject to compliance with requirements, provide one of the following:

- a. Polyguard; Alumaguard 60.

F. PVDC Jacket for Indoor Applications: 4-mil- thick, white PVDC biaxially oriented barrier film with a permeance at 0.02 perms when tested according to ASTM E 96 and with a flame-spread index of 5 and a smoke-developed index of 20 when tested according to ASTM E 84.

1. Products: Subject to compliance with requirements, provide one of the following:

- a. Dow Chemical Company (The), Saran 540 Vapor Retarder Film.

G. PVDC Jacket for Outdoor Applications: 6-mil- thick, white PVDC biaxially oriented barrier film with a permeance at 0.01 perms when tested according to ASTM E 96 and with a flame-spread index of 5 and a smoke-developed index of 25 when tested according to ASTM E 84.

1. Products: Subject to compliance with requirements, provide one of the following:

- a. Dow Chemical Company (The), Saran 560 Vapor Retarder Film.

H. PVDC-SSL Jacket: PVDC jacket with a self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip.

1. Products: Subject to compliance with requirements, provide one of the following:

- a. Dow Chemical Company (The); Saran 540 Vapor Retarder Film and Saran 560 Vapor Retarder Film.

2.9 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.

1. Products: Subject to compliance with requirements, provide one of the following:

- a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0835.
- b. Compac Corp.; 104 and 105.

- c. Ideal Tape Co., Inc., an American Biltrite Company; 428 AWF ASJ.
 - d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.
2. Width: 3 inches.
 3. Thickness: 11.5 mils.
 4. Adhesion: 90 ounces force/inch in width.
 5. Elongation: 2 percent.
 6. Tensile Strength: 40 lbf/inch in width.
 7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.
- B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0827.
 - b. Compac Corp.; 110 and 111.
 - c. Ideal Tape Co., Inc., an American Biltrite Company; 491 AWF FSK.
 - d. Venture Tape; 1525 CW, 1528 CW, and 1528 CW/SQ.
 2. Width: 3 inches.
 3. Thickness: 6.5 mils.
 4. Adhesion: 90 ounces force/inch in width.
 5. Elongation: 2 percent.
 6. Tensile Strength: 40 lbf/inch in width.
 7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.
- C. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive. Suitable for indoor and outdoor applications.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0555.
 - b. Compac Corp.; 130.
 - c. Ideal Tape Co., Inc., an American Biltrite Company; 370 White PVC tape.
 - d. Venture Tape; 1506 CW NS.
 2. Width: 2 inches.
 3. Thickness: 6 mils.
 4. Adhesion: 64 ounces force/inch in width.
 5. Elongation: 500 percent.
 6. Tensile Strength: 18 lbf/inch in width.
- D. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0800.
 - b. Compac Corp.; 120.
 - c. Ideal Tape Co., Inc., an American Biltrite Company; 488 AWF.
 - d. Venture Tape; 3520 CW.
 2. Width: 2 inches.
 3. Thickness: 3.7 mils.
 4. Adhesion: 100 ounces force/inch in width.

5. Elongation: 5 percent.
6. Tensile Strength: 34 lbf/inch in width.

E. PVDC Tape for Indoor Applications: White vapor-retarder PVDC tape with acrylic adhesive.

1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Dow Chemical Company (The); Saran 540 Vapor Retarder Tape.
2. Width: 3 inches.
3. Film Thickness: 4 mils.
4. Adhesive Thickness: 1.5 mils.
5. Elongation at Break: 145 percent.
6. Tensile Strength: 55 lbf/inch in width.

F. PVDC Tape for Outdoor Applications: White vapor-retarder PVDC tape with acrylic adhesive.

1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Dow Chemical Company (The); Saran 560 Vapor Retarder Tape.
2. Width: 3 inches.
3. Film Thickness: 6 mils.
4. Adhesive Thickness: 1.5 mils.
5. Elongation at Break: 145 percent.
6. Tensile Strength: 55 lbf/inch in width.

2.10 SECUREMENTS

A. Aluminum Bands: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch wide with wing or closed seal.

1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Products; Bands.
 - b. PABCO Metals Corporation; Bands.
 - c. RPR Products, Inc.; Bands.

B. Insulation Pins and Hangers:

1. Metal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
 - a. Products: Subject to compliance with requirements, provide one of the following:
 - 1) AGM Industries, Inc.; Tactoo Insul-Hangers, Series T.
 - 2) GEMCO; Perforated Base.
 - 3) Midwest Fasteners, Inc.; Spindle.
 - b. Baseplate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
 - c. Spindle: Copper- or zinc-coated, low carbon steel, fully annealed, 0.106-inch- diameter shank, length to suit depth of insulation indicated.

- d. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.
2. Nonmetal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate fastened to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
- a. Products: Subject to compliance with requirements, provide one of the following:
 - 1) GEMCO; Nylon Hangers.
 - 2) Midwest Fasteners, Inc.; Nylon Insulation Hangers.
 - b. Baseplate: Perforated, nylon sheet, 0.030 inch thick by 1-1/2 inches in diameter.
 - c. Spindle: Nylon, 0.106-inch- diameter shank, length to suit depth of insulation indicated, up to 2-1/2 inches.
 - d. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.
3. Self-Sticking-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
- a. Products: Subject to compliance with requirements, provide one of the following:
 - 1) AGM Industries, Inc.; Tactoo Insul-Hangers, Series TSA.
 - 2) GEMCO; Press and Peel.
 - 3) Midwest Fasteners, Inc.; Self Stick.
 - b. Baseplate: Galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
 - c. Spindle: Copper- or zinc-coated, low carbon steel, fully annealed, 0.106-inch- diameter shank, length to suit depth of insulation indicated.
 - d. Adhesive-backed base with a peel-off protective cover.
4. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- thick, galvanized-steel sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.
- a. Products: Subject to compliance with requirements, provide one of the following:
 - 1) AGM Industries, Inc.; RC-150.
 - 2) GEMCO; R-150.
 - 3) Midwest Fasteners, Inc.; WA-150.
 - 4) Nelson Stud Welding; Speed Clips.
 - b. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.
5. Nonmetal Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- thick nylon sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.
- a. Products: Subject to compliance with requirements, provide one of the following:

- 1) GEMCO.
- 2) Midwest Fasteners, Inc.

- C. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.
- D. Wire: 0.080-inch nickel-copper alloy.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. C & F Wire.
 - b. Childers Products.
 - c. PABCO Metals Corporation.
 - d. RPR Products, Inc.

2.11 CORNER ANGLES

- A. PVC Corner Angles: 30 mils thick, minimum 1 by 1 inch, PVC according to ASTM D 1784, Class 16354-C. White or color-coded to match adjacent surface.
- B. Aluminum Corner Angles: 0.040 inch thick, minimum 1 by 1 inch, aluminum according to ASTM B 209, Alloy 3003, 3005, 3105 or 5005; Temper H-14.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
- B. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.
- C. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.2 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment, ducts and fittings, and piping including fittings, valves, and specialties.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment, duct system, and pipe system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.

- F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- G. Keep insulation materials dry during application and finishing.
- H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- I. Install insulation with least number of joints practical.
- J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
 - 1. Install insulation continuously through hangers and around anchor attachments.
 - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
 - 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
 - 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- L. Install insulation with factory-applied jackets as follows:
 - 1. Draw jacket tight and smooth.
 - 2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
 - 3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.
 - a. For below ambient services, apply vapor-barrier mastic over staples.
 - 4. Cover joints and seams with tape as recommended by insulation material manufacturer to maintain vapor seal.
 - 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct and pipe flanges and fittings.
- M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.
- P. For above ambient services, do not install insulation to the following:
 - 1. Vibration-control devices.
 - 2. Testing agency labels and stamps.
 - 3. Nameplates and data plates.
 - 4. Manholes.
 - 5. Handholes.

6. Cleanouts.

3.3 PENETRATIONS

- A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
 1. Seal penetrations with flashing sealant.
 2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
 4. Seal jacket to roof flashing with flashing sealant.
- B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.
- C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
 1. Seal penetrations with flashing sealant.
 2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
 4. Seal jacket to wall flashing with flashing sealant.
- D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions. Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least 2 inches.
 1. Comply with requirements in Division 7 Section "Through-Penetration Firestop Systems" for firestopping and fire-resistive joint sealers.
- F. Insulation Installation at Floor Penetrations:
 1. Duct: Install insulation continuously through floor penetrations that are not fire rated. For penetrations through fire-rated assemblies, terminate insulation at fire damper sleeves and externally insulate damper sleeve beyond floor to match adjacent duct insulation. Overlap damper sleeve and duct insulation at least 2 inches.
 2. Pipe: Install insulation continuously through floor penetrations.
 3. Seal penetrations through fire-rated assemblies. Comply with requirements in Division 7 Section "Through-Penetration Firestop Systems."

3.4 GENERAL PIPE INSULATION INSTALLATION

- A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:

1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity, unless otherwise indicated.
2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below ambient services, provide a design that maintains vapor barrier.
6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below ambient services and a breather mastic for above ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
9. Stencil or label the outside insulation jacket of each union with the word "UNION." Match size and color of pipe labels.

C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes, vessels, and equipment. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

D. Install removable insulation covers at locations indicated. Installation shall conform to the following:

1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
3. Construct removable valve insulation covers in same manner as for flanges except divide the two-part section on the vertical center line of valve body.
4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve.

Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.

5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.5 CELLULAR-GLASS INSULATION INSTALLATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above ambient services, secure laps with outward clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets on below ambient services, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of cellular-glass block insulation of same thickness as pipe insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
2. When preformed sections of insulation are not available, install mitered sections of cellular-glass insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of cellular-glass insulation to valve body.
2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.

3.6 FLEXIBLE ELASTOMERIC INSULATION INSTALLATION

- #### A.
- Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:

1. Install pipe insulation to outer diameter of pipe flange.

2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install mitered sections of pipe insulation.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed valve covers manufactured of same material as pipe insulation when available.
2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.
4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.7 POLYOLEFIN INSULATION INSTALLATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Seal split-tube longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:

1. Install pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of polyolefin sheet insulation of same thickness as pipe insulation.
4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install mitered sections of polyolefin pipe insulation.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install cut sections of polyolefin pipe and sheet insulation to valve body.
2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.

4. Secure insulation to valves and specialties, and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.8 FIELD-APPLIED JACKET INSTALLATION

- A. Where FSK jackets are indicated, install as follows:
 1. Draw jacket material smooth and tight.
 2. Install lap or joint strips with same material as jacket.
 3. Secure jacket to insulation with manufacturer's recommended adhesive.
 4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch- wide joint strips at end joints.
 5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.
- B. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints; for horizontal applications, install with longitudinal seams along top and bottom of tanks and vessels. Seal with manufacturer's recommended adhesive.
 1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.
- C. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.
- D. Where PVDC jackets are indicated, install as follows:
 1. Apply three separate wraps of filament tape per insulation section to secure pipe insulation to pipe prior to installation of PVDC jacket.
 2. Wrap factory-presize jackets around individual pipe insulation sections with one end overlapping the previously installed sheet. Install presized jacket with an approximate overlap at butt joint of 2 inches over the previous section. Adhere lap seal using adhesive or SSL, and then apply 1-1/4 circumferences of appropriate PVDC tape around overlapped butt joint.
 3. Continuous jacket can be spiral wrapped around a length of pipe insulation. Apply adhesive or PVDC tape at overlapped spiral edge. When electing to use adhesives, refer to manufacturer's written instructions for application of adhesives along this spiral edge to maintain a permanent bond.
 4. Jacket can be wrapped in cigarette fashion along length of roll for insulation systems with an outer circumference of 33-1/2 inches or less. The 33-1/2-inch- circumference limit allows for 2-inch-overlap seal. Using the length of roll allows for longer sections of jacket to be installed at one time. Use adhesive on the lap seal. Visually inspect lap seal for "fishmouthing," and use PVDC tape along lap seal to secure joint.
 5. Repair holes or tears in PVDC jacket by placing PVDC tape over the hole or tear and wrapping a minimum of 1-1/4 circumferences to avoid damage to tape edges.

3.9 FIRE-RATED INSULATION SYSTEM INSTALLATION

- A. Where fire-rated insulation system is indicated, secure system to ducts and duct hangers and supports to maintain a continuous fire rating.
- B. Insulate duct access panels and doors to achieve same fire rating as duct.

- C. Install firestopping at penetrations through fire-rated assemblies. Fire-stop systems are specified in Division 7 Section "Through-Penetration Firestop Systems."

3.10 FINISHES

- A. Duct, Equipment, and Pipe Insulation with ASJ or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Division 9 painting Sections.
 - 1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.
 - a. Finish Coat Material: Interior, flat, latex-emulsion size.
- B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.
- C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.
- D. Do not field paint aluminum or stainless-steel jackets.

3.11 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:
 - 1. Inspect ductwork, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to one location(s) for each duct system defined in the "Duct Insulation Schedule, General" Article.
 - 2. Inspect field-insulated equipment, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to one location(s) for each type of equipment defined in the "Equipment Insulation Schedule" Article. For large equipment, remove only a portion adequate to determine compliance.
 - 3. Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe, three locations of threaded fittings, three locations of welded fittings, two locations of threaded strainers, two locations of welded strainers, three locations of threaded valves, and three locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.
- C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.12 DUCT INSULATION SCHEDULE, GENERAL

- A. Plenums and Ducts Requiring Insulation:
 - 1. Indoor, concealed supply and outdoor air.
 - 2. Indoor, exposed supply and outdoor air.
 - 3. Indoor, concealed return located in nonconditioned space.
 - 4. Indoor, exposed return located in nonconditioned space.

5. Indoor, concealed, Type I, commercial, kitchen hood exhaust.
6. Indoor, exposed, Type I, commercial, kitchen hood exhaust.
7. Indoor, concealed oven and warewash exhaust.
8. Indoor, exposed oven and warewash exhaust.
9. Indoor, concealed exhaust between isolation damper and penetration of building exterior.
10. Indoor, exposed exhaust between isolation damper and penetration of building exterior.
11. Outdoor, concealed supply and return.
12. Outdoor, exposed supply and return.

B. Items Not Insulated:

1. Fibrous-glass ducts.
2. Metal ducts with duct liner of sufficient thickness to comply with energy code and ASHRAE/IESNA 90.1.
3. Factory-insulated flexible ducts.
4. Factory-insulated plenums and casings.
5. Flexible connectors.
6. Vibration-control devices.
7. Factory-insulated access panels and doors.

3.13 INDOOR DUCT AND PLENUM INSULATION SCHEDULE

- A. Concealed, Supply-Air Duct and Plenum Insulation: Mineral-fiber blanket, 1-1/2 inches thick and 0.75-lb/cu. ft. nominal density.
- B. Concealed, Return-Air Duct and Plenum Insulation: Mineral-fiber blanket, 1-1/2 inches thick and 0.75-lb/cu. ft. nominal density.
- C. Concealed, Outdoor-Air Duct and Plenum Insulation: Mineral-fiber blanket, 1-1/2 inches thick and 0.75-lb/cu. ft. nominal density.
- D. Concealed, Exhaust-Air Duct and Plenum Insulation: Mineral-fiber blanket, 1-1/2 inches thick and 0.75-lb/cu. ft. nominal density.
- E. Concealed, Type I, Commercial, Kitchen Hood Exhaust Duct and Plenum Insulation: Fire-rated blanket or board; thickness as required to achieve 2-hour fire rating and zero clearance to combustibles.
- F. Exposed, Supply-Air Duct and Plenum Insulation: Mineral-fiber blanket, 1-1/2 inches thick and 0.75-lb/cu. ft. nominal density.
- G. Exposed, Return-Air Duct and Plenum Insulation: Mineral-fiber blanket, 1-1/2 inches thick and 0.75-lb/cu. ft. nominal density.
- H. Exposed, Outdoor-Air Duct and Plenum Insulation: Mineral-fiber blanket, 1-1/2 inches thick and 0.75-lb/cu. ft. nominal density.
- I. Exposed, Type I, Commercial, Kitchen Hood Exhaust Duct and Plenum Insulation: Fire-rated blanket or board; thickness as required to achieve 2-hour fire rating and zero clearance to combustibles.

3.14 ABOVEGROUND, OUTDOOR DUCT AND PLENUM INSULATION SCHEDULE

- A. Insulation materials and thicknesses are identified below. If more than one material is listed for a duct system, selection from materials listed is Contractor's option.

- B. Exposed, Supply-Air Duct and Plenum Insulation: Mineral-fiber blanket, 3 inches thick and 0.75-lb/cu. ft. nominal density.
- C. Exposed, Return-Air Duct and Plenum Insulation: Mineral-fiber blanket, 3 inches thick and 0.75-lb/cu. ft. nominal density.

3.15 EQUIPMENT INSULATION SCHEDULE

- A. Insulation materials and thicknesses are identified below. If more than one material is listed for a type of equipment, selection from materials listed is Contractor's option.
- B. Insulate indoor and outdoor equipment in paragraphs below that is not factory insulated.
- C. Heating-Hot-Water Expansion/Compression Tank Insulation: Mineral-Fiber Pipe and Tank: 1 inch thick.
- D. Heating-Hot-Water Air-Separator Insulation: Mineral-Fiber Pipe and Tank: 2 inches thick.

3.16 PIPING INSULATION SCHEDULE, GENERAL

- A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.
- B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
 - 1. Drainage piping located in crawl spaces.
 - 2. Underground piping.
 - 3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.17 INDOOR PIPING INSULATION SCHEDULE

- A. Heating-Hot-Water Supply and Return, 200 Deg F and below: Insulation shall be one of the following:
 - 1. Cellular Glass: 2 inches thick for piping greater than 1-1/2" in diameter. 1 inch thick for piping 1-1/2" or less in diameter.
- B. Refrigerant Suction and Hot-Gas Piping: Flexible elastomeric, 1 inch thick.
- C. Refrigerant Suction and Hot-Gas Flexible Tubing: Flexible elastomeric, 1 inch thick.

3.18 OUTDOOR, ABOVEGROUND PIPING INSULATION SCHEDULE

- A. Heating-Hot-Water Supply and Return, 200 Deg F and below: Insulation shall be the following:
 - 1. Cellular Glass: 3 inches thick.
- B. Refrigerant Suction and Hot-Gas Piping: Insulation shall be one of the following:
 - 1. Cellular Glass: 2 inches thick.
 - 2. Flexible Elastomeric: 2 inches thick.

3. Mineral-Fiber, Preformed Pipe Insulation, Type I: 2 inches thick.
4. Polyolefin: 2 inches thick.

C. Refrigerant Suction and Hot-Gas Flexible Tubing: Insulation shall be the following:

1. Flexible Elastomeric: 2 inches thick.

3.19 OUTDOOR, UNDERGROUND PIPING INSULATION SCHEDULE

- A. Loose-fill insulation, for belowground piping, is specified in Division 2 piping distribution Sections.
- B. Heating-Hot-Water Supply and Return, All Sizes, 200 Deg F and below: Cellular glass, 3 inches thick.

3.20 INDOOR, FIELD-APPLIED JACKET SCHEDULE

- A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
- B. If more than one material is listed, selection from materials listed is Contractor's option.
- C. Ducts and Plenums, Concealed:
 1. None.
- D. Ducts and Plenums, Exposed:
 1. None.
- E. Equipment, Concealed:
 1. None.
- F. Equipment, Exposed, up to 48 Inches in Diameter or with Flat Surfaces up to 72 Inches:
 1. None.
- G. Equipment, Exposed, Larger Than 48 Inches in Diameter or with Flat Surfaces Larger Than 72 Inches:
 1. None.
- H. Piping, Concealed:
 1. None.
- I. Piping, Exposed:
 1. None.

3.21 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

- A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

- B. If more than one material is listed, selection from materials listed is Contractor's option.
- C. Ducts and Plenums, Exposed, up to 48 Inches in Diameter or with Flat Surfaces up to 72 Inches:
 - 1. Aluminum, Smooth: 0.016 inch thick.
- D. Ducts and Plenums, Exposed, Larger Than 48 Inches in Diameter or with Flat Surfaces Larger Than 72 Inches:
 - 1. Aluminum, Smooth with: 0.032 inch thick.
- E. Piping, Concealed:
 - 1. None.
- F. Piping, Exposed:
 - 1. Aluminum, Smooth: 0.032 inch thick.

3.22 UNDERGROUND, FIELD-INSTALLED INSULATION JACKET

- A. For underground direct-buried piping applications, install underground direct-buried jacket over insulation material.

END OF SECTION 230700

SECTION 230900 - HVAC INSTRUMENTATION AND CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes control equipment for HVAC systems and components, including control components for terminal heating and cooling units not supplied with factory-wired controls.
- B. The scope of work for this section shall be to provide a building control module that will provide local building control and communication to the campus DDC system via LAN connection provided by the owner.

1.2 SUBMITTALS

- A. Product Data: For each control device indicated.
- B. Shop Drawings:
 - 1. Schematic flow diagrams.
 - 2. Power, signal, and control wiring diagrams.
 - 3. Details of control panel faces.
 - 4. Damper schedule.
 - 5. Valve schedule.
 - 6. DDC System Hardware: Wiring diagrams, schematic floor plans, and schematic control diagrams.
 - 7. Control System Software: Schematic diagrams, written descriptions, and points list.
- C. Software and firmware operational documentation.
- D. Field quality-control test reports.
- E. Operation and maintenance data.

1.3 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 CONTROL SYSTEM

- A. Available Manufacturers:
 1. Trane; Tracer SC System.
- B. Control system shall consist of sensors, indicators, actuators, final control elements, interface equipment, other apparatus, and accessories to control mechanical systems.
- C. Control system shall consist of sensors, indicators, actuators, final control elements, interface equipment, other apparatus, accessories, and software connected to distributed controllers operating in multiuser, multitasking environment on token-passing network and programmed to control mechanical systems. An operator workstation permits interface with the network via dynamic color graphics with each mechanical system, building floor plan, and control device depicted by point-and-click graphics.

2.3 DDC EQUIPMENT

- A. Control Units: Modular, comprising processor board with programmable, nonvolatile, random-access memory; local operator access and display panel; integral interface equipment; and backup power source.
 1. Units monitor or control each I/O point; process information; execute commands from other control units, devices, and operator stations; and download from or upload to operator workstation.
 2. Stand-alone mode control functions operate regardless of network status. Functions include the following:
 - a. Global communications.
 - b. Discrete/digital, analog, and pulse I/O.
 - c. Monitoring, controlling, or addressing data points.
 - d. Software applications, scheduling, and alarm processing.
 - e. Testing and developing control algorithms without disrupting field hardware and controlled environment.
- B. Local Control Units: Modular, comprising processor board with electronically programmable, nonvolatile, read-only memory; and backup power source.
 1. Units monitor or control each I/O point, process information, and download from or upload to operator workstation or diagnostic terminal unit.
 2. Stand-alone mode control functions operate regardless of network status. Functions include the following:
 - a. Global communications.
 - b. Discrete/digital, analog, and pulse I/O.
 - c. Monitoring, controlling, or addressing data points.
 3. Local operator interface provides for download from or upload to operator workstation.

- C. I/O Interface: Hardwired inputs and outputs may tie into system through controllers. Protect points so that shorting will cause no damage to controllers.
 - 1. Binary Inputs: Allow monitoring of on-off signals without external power.
 - 2. Pulse Accumulation Inputs: Accept up to 10 pulses per second.
 - 3. Analog Inputs: Allow monitoring of low-voltage (0- to 10-V dc), current (4 to 20 mA), or resistance signals.
 - 4. Binary Outputs: Provide on-off or pulsed low-voltage signal, selectable for normally open or normally closed operation with three-position (on-off-auto) override switches and status lights.
 - 5. Analog Outputs: Provide modulating signal, either low voltage (0- to 10-V dc) or current (4 to 20 mA).
 - 6. Tri-State Outputs: Provide two coordinated binary outputs for control of three-point, floating-type electronic actuators.
 - 7. Universal I/Os: Provide software selectable binary or analog outputs.

- D. Power Supplies: Transformers with Class 2 current-limiting type or overcurrent protection; limit connected loads to 80 percent of rated capacity. DC power supply shall match output current and voltage requirements and be full-wave rectifier type with the following:
 - 1. Output ripple of 5.0 mV maximum peak to peak.
 - 2. Combined 1 percent line and load regulation with 100-mic.sec. response time for 50 percent load changes.
 - 3. Built-in overvoltage and overcurrent protection and be able to withstand 150 percent overload for at least 3 seconds without failure.

- E. Power Line Filtering: Internal or external transient voltage and surge suppression for workstations or controllers with the following:
 - 1. Minimum dielectric strength of 1000 V.
 - 2. Maximum response time of 10 nanoseconds.
 - 3. Minimum transverse-mode noise attenuation of 65 dB.
 - 4. Minimum common-mode noise attenuation of 150 dB at 40 to 100 Hz.

2.4 UNITARY CONTROLLERS

- A. Unitized, capable of stand-alone operation with sufficient memory to support its operating system, database, and programming requirements, and with sufficient I/O capacity for the application.
 - 1. Configuration: Local keypad and display; diagnostic LEDs for power, communication, and processor; wiring termination to terminal strip or card connected with ribbon cable; memory with bios; and 72-hour battery backup.
 - 2. Operating System: Manage I/O communication to allow distributed controllers to share real and virtual object information and allow central monitoring and alarms. Perform scheduling with real-time clock. Perform automatic system diagnostics; monitor system and report failures.
 - 3. Enclosure: Dustproof rated for operation at 32 to 120 deg F.

2.5 ANALOG CONTROLLERS

- A. Step Controllers: 6- or 10-stage type, with heavy-duty switching rated to handle loads and operated by electric motor.

- B. Electric, Outdoor-Reset Controllers: Remote-bulb or bimetal rod-and-tube type, proportioning action with adjustable throttling range, adjustable set point, scale range minus 10 to plus 70 deg F, and single- or double-pole contacts.
- C. Electronic Controllers: Wheatstone-bridge-amplifier type, in steel enclosure with provision for remote-resistance readjustment. Identify adjustments on controllers, including proportional band and authority.
 - 1. Single controllers can be integral with control motor if provided with accessible control readjustment potentiometer.
- D. Fan-Speed Controllers: Solid-state model providing field-adjustable proportional control of motor speed from maximum to minimum of 55 percent and on-off action below minimum fan speed. Controller shall briefly apply full voltage, when motor is started, to rapidly bring motor up to minimum speed. Equip with filtered circuit to eliminate radio interference.

2.6 ELECTRONIC SENSORS

- A. Description: Vibration and corrosion resistant; for wall, immersion, or duct mounting as required.
- B. Thermistor Temperature Sensors and Transmitters:
 - 1. Available Manufacturers:
 - a. BEC Controls Corporation.
 - b. Ebtron, Inc.
 - c. Heat-Timer Corporation.
 - d. I.T.M. Instruments Inc.
 - e. MAMAC Systems, Inc.
 - f. RDF Corporation.
 - 2. Accuracy: Plus or minus 0.5 deg F at calibration point.
 - 3. Wire: Twisted, shielded-pair cable.
 - 4. Insertion Elements in Ducts: Single point, 8 inches long; use where not affected by temperature stratification or where ducts are smaller than 9 sq. ft..
 - 5. Averaging Elements in Ducts: 72 inches long, flexible; use where prone to temperature stratification or where ducts are larger than 10 sq. ft..
 - 6. Insertion Elements for Liquids: Brass or stainless-steel socket with minimum insertion length of 2-1/2 inches.
 - 7. Room Sensor Cover Construction: Manufacturer's standard locking covers.
 - a. Set-Point Adjustment: Exposed.
 - b. Set-Point Indication: Exposed.
 - c. Thermometer: Concealed.
 - d. Color: By Architect.
 - e. Orientation: Vertical.
 - 8. Outside-Air Sensors: Watertight inlet fitting, shielded from direct sunlight.
 - 9. Room Security Sensors: Stainless-steel cover plate with insulated back and security screws.
- C. RTDs and Transmitters:
 - 1. Available Manufacturers:
 - a. BEC Controls Corporation.

- b. MAMAC Systems, Inc.
 - c. RDF Corporation.
2. Accuracy: Plus or minus 0.2 percent at calibration point.
 3. Wire: Twisted, shielded-pair cable.
 4. Insertion Elements in Ducts: Single point, 8 inches long; use where not affected by temperature stratification or where ducts are smaller than 9 sq. ft..
 5. Averaging Elements in Ducts: 48 inches long, rigid; use where prone to temperature stratification or where ducts are larger than 9 sq. ft.; length as required.
 6. Insertion Elements for Liquids: Brass socket with minimum insertion length of 2-1/2 inches.
 7. Outside-Air Sensors: Watertight inlet fitting, shielded from direct sunlight.
 8. Room Security Sensors: Stainless-steel cover plate with insulated back and security screws.
 - 9.
- D. Room Sensor Cover Construction: Manufacturer's standard locking covers.
1. Set-Point Adjustment: Exposed.
 2. Set-Point Indication: Concealed.
 3. Thermometer: Concealed.
 4. Color: By Architect.
 5. Orientation: Vertical.
- E. Room sensor accessories include the following:
1. Insulating Bases: For sensors located on exterior walls.
 2. Guards: Metal wire, tamperproof.
 3. Adjusting Key: As required for calibration and cover screws.

2.7 STATUS SENSORS

- A. Status Inputs for Fans: Differential-pressure switch with pilot-duty rating and with adjustable range of 0- to 5-inch wg.
- B. Status Inputs for Pumps: Differential-pressure switch with pilot-duty rating and with adjustable pressure-differential range of 8 to 60 psig, piped across pump.
- C. Status Inputs for Electric Motors: Comply with ISA 50.00.01, current-sensing fixed- or split-core transformers with self-powered transmitter, adjustable and suitable for 175 percent of rated motor current.
- D. Voltage Transmitter (100- to 600-V ac): Comply with ISA 50.00.01, single-loop, self-powered transmitter, adjustable, with suitable range and 1 percent full-scale accuracy.
- E. Power Monitor: 3-phase type with disconnect/shorting switch assembly, listed voltage and current transformers, with pulse kilowatt hour output and 4- to 20-mA kW output, with maximum 2 percent error at 1.0 power factor and 2.5 percent error at 0.5 power factor.
- F. Current Switches: Self-powered, solid-state with adjustable trip current, selected to match current and system output requirements.
- G. Electronic Valve/Damper Position Indicator: Visual scale indicating percent of travel and 2- to 10-V dc, feedback signal.

- H. Carbon Dioxide Sensor and Transmitter: Single detectors using solid-state infrared sensors; suitable over a temperature range of 23 to 130 deg F and calibrated for 0 to 2 percent, with continuous or averaged reading, 4- to 20-mA output, for wall mounting.
- I. Occupancy Sensor: Passive infrared, with time delay, daylight sensor lockout, sensitivity control, and 180-degree field of view with vertical sensing adjustment; for flush mounting.

2.8 THERMOSTATS

- A. Low-Voltage, On-Off Thermostats: NEMA DC 3, 24-V, bimetal-operated, mercury-switch type, with adjustable or fixed anticipation heater, concealed set-point adjustment, 55 to 85 deg F set-point range, and 2 deg F maximum differential.
- B. Line-Voltage, On-Off Thermostats: Bimetal-actuated, open contact or bellows-actuated, enclosed, snap-switch or equivalent solid-state type, with heat anticipator; listed for electrical rating; with concealed set-point adjustment, 55 to 85 deg F set-point range, and 2 deg F maximum differential.
 - 1. Electric Heating Thermostats: Equip with off position on dial wired to break ungrounded conductors.
 - 2. Selector Switch: Integral, manual on-off-auto.
- C. Remote-Bulb Thermostats: On-off or modulating type, liquid filled to compensate for changes in ambient temperature; with copper capillary and bulb, unless otherwise indicated.
 - 1. Bulbs in water lines with separate wells of same material as bulb.
 - 2. Bulbs in air ducts with flanges and shields.
 - 3. Averaging Elements: Copper tubing with either single- or multiple-unit elements, extended to cover full width of duct or unit; adequately supported.
 - 4. Scale settings and differential settings are clearly visible and adjustable from front of instrument.
 - 5. On-Off Thermostat: With precision snap switches and with electrical ratings required by application.
 - 6. Modulating Thermostats: Construct so complete potentiometer coil and wiper assembly is removable for inspection or replacement without disturbing calibration of instrument.
- D. Fire-Protection Thermostats: Listed and labeled by an NRTL acceptable to authorities having jurisdiction; with fixed or adjustable settings to operate at not less than 75 deg F above normal maximum operating temperature, and the following:
 - 1. Reset: Manual.
 - 2. Reset: Automatic, with control circuit arranged to require manual reset at central control panel; with pilot light and reset switch on panel labeled to indicate operation.
- E. Immersion Thermostat: Remote-bulb or bimetal rod-and-tube type, proportioning action with adjustable throttling range and adjustable set point.
- F. Airstream Thermostats: Two-pipe, fully proportional, single-temperature type; with adjustable set point in middle of range, adjustable throttling range, plug-in test fitting or permanent pressure gage, remote bulb, bimetal rod and tube, or averaging element.
- G. Electric, Low-Limit Duct Thermostat: Snap-acting, single-pole, single-throw, manual- or automatic-reset switch that trips if temperature sensed across any 12 inches of bulb length is equal to or below set point.
 - 1. Bulb Length: Minimum 20 feet.

2. Quantity: One thermostat for every 20 sq. ft. of coil surface.
- H. Electric, High-Limit Duct Thermostat: Snap-acting, single-pole, single-throw, manual-reset switch that trips if temperature sensed across any 12 inches of bulb length is equal to or above set point.
1. Bulb Length: Minimum 20 feet.
 2. Quantity: One thermostat for every 20 sq. ft. of coil surface.
- I. Heating/Cooling Valve-Top Thermostats: Proportional acting for proportional flow, with molded-rubber diaphragm, remote-bulb liquid-filled element, direct and reverse acting at minimum shutoff pressure of 25 psig, and cast housing with position indicator and adjusting knob.

2.9 ACTUATORS

- A. Electric Motors: Size to operate with sufficient reserve power to provide smooth modulating action or two-position action.
1. Comply with requirements in Division 15 Section "Motors."
 2. Permanent Split-Capacitor or Shaded-Pole Type: Gear trains completely oil immersed and sealed. Equip spring-return motors with integral spiral-spring mechanism in housings designed for easy removal for service or adjustment of limit switches, auxiliary switches, or feedback potentiometer.
 3. Nonspring-Return Motors for Valves Larger Than NPS 2-1/2: Size for running torque of 150 in. x lbf and breakaway torque of 300 in. x lbf.
 4. Spring-Return Motors for Valves Larger Than NPS 2-1/2: Size for running and breakaway torque of 150 in. x lbf.
 5. Nonspring-Return Motors for Dampers Larger Than 25 Sq. Ft.: Size for running torque of 150 in. x lbf and breakaway torque of 300 in. x lbf.
 6. Spring-Return Motors for Dampers Larger Than 25 Sq. Ft.: Size for running and breakaway torque of 150 in. x lbf.
- B. Electronic Actuators: Direct-coupled type designed for minimum 60,000 full-stroke cycles at rated torque.
1. Available Manufacturers:
 - a. Belimo Aircontrols (USA), Inc.
 2. Valves: Size for torque required for valve close off at maximum pump differential pressure.
 3. Dampers: Size for running torque calculated as follows:
 - a. Parallel-Blade Damper with Edge Seals: 7 inch-lb/sq. ft. of damper.
 - b. Opposed-Blade Damper with Edge Seals: 5 inch-lb/sq. ft. of damper.
 - c. Parallel-Blade Damper without Edge Seals: 4 inch-lb/sq. ft. of damper.
 - d. Opposed-Blade Damper without Edge Seals: 3 inch-lb/sq. ft. of damper.
 - e. Dampers with 2- to 3-Inch wg of Pressure Drop or Face Velocities of 1000 to 2500 fpm: Increase running torque by 1.5.
 - f. Dampers with 3- to 4-Inch wg of Pressure Drop or Face Velocities of 2500 to 3000 fpm: Increase running torque by 2.0.
 4. Coupling: V-bolt and V-shaped, toothed cradle.
 5. Overload Protection: Electronic overload or digital rotation-sensing circuitry.
 6. Fail-Safe Operation: Mechanical, spring-return mechanism. Provide external, manual gear release on nonspring-return actuators.

7. Power Requirements (Two-Position Spring Return): 24 or 120-V ac.
8. Power Requirements (Modulating): Maximum 10 VA at 24-V ac or 8 W at 24-V dc.
9. Proportional Signal: 2- to 10-V dc or 4 to 20 mA, and 2- to 10-V dc position feedback signal.
10. Temperature Rating: Minus 22 to plus 122 deg F.
11. Temperature Rating (Smoke Dampers): Minus 22 to plus 250 deg F.
12. Run Time: 30 seconds.

2.10 CONTROL VALVES

A. Available Manufacturers:

1. Danfoss Inc.; Air Conditioning & Refrigeration Div.
2. Erie Controls.
3. Hayward Industrial Products, Inc.
4. Magnatrol Valve Corporation.
5. Neles-Jamesbury.
6. Parker Hannifin Corporation; Skinner Valve Division.
7. Pneuline Controls.
8. Sauter Controls Corporation.

B. Control Valves: Factory fabricated, of type, body material, and pressure class based on maximum pressure and temperature rating of piping system, unless otherwise indicated.

C. Hydronic system globe valves shall have the following characteristics:

1. NPS 2 and Smaller: Class 125 bronze body, bronze trim, rising stem, renewable composition disc, and screwed ends with backseating capacity repackable under pressure.
2. NPS 2-1/2 and Larger: Class 125 iron body, bronze trim, rising stem, plug-type disc, flanged ends, and renewable seat and disc.
3. Internal Construction: Replaceable plugs and stainless-steel or brass seats.
 - a. Single-Seated Valves: Cage trim provides seating and guiding surfaces for plug on top and bottom.
 - b. Double-Seated Valves: Balanced plug; cage trim provides seating and guiding surfaces for plugs on top and bottom.
4. Sizing: 3-psig maximum pressure drop at design flow rate or the following:
 - a. Two Position: Line size.
 - b. Two-Way Modulating: Either the value specified above or twice the load pressure drop, whichever is more.
 - c. Three-Way Modulating: Twice the load pressure drop, but not more than value specified above.
5. Flow Characteristics: Two-way valves shall have equal percentage characteristics; three-way valves shall have linear characteristics.
6. Close-Off (Differential) Pressure Rating: Combination of actuator and trim shall provide minimum close-off pressure rating of 150 percent of total system (pump) head for two-way valves and 100 percent of pressure differential across valve or 100 percent of total system (pump) head.

D. Butterfly Valves: 200-psig, 150-psig maximum pressure differential, ASTM A 126 cast-iron or ASTM A 536 ductile-iron body and bonnet, extended neck, stainless-steel stem, field-replaceable EPDM or Buna N sleeve and stem seals.

1. Body Style: Wafer.
 2. Disc Type: Elastomer-coated ductile iron.
 3. Sizing: 1-psig maximum pressure drop at design flow rate.
- E. Terminal Unit Control Valves: Bronze body, bronze trim, two or three ports as indicated, replaceable plugs and seats, and union and threaded ends.
1. Rating: Class 125 for service at 125 psig and 250 deg F operating conditions.
 2. Sizing: 3-psig maximum pressure drop at design flow rate, to close against pump shutoff head.
 3. Flow Characteristics: Two-way valves shall have equal percentage characteristics; three-way valves shall have linear characteristics.

2.11 DAMPERS

- A. Available Manufacturers:
1. Air Balance Inc.
 2. Don Park Inc.; Autodamp Div.
 3. TAMCO (T. A. Morrison & Co. Inc.).
 4. United Enertech Corp.
 5. Vent Products Company, Inc.
- B. Dampers: AMCA-rated, opposed-blade design; 0.108-inch- minimum thick, galvanized-steel or 0.125-inch- minimum thick, extruded-aluminum frames with holes for duct mounting; damper blades shall not be less than 0.064-inch- thick galvanized steel with maximum blade width of 8 inches and length of 48 inches.
1. Secure blades to 1/2-inch- diameter, zinc-plated axles using zinc-plated hardware, with oil-impregnated sintered bronze blade bearings, blade-linkage hardware of zinc-plated steel and brass, ends sealed against spring-stainless-steel blade bearings, and thrust bearings at each end of every blade.
 2. Operating Temperature Range: From minus 40 to plus 200 deg F.
 3. Edge Seals, Standard Pressure Applications: Closed-cell neoprene.
 4. Edge Seals, Low-Leakage Applications: Use inflatable blade edging or replaceable rubber blade seals and spring-loaded stainless-steel side seals, rated for leakage at less than 10 cfm per sq. ft. of damper area, at differential pressure of 4-inch wg when damper is held by torque of 50 in. x lbf; when tested according to AMCA 500D.

2.12 CONTROL CABLE

- A. Electronic and fiber-optic cables for control wiring are specified in Division 27 Section "Voice and Data Communication Cabling."

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Verify location of thermostats, humidistats, and other exposed control sensors with Drawings and room details before installation. Install devices 60 inches above the floor.

1. Install averaging elements in ducts and plenums in crossing or zigzag pattern.
- B. Install guards on thermostats in the following locations:
 1. Entrances.
 2. Public areas.
 3. Where indicated.
- C. Install automatic dampers according to Division 23 Section "Duct Accessories."
- D. Install damper motors on outside of duct in warm areas, not in locations exposed to outdoor temperatures.
- E. Install labels and nameplates to identify control components according to Division 23 Section "Mechanical Identification."
- F. Install hydronic instrument wells, valves, and other accessories according to Division 23 Section "Hydronic Piping."
- G. Install refrigerant instrument wells, valves, and other accessories according to Division 23 Section "Refrigerant Piping."
- H. Install duct volume-control dampers according to Division 23 Sections specifying air ducts.
- I. Install electronic and fiber-optic cables according to Division 27 Section "Voice and Data Communication Cabling."

3.2 ELECTRICAL WIRING AND CONNECTION INSTALLATION

- A. Install raceways, boxes, and cabinets according to Division 26 Section "Raceways and Boxes."
- B. Install building wire and cable according to Division 26 Section "Conductors and Cables."
- C. Install signal and communication cable according to Division 26 Section "Voice and Data Communication Cabling."
 1. Conceal cable, except in mechanical rooms and areas where other conduit and piping are exposed.
 2. Install exposed cable in raceway.
 3. Install concealed cable in raceway.
 4. Bundle and harness multiconductor instrument cable in place of single cables where several cables follow a common path.
 5. Fasten flexible conductors, bridging cabinets and doors, along hinge side; protect against abrasion. Tie and support conductors.
 6. Number-code or color-code conductors for future identification and service of control system, except local individual room control cables.
 7. Install wire and cable with sufficient slack and flexible connections to allow for vibration of piping and equipment.
- D. Connect manual-reset limit controls independent of manual-control switch positions. Automatic duct heater resets may be connected in interlock circuit of power controllers.
- E. Connect hand-off-auto selector switches to override automatic interlock controls when switch is in hand position.

3.3 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.
- B. Perform the following field tests and inspections and prepare test reports:
 - 1. Operational Test: After electrical circuitry has been energized, start units to confirm proper unit operation. Remove and replace malfunctioning units and retest.
 - 2. Test and adjust controls and safeties.
 - 3. Test calibration of controllers by disconnecting input sensors and stimulating operation with compatible signal generator.
 - 4. Test each point through its full operating range to verify that safety and operating control set points are as required.
 - 5. Test each control loop to verify stable mode of operation and compliance with sequence of operation. Adjust PID actions.
 - 6. Test each system for compliance with sequence of operation.
 - 7. Test software and hardware interlocks.
- C. DDC Verification:
 - 1. Verify that instruments are installed before calibration, testing, and loop or leak checks.
 - 2. Check instruments for proper location and accessibility.
 - 3. Check instrument installation for direction of flow, elevation, orientation, insertion depth, and other applicable considerations.
 - 4. Check instrument tubing for proper fittings, slope, material, and support.
 - 5. Check pressure instruments, piping slope, installation of valve manifold, and self-contained pressure regulators.
 - 6. Check temperature instruments and material and length of sensing elements.
 - 7. Check control valves. Verify that they are in correct direction.
 - 8. Check air-operated dampers. Verify that pressure gages are provided and that proper blade alignment, either parallel or opposed, has been provided.
 - 9. Check DDC system as follows:
 - a. Verify that DDC controller power supply is from emergency power supply, if applicable.
 - b. Verify that wires at control panels are tagged with their service designation and approved tagging system.
 - c. Verify that spare I/O capacity has been provided.
 - d. Verify that DDC controllers are protected from power supply surges.
- D. Replace damaged or malfunctioning controls and equipment and repeat testing procedures.

3.4 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain HVAC instrumentation and controls. Refer to Division 1 Section "Demonstration and Training."

3.5 SEQUENCE OF OPERATION

- A. VRF system: provide communication link to VRF controller to allow monitoring and control adjustments to be made from the Trane system.

- B. Unit heaters: Thermostats shown on the drawings for control of single or multiple unit heaters shall be tied into the building DDC system to allow monitoring and control adjustments from the campus DDC system.
- C. Radiant Tube heaters: Thermostats shown on the drawings for control of single or multiple unit heaters shall be tied into the building DDC system to allow monitoring and control adjustments from the campus DDC system.

END OF SECTION 230900

SECTION 231123 - FACILITY NATURAL-GAS PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Pipes, tubes, and fittings.
 2. Piping specialties.
 3. Piping and tubing joining materials.
 4. Valves.
 5. Pressure regulators.

1.2 PERFORMANCE REQUIREMENTS

- A. Minimum Operating-Pressure Ratings:
1. Piping and Valves: 100 psig minimum unless otherwise indicated.
 2. Service Regulators: 100 psig minimum unless otherwise indicated.
- B. Natural-Gas System Pressure within Buildings: More than 0.5 psig but not more than 2 psig.
- C. Natural-Gas System Pressures within Buildings: Two pressure ranges. Primary pressure is more than 0.5 psig but not more than 2 psig, and is reduced to secondary pressure of 0.5 psig or less.
- D. Delegated Design: Design restraints and anchors for natural-gas piping and equipment, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For facility natural-gas piping layout. Include plans, piping layout and elevations, sections, and details for fabrication of pipe anchors, hangers, supports for multiple pipes, alignment guides, expansion joints and loops, and attachments of the same to building structure. Detail location of anchors, alignment guides, and expansion joints and loops.
- C. Delegated-Design Submittal: For natural-gas piping and equipment indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
1. Detail fabrication and assembly of seismic restraints.
 2. Design Calculations: Calculate requirements for selecting seismic restraints.
- D. Welding certificates.
- E. Field quality-control reports.

- F. Operation and maintenance data.

1.4 QUALITY ASSURANCE

- A. Steel Support Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

PART 2 - PRODUCTS

2.1 PIPES, TUBES, AND FITTINGS

- A. Steel Pipe: ASTM A 53/A 53M, black steel, Schedule 40, Type E or S, Grade B.
 - 1. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150, standard pattern.
 - 2. Wrought-Steel Welding Fittings: ASTM A 234/A 234M for butt welding and socket welding.
 - 3. Unions: ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends.
 - 4. Protective Coating for Underground Piping: Factory-applied, three-layer coating of epoxy, adhesive, and PE.
 - a. Joint Cover Kits: Epoxy paint, adhesive, and heat-shrink PE sleeves.
- B. Annealed-Temper Copper Tube: Comply with ASTM B 88, Type K.
 - 1. Copper Fittings: ASME B16.22, wrought copper, and streamlined pattern.
 - 2. Flare Fittings: Comply with ASME B16.26 and SAE J513.
 - a. Copper fittings with long nuts.
 - b. Metal-to-metal compression seal without gasket.
 - c. Dryseal threads complying with ASME B1.20.3.
 - 3. Protective Coating for Underground Tubing: Factory-applied, extruded PE a minimum of 0.022 inch thick.
- C. PE Pipe: ASTM D 2513, SDR 11.
 - 1. PE Fittings: ASTM D 2683, socket-fusion type or ASTM D 3261, butt-fusion type with dimensions matching PE pipe.
 - 2. PE Transition Fittings: Factory-fabricated fittings with PE pipe complying with ASTM D 2513, SDR 11; and steel pipe complying with ASTM A 53/A 53M, black steel, Schedule 40, Type E or S, Grade B.
 - 3. Anodeless Service-Line Risers: Factory fabricated and leak tested.
 - a. Underground Portion: PE pipe complying with ASTM D 2513, SDR 11 inlet.
 - b. Casing: Steel pipe complying with ASTM A 53/A 53M, Schedule 40, black steel, Type E or S, Grade B, with corrosion-protective coating covering. Vent casing aboveground.

- c. Aboveground Portion: PE transition fitting.
 - d. Outlet shall be threaded or suitable for welded connection.
 - e. Tracer wire connection.
 - f. Ultraviolet shield.
 - g. Stake supports with factory finish to match steel pipe casing or carrier pipe.
4. Transition Service-Line Risers: Factory fabricated and leak tested.
- a. Underground Portion: PE pipe complying with ASTM D 2513, SDR 11 inlet connected to steel pipe complying with ASTM A 53/A 53M, Schedule 40, Type E or S, Grade B, with corrosion-protective coating for aboveground outlet.
 - b. Outlet shall be threaded or suitable for welded connection.
 - c. Bridging sleeve over mechanical coupling.
 - d. Factory-connected anode.
 - e. Tracer wire connection.
 - f. Ultraviolet shield.
 - g. Stake supports with factory finish to match steel pipe casing or carrier pipe.

2.2 PIPING SPECIALTIES

A. Appliance Flexible Connectors:

- 1. Indoor, Fixed-Appliance Flexible Connectors: Comply with ANSI Z21.24.
- 2. Indoor, Movable-Appliance Flexible Connectors: Comply with ANSI Z21.69.
- 3. Outdoor, Appliance Flexible Connectors: Comply with ANSI Z21.75.
- 4. Corrugated stainless-steel tubing with polymer coating.
- 5. Operating-Pressure Rating: 0.5 psig.
- 6. End Fittings: Zinc-coated steel.
- 7. Threaded Ends: Comply with ASME B1.20.1.
- 8. Maximum Length: 72 inches.

B. Quick-Disconnect Devices: Comply with ANSI Z21.41.

- 1. Copper-alloy convenience outlet and matching plug connector.
- 2. Nitrile seals.
- 3. Hand operated with automatic shutoff when disconnected.
- 4. For indoor or outdoor applications.
- 5. Adjustable, retractable restraining cable.

C. Y-Pattern Strainers:

- 1. Body: ASTM A 126, Class B, cast iron with bolted cover and bottom drain connection.
- 2. End Connections: Threaded ends for NPS 2 and smaller.
- 3. Strainer Screen: 60-mesh startup strainer, and perforated stainless-steel basket with 50 percent free area.
- 4. CWP Rating: 125 psig.

D. Weatherproof Vent Cap: Cast- or malleable-iron increaser fitting with corrosion-resistant wire screen, with free area at least equal to cross-sectional area of connecting pipe and threaded-end connection.

2.3 JOINING MATERIALS

A. Joint Compound and Tape: Suitable for natural gas.

- B. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
- C. Brazing Filler Metals: Alloy with melting point greater than 1000 deg F complying with AWS A5.8/A5.8M. Brazing alloys containing more than 0.05 percent phosphorus are prohibited.

2.4 MANUAL GAS SHUTOFF VALVES

- A. See "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles for where each valve type is applied in various services.

- B. General Requirements for Metallic Valves, NPS 2 and Smaller: Comply with ASME B16.33.

- 1. CWP Rating: 125 psig.
- 2. Threaded Ends: Comply with ASME B1.20.1.
- 3. Dryseal Threads on Flare Ends: Comply with ASME B1.20.3.
- 4. Tamperproof Feature: Locking feature for valves indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
- 5. Listing: Listed and labeled by an NRTL acceptable to authorities having jurisdiction for valves 1 inch and smaller.
- 6. Service Mark: Valves 1-1/4 inches to NPS 2 shall have initials "WOG" permanently marked on valve body.

- C. One-Piece, Bronze Ball Valve with Bronze Trim: MSS SP-110.

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. BrassCraft Manufacturing Company; a Masco company.
 - b. Conbraco Industries, Inc.; Apollo Div.
 - c. Lyall, R. W. & Company, Inc.
 - d. McDonald, A. Y. Mfg. Co.
 - e. Perfection Corporation; a subsidiary of American Meter Company.
- 2. Body: Bronze, complying with ASTM B 584.
- 3. Ball: Chrome-plated brass.
- 4. Stem: Bronze; blowout proof.
- 5. Seats: Reinforced TFE; blowout proof.
- 6. Packing: Separate packnut with adjustable-stem packing threaded ends.
- 7. Ends: Threaded, flared, or socket as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
- 8. CWP Rating: 600 psig.
- 9. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
- 10. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

- D. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim: MSS SP-110.

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. BrassCraft Manufacturing Company; a Masco company.
 - b. Conbraco Industries, Inc.; Apollo Div.
 - c. Lyall, R. W. & Company, Inc.

- d. McDonald, A. Y. Mfg. Co.
 - e. Perfection Corporation; a subsidiary of American Meter Company.
2. Body: Bronze, complying with ASTM B 584.
 3. Ball: Chrome-plated bronze.
 4. Stem: Bronze; blowout proof.
 5. Seats: Reinforced TFE; blowout proof.
 6. Packing: Threaded-body packnut design with adjustable-stem packing.
 7. Ends: Threaded, flared, or socket as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
 8. CWP Rating: 600 psig.
 9. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
 10. Service: Suitable for natural-gas service with "WOG" indicated on valve body.
- E. Two-Piece, Regular-Port Bronze Ball Valves with Bronze Trim: MSS SP-110.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. BrassCraft Manufacturing Company; a Masco company.
 - b. Conbraco Industries, Inc.; Apollo Div.
 - c. Lyall, R. W. & Company, Inc.
 - d. McDonald, A. Y. Mfg. Co.
 - e. Perfection Corporation; a subsidiary of American Meter Company.
 2. Body: Bronze, complying with ASTM B 584.
 3. Ball: Chrome-plated bronze.
 4. Stem: Bronze; blowout proof.
 5. Seats: Reinforced TFE.
 6. Packing: Threaded-body packnut design with adjustable-stem packing.
 7. Ends: Threaded, flared, or socket as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
 8. CWP Rating: 600 psig.
 9. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
 10. Service: Suitable for natural-gas service with "WOG" indicated on valve body.
- F. Bronze Plug Valves: MSS SP-78.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Lee Brass Company.
 - b. McDonald, A. Y. Mfg. Co.
 2. Body: Bronze, complying with ASTM B 584.
 3. Plug: Bronze.
 4. Ends: Threaded, socket, as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
 5. Operator: Square head or lug type with tamperproof feature where indicated.
 6. Pressure Class: 125 psig.
 7. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
 8. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

12. Atmospheric Vent: Factory- or field-installed, stainless-steel screen in opening if not connected to vent piping.
13. Maximum Inlet Pressure: 2 psig.

C. Appliance Pressure Regulators: Comply with ANSI Z21.18.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. Canadian Meter Company Inc.
 - b. Eaton Corporation; Controls Div.
 - c. Harper Wyman Co.
 - d. Maxitrol Company.
 - e. SCP, Inc.
3. Body and Diaphragm Case: Die-cast aluminum.
4. Springs: Zinc-plated steel; interchangeable.
5. Diaphragm Plate: Zinc-plated steel.
6. Seat Disc: Nitrile rubber.
7. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.
8. Factory-Applied Finish: Minimum three-layer polyester and polyurethane paint finish.
9. Regulator may include vent limiting device, instead of vent connection, if approved by authorities having jurisdiction.
10. Maximum Inlet Pressure: 2 psig.

2.8 DIELECTRIC UNIONS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Capitol Manufacturing Company.
2. Central Plastics Company.
3. Hart Industries International, Inc.
4. McDonald, A. Y. Mfg. Co.
5. Watts Regulator Co.; Division of Watts Water Technologies, Inc.
6. Wilkins; Zurn Plumbing Products Group.

B. Minimum Operating-Pressure Rating: 150 psig.

C. Combination fitting of copper alloy and ferrous materials.

D. Insulating materials suitable for natural gas.

E. Combination fitting of copper alloy and ferrous materials with threaded, brazed-joint, plain, or welded end connections that match piping system materials.

2.9 LABELING AND IDENTIFYING

- A. Detectable Warning Tape: Acid- and alkali-resistant, PE film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description of utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored yellow.

PART 3 - EXECUTION

3.1 OUTDOOR PIPING INSTALLATION

- A. Comply with the International Fuel Gas Code for installation and purging of natural-gas piping.
- B. Install underground, natural-gas piping buried at least 36 inches below finished grade. Comply with requirements in Division 2 Section "Earthwork" for excavating, trenching, and backfilling.
 - 1. If natural-gas piping is installed less than 36 inches below finished grade, install it in containment conduit.
- C. Install underground, PE, natural-gas piping according to ASTM D 2774.
- D. Steel Piping with Protective Coating:
 - 1. Apply joint cover kits to pipe after joining to cover, seal, and protect joints.
 - 2. Repair damage to PE coating on pipe as recommended in writing by protective coating manufacturer.
 - 3. Replace pipe having damaged PE coating with new pipe.
- E. Copper Tubing with Protective Coating:
 - 1. Apply joint cover kits over tubing to cover, seal, and protect joints.
 - 2. Repair damage to PE coating on pipe as recommended in writing by protective coating manufacturer.
- F. Install fittings for changes in direction and branch connections.
- G. Install pressure gage downstream from each service regulator.

3.2 INDOOR PIPING INSTALLATION

- A. Comply with the International Fuel Gas Code for installation and purging of natural-gas piping.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- C. Arrange for pipe spaces, chases, slots, sleeves, and openings in building structure during progress of construction, to allow for mechanical installations.
- D. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- E. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- F. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- G. Locate valves for easy access.

- H. Install natural-gas piping at uniform grade of 2 percent down toward drip and sediment traps.
- I. Install piping free of sags and bends.
- J. Install fittings for changes in direction and branch connections.
- K. Verify final equipment locations for roughing-in.
- L. Comply with requirements in Sections specifying gas-fired appliances and equipment for roughing-in requirements.
- M. Drips and Sediment Traps: Install drips at points where condensate may collect, including service-meter outlets. Locate where accessible to permit cleaning and emptying. Do not install where condensate is subject to freezing.
 - 1. Construct drips and sediment traps using tee fitting with bottom outlet plugged or capped. Use nipple a minimum length of 3 pipe diameters, but not less than 3 inches long and same size as connected pipe. Install with space below bottom of drip to remove plug or cap.
- N. Extend relief vent connections for service regulators, line regulators, and overpressure protection devices to outdoors and terminate with weatherproof vent cap.
- O. Conceal pipe installations in walls, pipe spaces, utility spaces, above ceilings, below grade or floors, and in floor channels unless indicated to be exposed to view.
- P. Use eccentric reducer fittings to make reductions in pipe sizes. Install fittings with level side down.
- Q. Connect branch piping from top or side of horizontal piping.
- R. Install unions in pipes NPS 2 and smaller, adjacent to each valve, at final connection to each piece of equipment.
- S. Do not use natural-gas piping as grounding electrode.
- T. Install strainer on inlet of each line-pressure regulator and automatic or electrically operated valve.
- U. Install pressure gage downstream from each line regulator. Pressure gages are specified in Division 23 Section "Meters and Gages."
- V. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Division 23 Section "Sleeves and Sleeve Seals for HVAC Piping."
- W. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Division 23 Section "Sleeves and Sleeve Seals for HVAC Piping."
- X. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Division 23 Section "Escutcheons for HVAC Piping."

3.3 VALVE INSTALLATION

- A. Install manual gas shutoff valve for each gas appliance ahead of corrugated stainless-steel tubing or copper connector.
- B. Install underground valves with valve boxes.

- C. Install regulators and overpressure protection devices with maintenance access space adequate for servicing and testing.
- D. Install earthquake valves aboveground outside buildings according to listing.
- E. Install anode for metallic valves in underground PE piping.

3.4 PIPING JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- C. Threaded Joints:
 1. Thread pipe with tapered pipe threads complying with ASME B1.20.1.
 2. Cut threads full and clean using sharp dies.
 3. Ream threaded pipe ends to remove burrs and restore full inside diameter of pipe.
 4. Apply appropriate tape or thread compound to external pipe threads unless dryseal threading is specified.
 5. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- D. Welded Joints:
 1. Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators.
 2. Bevel plain ends of steel pipe.
 3. Patch factory-applied protective coating as recommended by manufacturer at field welds and where damage to coating occurs during construction.
- E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter.
- F. Flared Joints: Cut tubing with roll cutting tool. Flare tube end with tool to result in flare dimensions complying with SAE J513. Tighten finger tight, then use wrench. Do not overtighten.
- G. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.
 1. Plain-End Pipe and Fittings: Use butt fusion.
 2. Plain-End Pipe and Socket Fittings: Use socket fusion.

3.5 HANGER AND SUPPORT INSTALLATION

- A. Install seismic restraints on piping. Comply with requirements for seismic-restraint devices specified in Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment."
- B. Comply with requirements for pipe hangers and supports specified in Division 23 Section "Hangers and Supports."
- C. Install hangers for horizontal steel piping with the following maximum spacing and minimum rod sizes:
 1. NPS 1 and Smaller: Maximum span, 96 inches; minimum rod size, 3/8 inch.

2. NPS 1-1/4: Maximum span, 108 inches; minimum rod size, 3/8 inch.
3. NPS 1-1/2 and NPS 2: Maximum span, 108 inches; minimum rod size, 3/8 inch.

D. Install hangers for horizontal, corrugated stainless-steel tubing with the following maximum spacing and minimum rod sizes:

1. NPS 3/8: Maximum span, 48 inches; minimum rod size, 3/8 inch.
2. NPS 1/2: Maximum span, 72 inches; minimum rod size, 3/8 inch.
3. NPS 3/4 and Larger: Maximum span, 96 inches; minimum rod size, 3/8 inch.

3.6 CONNECTIONS

- A. Connect to utility's gas main according to utility's procedures and requirements.
- B. Install natural-gas piping electrically continuous, and bonded to gas appliance equipment grounding conductor of the circuit powering the appliance according to NFPA 70.
- C. Install piping adjacent to appliances to allow service and maintenance of appliances.
- D. Connect piping to appliances using manual gas shutoff valves and unions. Install valve within 72 inches of each gas-fired appliance and equipment. Install union between valve and appliances or equipment.
- E. Sediment Traps: Install tee fitting with capped nipple in bottom to form drip, as close as practical to inlet of each appliance.

3.7 LABELING AND IDENTIFYING

- A. Comply with requirements in Division 23 Section "Mechanical Identification" for piping and valve identification.
- B. Install detectable warning tape directly above gas piping, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

3.8 FIELD QUALITY CONTROL

- A. Test, inspect, and purge natural gas according to the International Fuel Gas Code and authorities having jurisdiction.
- B. Natural-gas piping will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

3.9 OUTDOOR PIPING SCHEDULE

- A. Underground natural-gas piping shall be one of the following:
 1. PE pipe and fittings joined by heat fusion; service-line risers with tracer wire terminated in an accessible location.
 2. Steel pipe with wrought-steel fittings and welded joints. Coat pipe and fittings with protective coating for steel piping.

3. Annealed-temper copper tube with wrought-copper fittings and brazed joints. Coat pipe and fittings with protective coating for copper tubing.
- B. Aboveground natural-gas piping shall be one of the following:
1. Steel pipe with malleable-iron fittings and threaded joints.
 2. Steel pipe with wrought-steel fittings and welded joints.
 3. Annealed-temper copper tube with wrought-copper fittings and brazed joints.
- C. Containment Conduit: Steel pipe with wrought-steel fittings and welded joints. Coat pipe and fittings with protective coating for steel piping.

3.10 INDOOR PIPING SCHEDULE

- A. Aboveground, branch piping NPS 1 and smaller shall be one of the following:
1. Annealed-temper copper tube with wrought-copper fittings and brazed joints.
 2. Steel pipe with malleable-iron fittings and threaded joints.
- B. Aboveground, distribution piping shall be one of the following:
1. Steel pipe with malleable-iron fittings and threaded joints.
 2. Steel pipe with wrought-steel fittings and welded joints.

3.11 UNDERGROUND MANUAL GAS SHUTOFF VALVE SCHEDULE

- A. Connections to Existing Gas Piping: Use valve and fitting assemblies made for tapping utility's gas mains and listed by an NRTL.

3.12 ABOVEGROUND MANUAL GAS SHUTOFF VALVE SCHEDULE

- A. Valves for pipe sizes NPS 2 and smaller at service meter shall be one of the following:
1. One-piece, bronze ball valve with bronze trim.
 2. Two-piece, full-port, bronze ball valves with bronze trim.
 3. Bronze plug valve.
- B. Distribution piping valves for pipe sizes NPS 2 and smaller shall be one of the following:
1. One-piece, bronze ball valve with bronze trim.
 2. Two-piece, full-port, bronze ball valves with bronze trim.
 3. Bronze plug valve.
- C. Valves in branch piping for single appliance shall be one of the following:
1. One-piece, bronze ball valve with bronze trim.
 2. Two-piece, full-port, bronze ball valves with bronze trim.
 3. Bronze plug valve.

END OF SECTION 231123

SECTION 260500 - COMMON WORK RESULTS FOR ELECTRICAL

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Grout.
 - 2. Common electrical installation requirements.

PART 2 - PRODUCTS

2.1 GROUT

- A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

PART 3 - EXECUTION

3.1 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION

- A. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.
- B. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.
- C. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.
- D. Right of Way: Give to piping systems installed at a required slope.

3.2 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Electrical penetrations occur when raceways, cables, wireways, cable trays, or busways penetrate concrete slabs, concrete or masonry walls, or fire-rated floor and wall assemblies.
- B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.
- C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
- D. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.

- E. Cut sleeves to length for mounting flush with both surfaces of walls.
- F. Extend sleeves installed in floors 2 inches above finished floor level.
- G. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway or cable, unless indicated otherwise.
- H. Seal space outside of sleeves with grout for penetrations of concrete and masonry
 - 1. Promptly pack grout solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect grout while curing.
- I. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Division 7 Section "Joint Sealants."
- J. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway and cable penetrations. Install sleeves and seal raceway and cable penetration sleeves with firestop materials.
- K. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.
- L. Aboveground, Exterior-Wall Penetrations: Seal penetrations using pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

3.3 SLEEVE-SEAL INSTALLATION

- A. Install to seal exterior wall penetrations.
- B. Use type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.4 FIRESTOPPING

- A. Apply firestopping to penetrations of fire-rated floor and wall assemblies for electrical installations to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 7 Section "Through-Penetration Firestop Systems."

END OF SECTION 260500

SECTION 260519 - CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Building wires and cables rated 600 V and less.
 - 2. Connectors, splices, and terminations rated 600 V and less.
 - 3. Sleeves and sleeve seals for cables.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Field quality-control test reports.

1.3 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

- A. Copper Conductors: Comply with NEMA WC 70.
- B. Conductor Insulation: Comply with NEMA WC 70 for Types THHN-THWN, XHHW and SO.
- C. Multiconductor Cable: Comply with NEMA WC 70 for armored cable, Type AC metal-clad cable, Type MC mineral-insulated, metal-sheathed cable.

2.2 CONNECTORS AND SPLICES

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. AFC Cable Systems, Inc.
 - 2. Hubbell Power Systems, Inc.
 - 3. O-Z/Gedney; EGS Electrical Group LLC.

4. 3M; Electrical Products Division.
5. Tyco Electronics Corp.

C. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

2.3 SLEEVES FOR CABLES

- A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.
- B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
- C. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 7 Section "Through-Penetration Firestop Systems."

2.4 SLEEVE SEALS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 1. Advance Products & Systems, Inc.
 2. Calpico, Inc.
 3. Metraflex Co.
 4. Pipeline Seal and Insulator, Inc.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

- A. Feeders: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
- B. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

- A. Service Entrance: Type THHN-THWN, single conductors in raceway, Type XHHW, single conductors in raceway.
- B. Exposed Feeders: **Type** THHN-THWN, single conductors in raceway.
- C. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspace: Type THHN-THWN, single conductors in raceway, Armored cable, Type AC, Metal-clad cable, Type MC.
- D. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-THWN, single conductors in raceway.
- E. Exposed Branch Circuits, Including in Crawlspace: Type THHN-THWN, single conductors in raceway.

- F. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN-THWN, single conductors in raceway, Armored cable, Type AC, Metal-clad cable, Type MC, Mineral-insulated, metal-sheathed cable, Type MI.
- G. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-THWN, single conductors in raceway.
- H. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, strain relief device at terminations to suit application.
- I. Class 1 Control Circuits: Type THHN-THWN, in raceway.
- J. Class 2 Control Circuits: Power-limited cable, concealed in building finishes, Power-limited tray cable, in cable tray.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

- A. Conceal cables in finished walls, ceilings, and floors, unless otherwise indicated.
- B. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
- C. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.
- D. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.
- E. Support cables according to Division 26 Section "Electrical Supports and Seismic Restraints."
- F. Identify and color-code conductors and cables according to Division 26 Section "Electrical Identification."
- G. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
- H. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
 - 1. Use oxide inhibitor in each splice and tap conductor for aluminum conductors.
- I. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches of slack.

3.4 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 7 Section "Through-Penetration Firestop Systems."
- B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.

- C. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.
- D. Cut sleeves to length for mounting flush with both wall surfaces.
- E. Extend sleeves installed in floors 2 inches above finished floor level.
- F. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and cable unless sleeve seal is to be installed.
- G. Seal space outside of sleeves with grout for penetrations of concrete and masonry.
- H. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and cable, using joint sealant appropriate for size, depth, and location of joint according to Division 7 Section "Joint Sealants."
- I. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at cable penetrations. Install sleeves and seal with firestop materials according to Division 7 Section "Through-Penetration Firestop Systems."
- J. Roof-Penetration Sleeves: Seal penetration of individual cables with flexible boot-type flashing units applied in coordination with roofing work.
- K. Aboveground Exterior-Wall Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Size sleeves to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
- L. Underground Exterior-Wall Penetrations: Install cast-iron "wall pipes" for sleeves. Size sleeves to allow for 1-inch annular clear space between cable and sleeve for installing mechanical sleeve seals.

3.5 SLEEVE-SEAL INSTALLATION

- A. Install to seal underground exterior-wall penetrations.
- B. Use type and number of sealing elements recommended by manufacturer for cable material and size. Position cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.6 FIRESTOPPING

- A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Division 7 Section "Through-Penetration Firestop Systems."

3.7 FIELD QUALITY CONTROL

- A. Perform tests and inspections and prepare test reports.
- B. Tests and Inspections:

1. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors for compliance with requirements.
 2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
 3. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each splice in cables and conductors No. 3 AWG and larger. Remove box and equipment covers so splices are accessible to portable scanner.
 - a. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each splice 11 months after date of Substantial Completion.
 - b. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
 - c. Record of Infrared Scanning: Prepare a certified report that identifies splices checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.
- C. Test Reports: Prepare a written report to record the following:
1. Test procedures used.
 2. Test results that comply with requirements.
 3. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.
- D. Remove and replace malfunctioning units and retest as specified above.

END OF SECTION 260519

SECTION 260526 - GROUNDING AND BONDING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Grounding systems and equipment.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Field quality-control reports.

1.3 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with UL 467 for grounding and bonding materials and equipment.

PART 2 - PRODUCTS

2.1 CONDUCTORS

- A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.
- B. Bare Copper Conductors:
 - 1. Solid Conductors: ASTM B 3.
 - 2. Stranded Conductors: ASTM B 8.
 - 3. Tinned Conductors: ASTM B 33.
 - 4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch in diameter.
 - 5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
 - 6. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.

2.2 CONNECTORS

- A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.
- B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, pressure type with at least two bolts.
 - 1. Pipe Connectors: Clamp type, sized for pipe.

- C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

2.3 GROUNDING ELECTRODES

- A. Ground Rods: Copper-clad steel; 3/4 inch by 10 feet in diameter.

PART 3 - EXECUTION

3.1 APPLICATIONS

- A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger unless otherwise indicated.
- B. Underground Grounding Conductors: Install bare copper conductor, No. 2/0 AWG minimum. Bury at least 24 inches below grade.
- C. Isolated Grounding Conductors: Green-colored insulation.
- D. Conductor Terminations and Connections:
 - 1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
 - 2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.
 - 3. Connections to Ground Rods at Test Wells: Bolted connectors.
 - 4. Connections to Structural Steel: Bolted connectors.

3.2 EQUIPMENT GROUNDING

- A. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:
 - 1. Feeders and branch circuits.
 - 2. Lighting circuits.
 - 3. Receptacle circuits.
 - 4. Single-phase motor and appliance branch circuits.
 - 5. Three-phase motor and appliance branch circuits.
 - 6. Flexible raceway runs.
 - 7. Armored and metal-clad cable runs.
 - 8. Busway Supply Circuits: Install insulated equipment grounding conductor from grounding bus in the switchgear, switchboard, or distribution panel to equipment grounding bar terminal on busway.
 - 9. Computer and Rack-Mounted Electronic Equipment Circuits: Install insulated equipment grounding conductor in branch-circuit runs from equipment-area power panels and power-distribution units.
 - 10. X-Ray Equipment Circuits: Install insulated equipment grounding conductor in circuits supplying x-ray equipment.
- B. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.

- C. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.
- D. Signal and Communication Equipment: In addition to grounding and bonding required by NFPA 70, provide a separate grounding system complying with requirements in TIA/ATIS J-STD-607-A.
 - 1. For telephone, alarm, voice and data, and other communication equipment, provide No. 4 AWG minimum insulated grounding conductor in raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location.
 - 2. Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a 1/4-by-4-by-12-inch grounding bus.
 - 3. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.
- E. Metal Poles Supporting Outdoor Lighting Fixtures: Install grounding conductor installed with branch-circuit conductors.

3.3 INSTALLATION

- A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
- B. Ground Rods: Drive rods until tops are 2 inches below finished floor or final grade unless otherwise indicated.
 - 1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.
- C. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.
 - 1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
 - 2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.
 - 3. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.
- D. 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; use a bolted clamp connector or bolt 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 conduit 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.

3.4 LABELING

- A. Comply with requirements in Division 26 Section "Electrical Identification" Article for instruction signs. The label or its text shall be green.

3.5 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections and prepare test reports:
 - 1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
 - 2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
 - 3. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, and at ground test wells. Make tests at ground rods before any conductors are connected.
- B. Report measured ground resistances that exceed the following values:
 - 1. Power and Lighting Equipment or System with Capacity of 500 kVA and Less: 10 ohms.
 - 2. Power and Lighting Equipment or System with Capacity of 500 to 1000 kVA: 5 ohms.
 - 3. Power and Lighting Equipment or System with Capacity More Than 1000 kVA: 3 ohms.
 - 4. Power Distribution Units or Panelboards Serving Electronic Equipment: 3 ohm(s).
- C. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END OF SECTION 260526

SECTION 260529 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes:
 - 1. Hangers and supports for electrical equipment and systems.
 - 2. Construction requirements for concrete bases.

1.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design supports for multiple raceways, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.
- C. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
- D. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of five times the applied force.

1.3 SUBMITTALS

- A. Product Data: For steel slotted support systems.
- B. Shop Drawings: Show fabrication and installation details and include calculations for the following:
 - 1. Trapeze hangers. Include Product Data for components.
 - 2. Steel slotted channel systems. Include Product Data for components.
 - 3. Equipment supports.

1.4 QUALITY ASSURANCE

- A. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

- A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Allied Tube & Conduit.
 - b. Cooper B-Line, Inc.; a division of Cooper Industries.
 - c. ERICO International Corporation.
 - d. GS Metals Corp.
 - e. Thomas & Betts Corporation.
 - f. Unistrut; Tyco International, Ltd.
 - g. Wesanco, Inc.
 3. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
 4. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
 5. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
 6. Channel Dimensions: Selected for applicable load criteria.
- B. Raceway and Cable Supports: As described in NECA 1 and NECA 101.
- C. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.
- D. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.
- E. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
- F. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
 - a. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - b. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Hilti Inc.
 - 2) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
 - 3) MKT Fastening, LLC.
 - 4) Simpson Strong-Tie Co., Inc.; Masterset Fastening Systems Unit.
 2. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.

- a. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- b. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Cooper B-Line, Inc.; a division of Cooper Industries.
 - 2) Empire Tool and Manufacturing Co., Inc.
 - 3) Hilti Inc.
 - 4) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
 - 5) MKT Fastening, LLC.
- 3. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
- 4. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
- 5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
- 6. Toggle Bolts: All-steel springhead type.
- 7. Hanger Rods: Threaded steel.

2.2 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

- A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.
- B. Materials: Comply with requirements in Division 5 Section "Metal Fabrications" for steel shapes and plates.

PART 3 - EXECUTION

3.1 APPLICATION

- A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.
- B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as required by NFPA 70. Minimum rod size shall be 1/4 inch in diameter.
- C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.
 - 1. Secure raceways and cables to these supports with single-bolt conduit clamps.
- D. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

3.2 SUPPORT INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.

- B. Raceway Support Methods: In addition to methods described in NECA 1, EMT, IMC, and RMC may be supported by openings through structure members, as permitted in NFPA 70.
- C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.
- D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
 - 1. To Wood: Fasten with lag screws or through bolts.
 - 2. To New Concrete: Bolt to concrete inserts.
 - 3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
 - 4. To Existing Concrete: Expansion anchor fasteners.
 - 5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches thick.
 - 6. To Steel: Beam clamps complying with MSS SP-69 or Spring-tension clamps.
 - 7. To Light Steel: Sheet metal screws.
 - 8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate **[by means that meet seismic-restraint strength and anchorage requirements]**.
- E. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

- A. Comply with installation requirements in Division 5 Section "Metal Fabrications" for site-fabricated metal supports.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

3.4 CONCRETE BASES

- A. Construct concrete bases of dimensions indicated but not less than 4 inches larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.
- B. Use 3000-psi, 28-day compressive-strength concrete.
- C. Anchor equipment to concrete base.
 - 1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 2. Install anchor bolts to elevations required for proper attachment to supported equipment.
 - 3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

3.5 PAINTING

- A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
 - 1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.
- B. Touchup: Comply with requirements in painting Sections for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 260529

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

- A. Outdoors: Apply raceway products as specified below, unless otherwise indicated:
1. Exposed Conduit: Rigid steel conduit, IMC, RNC, Type EPC-80-PVC.
 2. Concealed Conduit, Aboveground: EMT, RNC, Type EPC-40-PVC.
 3. Underground Conduit: RNC, Type EPC-40-PVC, direct buried.
 4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
 5. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.
- B. Comply with the following indoor applications, unless otherwise indicated:
1. Exposed, Not Subject to Physical Damage: EMT.
 2. Exposed, Not Subject to Severe Physical Damage: EMT.
 3. Exposed and Subject to Severe Physical Damage: Rigid steel conduit, IMC. Includes raceways in the following locations:
 - a. Loading dock.
 - b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
 - c. Mechanical rooms.
 4. Concealed in Ceilings and Interior Walls and Partitions: EMT.
 5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
 6. Damp or Wet Locations: Rigid steel conduit or IMC.
 7. Raceways for Optical Fiber or Communications Cable: EMT.
 8. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4, nonmetallic in damp or wet locations.
- C. Minimum Raceway Size: 1/2-inch trade size.
- D. Raceway Fittings: Compatible with raceways and suitable for use and location.
1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings, unless otherwise indicated.

3.2 INSTALLATION

- A. Comply with NECA 1 for installation requirements applicable to products specified in Part 2 except where requirements on Drawings or in this Article are stricter.
- B. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
- C. Complete raceway installation before starting conductor installation.
- D. Support raceways as specified in Division 26 Section "Electrical Supports and Seismic Restraints."
- E. Arrange stub-ups so curved portions of bends are not visible above the finished slab.

- F. Install no more than the equivalent of three 90-degree bends in any conduit run except for communications conduits, for which fewer bends are allowed.
- G. Conceal conduit and EMT within finished walls, ceilings, and floors, unless otherwise indicated.
- H. Raceways Embedded in Slabs:
 - 1. Run conduit larger than 1-inch trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support.
 - 2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
 - 3. Change from ENT to RNC, Type EPC-40-PVC, rigid steel conduit, or IMC before rising above the floor.
- I. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors, including conductors smaller than No. 4 AWG.
- J. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire.
- K. Raceways for Optical Fiber and Communications Cable: Install as follows:
 - 1. 3/4-Inch Trade Size and Smaller: Install raceways in maximum lengths of 50 feet.
 - 2. 1-Inch Trade Size and Larger: Install raceways in maximum lengths of 75 feet.
 - 3. Install with a maximum of two 90-degree bends or equivalent for each length of raceway unless Drawings show stricter requirements. Separate lengths with pull or junction boxes or terminations at distribution frames or cabinets where necessary to comply with these requirements.
- L. Install raceway sealing fittings at suitable, approved, and accessible locations and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points:
 - 1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
 - 2. Where otherwise required by NFPA 70.
- M. Expansion-Joint Fittings for RNC: Install in each run of aboveground conduit that is located where environmental temperature change may exceed 30 deg F, and that has straight-run length that exceeds 25 feet.
 - 1. Install expansion-joint fittings for each of the following locations, and provide type and quantity of fittings that accommodate temperature change listed for location:
 - a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F temperature change.
 - b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F temperature change.
 - c. Indoor Spaces: Connected with the Outdoors without Physical Separation: 125 deg F temperature change.
 - d. Attics: 135 deg F temperature change.
 - 2. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F of temperature change.
 - 3. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at the time of installation.

- N. Flexible Conduit Connections: Use maximum of 72 inches of flexible conduit for recessed and semirecessed lighting fixtures, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.
 - 1. Use LFMC in damp or wet locations subject to severe physical damage.
 - 2. Use LFMC or LFNC in damp or wet locations not subject to severe physical damage.
- O. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall.
- P. Set metal floor boxes level and flush with finished floor surface.
- Q. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

3.3 INSTALLATION OF UNDERGROUND CONDUIT

A. Direct-Buried Conduit:

- 1. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottom as specified in Division 2 Section "Earthwork" for pipe less than 6 inches in nominal diameter.
- 2. Install backfill as specified in Division 2 Section "Earthwork."
- 3. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified in Division 2 Section "Earthwork."
- 4. Install manufactured duct elbows for stub-ups at poles and equipment and at building entrances through the floor, unless otherwise indicated. Encase elbows for stub-up ducts throughout the length of the elbow.
- 5. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through the floor.
 - a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches of concrete.
 - b. For stub-ups at equipment mounted on outdoor concrete bases, extend steel conduit horizontally a minimum of 60 inches from edge of equipment pad or foundation. Install insulated grounding bushings on terminations at equipment.
- 6. Warning Planks: Bury warning planks approximately 12 inches above direct-buried conduits, placing them 24 inches o.c. Align planks along the width and along the centerline of conduit.

3.4 FIRESTOPPING

- A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 7 Section "Through-Penetration Firestop Systems."

END OF SECTION 260533

SECTION 260553 - ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 1. Identification for conductors.
 2. Warning labels and signs.
 3. Instruction signs.
 4. Equipment identification labels.
 5. Miscellaneous identification products.

1.2 SUBMITTALS

- A. Product Data: For each electrical identification product indicated.

1.3 QUALITY ASSURANCE

- A. Comply with ANSI A13.1.
- B. Comply with NFPA 70.
- C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.
- D. Comply with ANSI Z535.4 for safety signs and labels.
- E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

PART 2 - PRODUCTS

2.1 CONDUCTOR IDENTIFICATION MATERIALS

- A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils thick by 1 to 2 inches wide.
- B. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.
- C. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

2.2 WARNING LABELS AND SIGNS

- A. Comply with NFPA 70 and 29 CFR 1910.145.

- B. Self-Adhesive Warning Labels: Factory-printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment unless otherwise indicated.
- C. Baked-Enamel Warning Signs:
 - 1. Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application.
 - 2. 1/4-inch grommets in corners for mounting.
 - 3. Nominal size, 7 by 10 inches.
- D. Metal-Backed, Butyrate Warning Signs:
 - 1. Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with 0.0396-inch galvanized-steel backing; and with colors, legend, and size required for application.
 - 2. 1/4-inch grommets in corners for mounting.
 - 3. Nominal size, 10 by 14 inches.
- E. Warning label and sign shall include, but are not limited to, the following legends:
 - 1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
 - 2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES."

2.3 INSTRUCTION SIGNS

- A. Engraved, laminated acrylic or melamine plastic, minimum 1/16 inch thick for signs up to 20 sq. inches and 1/8 inch thick for larger sizes.
 - 1. Engraved legend with black letters on white face.
 - 2. Punched or drilled for mechanical fasteners.
 - 3. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.
- B. Adhesive Film Label: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch.
- C. Adhesive Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch. Overlay shall provide a weatherproof and UV-resistant seal for label.

2.4 EQUIPMENT IDENTIFICATION LABELS

- A. Adhesive Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch. Overlay shall provide a weatherproof and UV-resistant seal for label.
- B. Self-Adhesive, Engraved, Laminated Acrylic or Melamine Label: Adhesive backed, with white letters on a dark-gray background. Minimum letter height shall be 3/8 inch.
- C. Stenciled Legend: In nonfading, waterproof, black ink or paint. Minimum letter height shall be 1 inch.

2.5 MISCELLANEOUS IDENTIFICATION PRODUCTS

- A. Paint: Comply with requirements in Division 9 painting Sections for paint materials and application requirements. Select paint system applicable for surface material and location (exterior or interior).
- B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.
- B. Apply identification devices to surfaces that require finish after completing finish work.
- C. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.
- D. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
- E. System Identification Color-Coding Bands for Raceways and Cables: Each color-coding band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.
- F. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at 6 to 8 inches below finished grade. Use multiple tapes where width of multiple lines installed in a common trench [**or concrete envelope**] exceeds 16 inches overall.
- G. Painted Identification: Comply with requirements in Division 9 painting Sections for surface preparation and paint application.

3.2 IDENTIFICATION SCHEDULE

- A. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use color-coding conductor tape to identify the phase.
 - 1. Color-Coding for Phase Identification, 600 V or Less: Use colors listed below for ungrounded service feeder and branch-circuit conductors.
 - a. Color shall be factory applied **or** field applied for sizes larger than No. 8 AWG, if authorities having jurisdiction permit.
 - b. Colors for 208/120-V Circuits:
 - 1) Phase A: Black.
 - 2) Phase B: Red.
 - 3) Phase C: Blue.
 - c. Colors for 480/277-V Circuits:

- 1) Phase A: Brown.
 - 2) Phase B: Orange.
 - 3) Phase C: Yellow.
- d. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.
- B. Install instructional sign including the color-code for grounded and ungrounded conductors using adhesive-film-type labels.
- C. Conductors to Be Extended in the Future: Attach write-on tags to conductors and list source.
- D. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.
1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
 2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
 3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual.
- E. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable.
1. Limit use of underground-line warning tape to direct-buried cables.
 2. Install underground-line warning tape for both direct-buried cables and cables in raceway.
- F. Workspace Indication: Install floor marking tape to show working clearances in the direction of access to live parts. Workspace shall be as required by NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces.
- G. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Baked-enamel warning signs.
1. Comply with 29 CFR 1910.145.
 2. Identify system voltage with black letters on an orange background.
 3. Apply to exterior of door, cover, or other access.
 4. For equipment with multiple power or control sources, apply to door or cover of equipment including, but not limited to, the following:
 - a. Power transfer switches.
 - b. Controls with external control power connections.
- H. Operating Instruction Signs: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.
- I. Emergency Operating Instruction Signs: Install instruction signs with white legend on a red background with minimum 3/8-inch- high letters for emergency instructions at equipment used for power transfer or load shedding.

J. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and the Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.

1. Labeling Instructions:

- a. Indoor Equipment: Engraved, laminated acrylic or melamine label. Unless otherwise indicated, provide a single line of text with 1/2-inch- high letters on 1-1/2-inch- high label; where two lines of text are required, use labels 2 inches high.
- b. Outdoor Equipment: Engraved, laminated acrylic or melamine label.
- c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
- d. Unless provided with self-adhesive means of attachment, fasten labels with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.

END OF SECTION 260553

SECTION 260923 - LIGHTING CONTROL DEVICES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following lighting control devices:
 - 1. Time switches.
 - 2. Outdoor photoelectric switches.
 - 3. Indoor occupancy sensors.
 - 4. Outdoor motion sensors.
 - 5. Lighting contactors.
 - 6. Emergency shunt relay.
- B. See Division 26 Section "Wiring Devices" for wall-box dimmers, wall-switch occupancy sensors, and manual light switches.
- C. See Division 26 Section "Stage Lighting" for theatrical lighting controls.
- D. See Division 26 Section "Dimming Controls" for architectural dimming system equipment.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Field quality-control test reports.
- C. Operation and maintenance data.

1.3 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

PART 2 - PRODUCTS

2.1 TIME SWITCHES

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- C. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:

1. Area Lighting Research, Inc.; Tyco Electronics.
2. Grasslin Controls Corporation; a GE Industrial Systems Company.
3. Intermatic, Inc.
4. Leviton Mfg. Company Inc.
5. Lightolier Controls; a Genlyte Company.
6. Lithonia Lighting; Acuity Lighting Group, Inc.
7. Paragon Electric Co.; Invensys Climate Controls.
8. Square D; Schneider Electric.
9. TORK.
10. Touch-Plate, Inc.
11. Watt Stopper (The).

D. Electronic Time Switches: Electronic, solid-state programmable units with alphanumeric display; complying with UL 917.

1. Contact Configuration: DPDT.
2. Contact Rating: 30-A inductive or resistive, 240-V ac.
3. Program: 8 on-off set points on a 24-hour schedule and an annual holiday schedule that overrides the weekly operation on holidays.
4. Circuitry: Allow connection of a photoelectric relay as substitute for on-off function of a program on selected channels.
5. Astronomic Time: All channels.
6. Battery Backup: For schedules and time clock.

E. Electromechanical-Dial Time Switches: Type complying with UL 917.

1. Contact Configuration: DPDT.
2. Contact Rating: 30-A inductive or resistive, 240-V ac.
3. Circuitry: Allow connection of a photoelectric relay as substitute for on-off function of a program.
4. Astronomic time dial.
5. Eight-Day Program: Uniquely programmable for each weekday and holidays.
6. Skip-a-day mode.
7. Wound-spring reserve carryover mechanism to keep time during power failures, minimum of 16 hours.

2.2 OUTDOOR PHOTOELECTRIC SWITCHES

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

C. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:

1. Area Lighting Research, Inc.; Tyco Electronics.
2. Grasslin Controls Corporation; a GE Industrial Systems Company.
3. Intermatic, Inc.
4. Lithonia Lighting; Acuity Lighting Group, Inc.
5. Novitas, Inc.
6. Paragon Electric Co.; Invensys Climate Controls.
7. Square D; Schneider Electric.
8. TORK.
9. Touch-Plate, Inc.

10. Watt Stopper (The).
- D. Description: Solid state, with SPST dry contacts rated for 1800-VA tungsten or 1000-VA inductive, to operate connected relay, contactor coils, or microprocessor input; complying with UL 773A.
1. Light-Level Monitoring Range: 1.5 to 10 fc, with an adjustment for turn-on and turn-off levels within that range, and a directional lens in front of photocell to prevent fixed light sources from causing turn-off.
 2. Time Delay: 15-second minimum, to prevent false operation.
 3. Surge Protection: Metal-oxide varistor, complying with IEEE C62.41.1, IEEE C62.41.2, and IEEE 62.45 for Category A1 locations.
 4. Mounting: Twist lock complying with IEEE C136.10, with base-and-stem mounting or stem-and-swivel mounting accessories as required to direct sensor to the north sky exposure.
- E. Description: Solid state, with SPST dry contacts rated for 1800 VA to operate connected load, relay, or contactor coils; complying with UL 773.
1. Light-Level Monitoring Range: 1.5 to 10 fc, with an adjustment for turn-on and turn-off levels within that range.
 2. Time Delay: 30-second minimum, to prevent false operation.
 3. Lightning Arrester: Air-gap type.
 4. Mounting: Twist lock complying with IEEE C136.10, with base.

2.3 INDOOR OCCUPANCY SENSORS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- C. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
1. Hubbell Lighting.
 2. Leviton Mfg. Company Inc.
 3. Lithonia Lighting; Acuity Lighting Group, Inc.
 4. Novitas, Inc.
 5. RAB Lighting, Inc.
 6. Sensor Switch, Inc.
 7. TORK.
 8. Watt Stopper (The).
- D. General Description: Wall- or ceiling-mounting, solid-state units with a separate relay unit.
1. Operation: Unless otherwise indicated, turn lights on when covered area is occupied and off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
 2. Sensor Output: Contacts rated to operate the connected relay, complying with UL 773A. Sensor shall be powered from the relay unit.
 3. Relay Unit: Dry contacts rated for 20-A ballast load at 120- and 277-V ac, for 13-A tungsten at 120-V ac, and for 1 hp at 120-V ac. Power supply to sensor shall be 24-V dc, 150-mA, Class 2 power source as defined by NFPA 70.
 4. Mounting:

- a. Sensor: Suitable for mounting in any position on a standard outlet box.
 - b. Relay: Externally mounted through a 1/2-inch knockout in a standard electrical enclosure.
 - c. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.
- 5. Indicator: LED, to show when motion is being detected during testing and normal operation of the sensor.
 - 6. Bypass Switch: Override the on function in case of sensor failure.
 - 7. Automatic Light-Level Sensor: Adjustable from 2 to 200 fc; keep lighting off when selected lighting level is present.
- E. PIR Type: Ceiling mounting; detect occupancy by sensing a combination of heat and movement in area of coverage.
 - 1. Detector Sensitivity: Detect occurrences of 6-inch- minimum movement of any portion of a human body that presents a target of not less than 36 sq. in..
 - 2. Detection Coverage (Room): Detect occupancy anywhere in a circular area of 1000 sq. ft. when mounted on a 96-inch- high ceiling.
 - 3. Detection Coverage (Corridor): Detect occupancy within 90 feet when mounted on a 10-foot-high ceiling.

2.4 OUTDOOR MOTION SENSORS (PIR)

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- C. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
 - 1. Bryant Electric; a Hubbell Company.
 - 2. Hubbell Lighting.
 - 3. Lithonia Lighting; Acuity Lighting Group, Inc.
 - 4. Paragon Electric Co.; Invensys Climate Controls.
 - 5. RAB Lighting, Inc.
 - 6. TORK.
 - 7. Watt Stopper (The).
- D. Performance Requirements: Suitable for operation in ambient temperatures ranging from minus 40 to plus 130 deg F, rated as raintight according to UL 773A.
 - 1. Operation: Turn lights on when sensing infrared energy changes between background and moving body in area of coverage; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
 - 2. Mounting:
 - a. Sensor: Suitable for mounting in any position on a standard outdoor junction box.
 - b. Relay: Internally mounted in a standard weatherproof electrical enclosure.
 - c. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.
 - 3. Bypass Switch: Override the on function in case of sensor failure.
 - 4. Automatic Light-Level Sensor: Adjustable from 1 to 20 fc; keep lighting off during daylight hours.

- E. Detector Sensitivity: Detect occurrences of 6-inch- minimum movement of any portion of a human body that presents a target of not less than 36 sq. in..
- F. Detection Coverage: Up to 35 feet, with a field of view of 180 degrees.
- G. Lighting Fixture Mounted Sensor: Suitable for switching 300 W of tungsten load at 120- or 277-V ac.
- H. Individually Mounted Sensor: Contacts rated to operate the connected relay, complying with UL 773A. Sensor shall be powered from the relay unit.
 - 1. Relay Unit: Dry contacts rated for 20-A ballast load at 120- and 277-V ac, for 13-A tungsten at 120-V ac, and for 1 hp at 120-V ac. Power supply to sensor shall be 24-V dc, 150-mA, Class 2 power source as defined by NFPA 70.
 - 2. Indicator: LED, to show when motion is being detected during testing and normal operation of the sensor.

2.5 LIGHTING CONTACTORS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- C. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
 - 1. Allen-Bradley/Rockwell Automation.
 - 2. ASCO Power Technologies, LP; a division of Emerson Electric Co.
 - 3. Eaton Electrical Inc.; Cutler-Hammer Products.
 - 4. GE Industrial Systems; Total Lighting Control.
 - 5. Grasslin Controls Corporation; a GE Industrial Systems Company.
 - 6. Hubbell Lighting.
 - 7. Lithonia Lighting; Acuity Lighting Group, Inc.
 - 8. MicroLite Lighting Control Systems.
 - 9. Square D; Schneider Electric.
 - 10. TORK.
 - 11. Touch-Plate, Inc.
 - 12. Watt Stopper (The).
 - 13.
- D. Description: Electrically operated and mechanically held, combination type with nonfused disconnect, complying with NEMA ICS 2 and UL 508.
 - 1. Current Rating for Switching: Listing or rating consistent with type of load served, including tungsten filament, inductive, and high-inrush ballast (ballast with 15 percent or less total harmonic distortion of normal load current).
 - 2. Fault Current Withstand Rating: Equal to or exceeding the available fault current at the point of installation.
 - 3. Enclosure: Comply with NEMA 250.
 - 4. Provide with control and pilot devices as indicated on Drawings, matching the NEMA type specified for the enclosure.

2.6 CONDUCTORS AND CABLES

- A. Power Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG. Comply with requirements in Division 16 Section "Conductors and Cables."
- B. Classes 2 and 3 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 18 AWG. Comply with requirements in Division 26 Section "Conductors and Cables."
- C. Class 1 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 18 AWG. Comply with requirements in Division 26 Section "Conductors and Cables."

PART 3 - EXECUTION

3.1 SENSOR INSTALLATION

- A. Install and aim sensors in locations to achieve not less than 90 percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions.
- B. When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting sensors to suit actual occupied conditions. Provide up to two visits to Project during other than normal occupancy hours for this purpose.

3.2 CONTACTOR INSTALLATION

- A. Mount electrically held lighting contactors with elastomeric isolator pads, to eliminate structure-borne vibration, unless contactors are installed in an enclosure with factory-installed vibration isolators.

3.3 WIRING INSTALLATION

- A. Wiring Method: Comply with Division 26 Section "Conductors and Cables." Minimum conduit size shall be 1/2 inch.
- B. Wiring within Enclosures: Comply with NECA 1. Separate power-limited and nonpower-limited conductors according to conductor manufacturer's written instructions.
- C. Size conductors according to lighting control device manufacturer's written instructions, unless otherwise indicated.
- D. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

3.4 IDENTIFICATION

- A. Identify components and power and control wiring according to Division 26 Section "Electrical Identification."
 - 1. Identify controlled circuits in lighting contactors.
 - 2. Identify circuits or luminaries controlled by photoelectric and occupancy sensors at each sensor.
- B. Label time switches and contactors with a unique designation.

3.5 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections and prepare test reports:
 - 1. After installing time switches and sensors, and after electrical circuitry has been energized, adjust and test for compliance with requirements.
 - 2. Operational Test: Verify operation of each lighting control device, and adjust time delays.
- B. Lighting control devices that fail tests and inspections are defective work.

END OF SECTION 260923

SECTION 262726 - WIRING DEVICES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Receptacles, receptacles with integral GFCI, and associated device plates.
 - 2. Wall-box motion sensors.
 - 3. Snap switches and wall-box dimmers.
 - 4. Solid-state fan speed controls.
 - 5. Wall-switch and exterior occupancy sensors.
 - 6. Communications outlets.
- B. See Division 26 Section "Voice and Data Communication Cabling" for workstation outlets.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.
- C. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing label warnings and instruction manuals that include labeling conditions.

1.3 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:
 - 1. Cooper Wiring Devices; a division of Cooper Industries, Inc. (Cooper).
 - 2. Hubbell Incorporated; Wiring Device-Kellems (Hubbell).
 - 3. Leviton Mfg. Company Inc. (Leviton).
 - 4. Pass & Seymour/Legrand; Wiring Devices & Accessories (Pass & Seymour).

2.2 STRAIGHT BLADE RECEPTACLES

- A. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498.
 - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - 2. Products: Subject to compliance with requirements, provide one of the following:
 - a. Cooper; 5351 (single), 5352 (duplex).
 - b. Hubbell; HBL5351 (single), CR5352 (duplex).
 - c. Leviton; 5891 (single), 5352 (duplex).
 - d. Pass & Seymour; 5381 (single), 5352 (duplex).

2.3 GFCI RECEPTACLES

- A. General Description: Straight blade, feed-through type. Comply with NEMA WD 1, NEMA WD 6, UL 498, and UL 943, Class A, and include indicator light that is lighted when device is tripped.
- B. Duplex GFCI Convenience Receptacles, 125 V, 20 A:
 - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - 2. Products: Subject to compliance with requirements, provide one of the following:
 - a. Cooper; GF20.
 - b. Pass & Seymour; 2084.
 - c. Leviton

2.4 SNAP SWITCHES

- A. Comply with NEMA WD 1 and UL 20.
- B. Switches, 120/277 V, 20 A:
 - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - 2. Products: Subject to compliance with requirements, provide one of the following:
 - a. Cooper; 2221 (single pole), 2222 (two pole), 2223 (three way), 2224 (four way).
 - b. Hubbell; CS1221 (single pole), CS1222 (two pole), CS1223 (three way), CS1224 (four way).
 - c. Leviton; 1221-2 (single pole), 1222-2 (two pole), 1223-2 (three way), 1224-2 (four way).
 - d. Pass & Seymour; 20AC1 (single pole), 20AC2 (two pole), 20AC3 (three way), 20AC4 (four way).
- C. Pilot Light Switches, 20 A:
 - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - 2. Products: Subject to compliance with requirements, provide one of the following:
 - a. Cooper; 2221PL for 120 V and 277 V.

- b. Hubbell; HPL1221PL for 120 V and 277 V.
 - c. Leviton; 1221-PLR for 120 V, 1221-7PLR for 277 V.
 - d. Pass & Seymour; PS20AC1-PLR for 120 V.
3. Description: Single pole, with neon-lighted handle, illuminated when switch is "ON."
- D. Key-Operated Switches, 120/277 V, 20 A:
- 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - 2. Products: Subject to compliance with requirements, provide one of the following:
 - a. Cooper; 2221L.
 - b. Hubbell; HBL1221L.
 - c. Leviton; 1221-2L.
 - d. Pass & Seymour; PS20AC1-L.
 - 3. Description: Single pole, with factory-supplied key in lieu of switch handle.
- E. Single-Pole, Double-Throw, Momentary Contact, Center-Off Switches, 120/277 V, 20 A; for use with mechanically held lighting contactors.
- 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - 2. Products: Subject to compliance with requirements, provide one of the following:
 - a. Cooper; 1995.
 - b. Hubbell; HBL1557.
 - c. Leviton; 1257.
 - d. Pass & Seymour; 1251.
- F. Key-Operated, Single-Pole, Double-Throw, Momentary Contact, Center-Off Switches, 120/277 V, 20 A; for use with mechanically held lighting contactors, with factory-supplied key in lieu of switch handle.
- 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - 2. Products: Subject to compliance with requirements, provide one of the following:
 - a. Cooper; 1995L.
 - b. Hubbell; HBL1557L.
 - c. Leviton; 1257L.
 - d. Pass & Seymour; 1251L.

2.5 WALL-BOX DIMMERS

- A. Dimmer Switches: Modular, full-wave, solid-state units with integral, quiet on-off switches, with audible frequency and EMI/RFI suppression filters.
- B. Control: Continuously adjustable slider; with single-pole or three-way switching. Comply with UL 1472.
- C. Incandescent Lamp Dimmers: 120 V; control shall follow square-law dimming curve. On-off switch positions shall bypass dimmer module.

1. 600 W; dimmers shall require no derating when ganged with other devices.
- D. Fluorescent Lamp Dimmer Switches: Modular; compatible with dimmer ballasts; trim potentiometer to adjust low-end dimming; dimmer-ballast combination capable of consistent dimming with low end not greater than 20 percent of full brightness.

2.6 FAN SPEED CONTROLS

- A. Modular, 120-V, full-wave, solid-state units with integral, quiet on-off switches and audible frequency and EMI/RFI filters. Comply with UL 1917.
1. Three-speed adjustable rotary knob, 1.5 A.

2.7 OCCUPANCY SENSORS

A. Wall-Switch Sensors:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:
 - a. Cooper; 6111 for 120 V, 6117 for 277 V.
 - b. Hubbell; WS1277.
 - c. Leviton; ODS 10-ID.
 - d. Pass & Seymour; WS3000.
 - e. Watt Stopper (The); WS-200.
3. Description: Passive-infrared type, 120/277 V, adjustable time delay up to 30 minutes, 180-degree field of view, with a minimum coverage area of 900 sq. ft..

B. Wall-Switch Sensors:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:
 - a. Hubbell; AT120 for 120 V, AT277 for 277 V.
 - b. Leviton; ODS 15-ID.
3. Description: Adaptive-technology type, 120/277 V, adjustable time delay up to 20 minutes, 180-degree field of view, with a minimum coverage area of 900 sq. ft..

C. Long-Range Wall-Switch Sensors:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:
 - a. Hubbell; ATP1600WRP.
 - b. Leviton; ODWWV-IRW.
 - c. Pass & Seymour; WA1001.
 - d. Watt Stopper (The); CX-100.

3. Description: Passive-infrared type, 120/277 V, adjustable time delay up to 30 minutes, 110-degree field of view, with a minimum coverage area of 1200 sq. ft..
- D. Long-Range Wall-Switch Sensors:
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 2. Products: Subject to compliance with requirements, provide one of the following:
 - a. Hubbell; ATD1600WRP.
 - b. Leviton; ODW12-MRW.
 - c. Watt Stopper (The); DT-200.
 3. Description: Dual technology, with both passive-infrared- and ultrasonic-type sensing, 120/277 V, adjustable time delay up to 30 minutes, 110-degree field of view, and a minimum coverage area of 1200 sq. ft..
- E. Wide-Range Wall-Switch Sensors:
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 2. Products: Subject to compliance with requirements, provide one of the following:
 - a. Hubbell; ATP120HBRP.
 - b. Leviton; ODWHB-IRW.
 - c. Pass & Seymour; HS1001.
 - d. Watt Stopper (The); CX-100-3.
 3. Description: Passive-infrared type, 120/277 V, adjustable time delay up to 30 minutes, 150-degree field of view, with a minimum coverage area of 1200 sq. ft..
- F. Exterior Occupancy Sensors:
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 2. Products: Subject to compliance with requirements, provide one of the following:
 - a. Leviton; PS200-10.
 - b. Watt Stopper (The); EW-100-120.
 3. Description: Passive-infrared type, 120/277 V, weatherproof, adjustable time delay up to 15 minutes, 180-degree field of view, and 110-foot detection range. Minimum switch rating: 1000-W incandescent, 500-VA fluorescent.

2.8 COMMUNICATIONS OUTLETS

A. Telephone Outlet:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:
 - a. Cooper; 3560-6.
 - b. Leviton; 40649.

3. Description: Single RJ-45 jack for terminating 100-ohm, balanced, four-pair UTP; TIA/EIA-568-B.1 complying with Category 5e. Comply with UL 1863.

B. Combination TV and Telephone Outlet:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:
 - a. Cooper; 3562.
 - b. Leviton; 40595.
3. Description: Single RJ-45 jack for 100-ohm, balanced, four-pair UTP; TIA/EIA-568-B.1; complying with Category 5e; and one Type F coaxial cable connector.

2.9 WALL PLATES

A. Single and combination types to match corresponding wiring devices.

1. Plate-Securing Screws: Metal with head color to match plate finish.
2. Material for Finished Spaces: 0.035-inch- thick, satin-finished stainless steel.
3. Material for Unfinished Spaces: Galvanized steel.
4. Material for Damp Locations: Cast aluminum with spring-loaded lift cover, and listed and labeled for use in "wet locations."

B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with type 3R weather-resistant, die-cast aluminum with lockable cover.

2.10 FLOOR SERVICE FITTINGS

- A. Type: Modular, flush-type, dual-service units suitable for wiring method used.
- B. Compartments: Barrier separates power from voice and data communication cabling.
- C. Service Plate: Rectangular with satin finish.
- D. Power Receptacle: NEMA WD 6 configuration 5-20R, gray finish, unless otherwise indicated.
- E. Voice and Data Communication Outlet: Two modular, keyed, color-coded, RJ-45 Category 5e jacks for UTP cable.

2.11 FINISHES

- A. Color: Wiring device catalog numbers in Section Text do not designate device color.
 1. Wiring Devices Connected to Normal Power System: As selected by Architect, unless otherwise indicated or required by NFPA 70 or device listing.
 2. Wiring Devices Connected to Emergency Power System: Red.
 3. TVSS Devices: Blue.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with NECA 1, including the mounting heights listed in that standard, unless otherwise noted.
- B. Coordination with Other Trades:
 - 1. Take steps to insure that devices and their boxes are protected. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of the boxes.
 - 2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
 - 3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
 - 4. Install wiring devices after all wall preparation, including painting, is complete.
- C. Conductors:
 - 1. Do not strip insulation from conductors until just before they are spliced or terminated on devices.
 - 2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
 - 3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
 - 4. Existing Conductors:
 - a. Cut back and pigtail, or replace all damaged conductors.
 - b. Straighten conductors that remain and remove corrosion and foreign matter.
 - c. Pigtailing existing conductors is permitted provided the outlet box is large enough.
- D. Device Installation:
 - 1. Replace all devices that have been in temporary use during construction or that show signs that they were installed before building finishing operations were complete.
 - 2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
 - 3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
 - 4. Connect devices to branch circuits using pigtails that are not less than 6 inches in length.
 - 5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, 2/3 to 3/4 of the way around terminal screw.
 - 6. Use a torque screwdriver when a torque is recommended or required by the manufacturer.
 - 7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
 - 8. When mounting into metal boxes, remove the fiber or plastic washers used to hold device mounting screws in yokes, allowing metal-to-metal contact.
- E. Receptacle Orientation:
 - 1. Install ground pin of vertically mounted receptacles down, and on horizontally mounted receptacles to the left.
- F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

G. Dimmers:

1. Install dimmers within terms of their listing.
2. Verify that dimmers used for fan speed control are listed for that application.
3. Install unshared neutral conductors on line and load side of dimmers according to manufacturers' device listing conditions in the written instructions.

H. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

3.2 IDENTIFICATION

A. Comply with Division 26 Section "Electrical Identification."

1. Receptacles: Identify panelboard and circuit number from which served. Use hot, stamped or engraved machine printing with white-filled lettering on backside of plate, and durable wire markers or tags inside outlet boxes.

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

1. Test Instruments: Use instruments that comply with UL 1436.
2. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated LED indicators of measurement.

B. Tests for Convenience Receptacles:

1. Line Voltage: Acceptable range is 105 to 132 V.
2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is not acceptable.
3. Ground Impedance: Values of up to 2 ohms are acceptable.
4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
5. Using the test plug, verify that the device and its outlet box are securely mounted.
6. The tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new, and retest as specified above.

END OF SECTION 262726

SECTION 265100 - INTERIOR LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Interior lighting fixtures, lamps, and ballasts.
2. Emergency lighting units.
3. Exit signs.
4. Lighting fixture supports.
5. Retrofit kits for fluorescent lighting fixtures.

B. Related Sections:

1. Division 26 Section "Wiring Devices" for manual wall-box dimmers for incandescent lamps.
2. Division 26 Section "Lighting Control Devices" for automatic control of lighting, including time switches, photoelectric relays, occupancy sensors, and multipole lighting relays and contactors.

1.2 SUBMITTALS

- A. Product Data: For each type of lighting fixture, arranged in order of fixture designation. Include data on features, accessories, and finishes.
- B. Shop Drawings: Show details of nonstandard or custom lighting fixtures. Indicate dimensions, weights, methods of field assembly, components, features, and accessories. Product Certificates: For each type of ballast for bi-level and dimmer-controlled fixtures, from manufacturer.
- C. Field quality-control reports.

1.3 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Products: Subject to compliance with requirements, provide product indicated on Drawings .

2.2 GENERAL REQUIREMENTS FOR LIGHTING FIXTURES AND COMPONENTS

- A. Recessed Fixtures: Comply with NEMA LE 4 for ceiling compatibility for recessed fixtures.

- B. Incandescent Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE 5A.
- C. Fluorescent Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE 5 and NEMA LE 5A as applicable.
- D. HID Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE 5B.
- E. Metal Parts: Free of burrs and sharp corners and edges.
- F. Sheet Metal Components: Steel unless otherwise indicated. Form and support to prevent warping and sagging.
- G. 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.
- H. Diffusers and Globes:
 - 1. Acrylic Lighting Diffusers: 100 percent virgin acrylic plastic. High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
 - a. Lens Thickness: At least 0.125 inch minimum unless otherwise indicated.
 - b. UV stabilized.
 - 2. Glass: Annealed crystal glass unless otherwise indicated.
- I. Air-Handling Fluorescent Fixtures: For use with plenum ceiling for air return and heat extraction and for attaching an air-diffuser-boot assembly specified in Division 23 Section "Diffusers, Registers, and Grilles."
 - 1. Air-Supply Units: Slots in one or both side trims join with air-diffuser-boot assemblies.
 - 2. Heat-Removal Units: Air path leads through lamp cavity.
 - 3. Combination Heat-Removal and Air-Supply Unit: Heat is removed through lamp cavity at both ends of the fixture door with air supply same as for air-supply units.
 - 4. Dampers: Operable from outside fixture for control of return-air volume.
 - 5. Static Fixture: Air-supply slots are blanked off, and fixture appearance matches active units.

2.3 BALLASTS FOR LINEAR FLUORESCENT LAMPS

- A. General Requirements for Electronic Ballasts:
 - 1. Comply with UL 935 and with ANSI C82.11.
 - 2. Designed for type and quantity of lamps served.
 - 3. Ballasts shall be designed for full light output unless another BF, dimmer, or bi-level control is indicated.
 - 4. Sound Rating: Class A.
 - 5. Total Harmonic Distortion Rating: Less than 10 percent.
 - 6. Transient Voltage Protection: IEEE C62.41.1 and IEEE C62.41.2, Category A or better.
 - 7. Operating Frequency: 42 kHz or higher.
 - 8. Lamp Current Crest Factor: 1.7 or less.
 - 9. BF: 0.88 or higher.
 - 10. Power Factor: 0.95 or higher.

- B. luminaires controlled by occupancy sensors shall have programmed-start ballasts.
- C. Electromagnetic Ballasts: Comply with ANSI C82.1; energy saving, high-power factor, Class P, and having automatic-reset thermal protection.
 - 1. Ballast Manufacturer Certification: Indicated by label.
- D. Single Ballasts for Multiple Lighting Fixtures: Factory wired with ballast arrangements and bundled extension wiring to suit final installation conditions without modification or rewiring in the field.
- E. Ballasts for Low-Temperature Environments: Electronic type rated for 0 deg F starting and operating temperature with indicated lamp types.
- F. Ballasts for Residential Applications: Fixtures designated as "Residential" may use low-power-factor electronic ballasts having a Class B sound rating and total harmonic distortion of approximately 30 percent.
- G. Ballasts for Dimmer-Controlled Lighting Fixtures: Electronic type.
 - 1. Dimming Range: 100 to 5 percent of rated lamp lumens.
 - 2. Ballast Input Watts: Can be reduced to 20 percent of normal.
 - 3. Compatibility: Certified by manufacturer for use with specific dimming control system and lamp type indicated.
 - 4. Control: Coordinate wiring from ballast to control device to ensure that the ballast, controller, and connecting wiring are compatible.
- H. Ballasts for Bi-Level Controlled Lighting Fixtures: Electronic type.
 - 1. Operating Modes: Ballast circuit and leads provide for remote control of the light output of the associated lamp between high- and low-level and off.
 - a. High-Level Operation: 100 percent of rated lamp lumens.
 - b. Low-Level Operation: 30 percent of rated lamp lumens.
 - 2. Ballast shall provide equal current to each lamp in each operating mode.
 - 3. Compatibility: Certified by manufacturer for use with specific bi-level control system and lamp type indicated.
- I. Ballasts for Tri-Level Controlled Lighting Fixtures: Electronic type.
 - 1. Operating Modes: Ballast circuit and leads provide for remote control of the light output of the associated lamp between high- and low-level and off.
 - a. High-Level Operation: 100 percent of rated lamp lumens.
 - b. Low-Level Operation: 30 and 50 percent of rated lamp lumens.
 - 2. Ballast shall provide equal current to each lamp in each operating mode.
 - 3. Compatibility: Certified by manufacturer for use with specific tri-level control system and lamp type indicated.

2.4 BALLASTS FOR COMPACT FLUORESCENT LAMPS

- A. Description: Electronic-programmed rapid-start type, complying with UL 935 and with ANSI C 82.11, designed for type and quantity of lamps indicated. Ballast shall be designed for full light output unless dimmer or bi-level control is indicated:
1. Lamp end-of-life detection and shutdown circuit.
 2. Automatic lamp starting after lamp replacement.
 3. Sound Rating: Class A.
 4. Total Harmonic Distortion Rating: Less than 20 percent.
 5. Transient Voltage Protection: IEEE C62.41.1 and IEEE C62.41.2, Category A or better.
 6. Operating Frequency: 20 kHz or higher.
 7. Lamp Current Crest Factor: 1.7 or less.
 8. BF: 0.95 or higher unless otherwise indicated.
 9. Power Factor: 0.95 or higher.
 10. Interference: Comply with 47 CFR 18, Ch. 1, Subpart C, for limitations on electromagnetic and radio-frequency interference for nonconsumer equipment.

2.5 EMERGENCY FLUORESCENT POWER UNIT

- A. Internal Type: Self-contained, modular, battery-inverter unit, factory mounted within lighting fixture body and compatible with ballast. Comply with UL 924.
1. Emergency Connection: Operate two fluorescent lamp(s) continuously at an output of 1100 lumens. Connect unswitched circuit to battery-inverter unit and switched circuit to fixture ballast.
 2. Nightlight Connection: Operate one fluorescent lamp continuously.
 3. Test Push Button and Indicator Light: Visible and accessible without opening fixture or entering ceiling space.
 - a. Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
 - b. Indicator Light: LED indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
 4. Battery: Sealed, maintenance-free, nickel-cadmium type.
 5. Charger: Fully automatic, solid-state, constant-current type with sealed power transfer relay.
 6. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing red LED.

2.6 BALLASTS FOR HID LAMPS

- A. Electromagnetic Ballast for Metal-Halide Lamps: Comply with ANSI C82.4 and UL 1029. Include the following features unless otherwise indicated:
1. Ballast Circuit: Constant-wattage autotransformer or regulating high-power-factor type.
 2. Minimum Starting Temperature: Minus 22 deg F for single-lamp ballasts.
 3. Rated Ambient Operating Temperature: 104 deg F.
 4. Open-circuit operation that will not reduce average life.
 5. Low-Noise Ballasts: Manufacturers' standard epoxy-encapsulated models designed to minimize audible fixture noise.
- B. Electronic Ballast for Metal-Halide Lamps: Include the following features unless otherwise indicated:

1. Minimum Starting Temperature: Minus 20 deg F for single-lamp ballasts.
 2. Rated Ambient Operating Temperature: 130 deg F.
 3. Lamp end-of-life detection and shutdown circuit.
 4. Sound Rating: Class A.
 5. Total Harmonic Distortion Rating: Less than 20 percent.
 6. Transient Voltage Protection: IEEE C62.41.1 and IEEE C62.41.2, Category A or better.
 7. Lamp Current Crest Factor: 1.5 or less.
 8. Power Factor: 0.90 or higher.
 9. Interference: Comply with 47 CFR 18, Ch. 1, Subpart C, for limitations on electromagnetic and radio-frequency interference for nonconsumer equipment.
 10. Protection: Class P thermal cutout.
- C. High-Pressure Sodium Ballasts: Electromagnetic type, with solid-state igniter/starter. Igniter/starter shall have an average life in pulsing mode of 10,000 hours at an igniter/starter-case temperature of 90 deg C.
1. Instant-Restrike Device: Integral with ballast, or solid-state potted module, factory installed within fixture and compatible with lamps, ballasts, and mogul sockets up to 150 W.
 2. Minimum Starting Temperature: Minus 40 deg F.

2.7 EXIT SIGNS

- A. General Requirements for Exit Signs: Comply with UL 924; for sign colors, visibility, luminance, and lettering size, comply with authorities having jurisdiction.
- B. Internally Lighted Signs:
1. Lamps for AC Operation: Fluorescent, two for each fixture, 20,000 hours of rated lamp life.
 2. Lamps for AC Operation: LEDs, 50,000 hours minimum rated lamp life.
 3. Self-Powered Exit Signs (Battery Type): Integral automatic charger in a self-contained power pack.
 - a. Battery: Sealed, maintenance-free, nickel-cadmium type.
 - b. Charger: Fully automatic, solid-state type with sealed transfer relay.
 - c. Operation: Relay automatically energizes lamp from battery when circuit voltage drops to 80 percent of nominal voltage or below. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
 - d. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
 - e. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.

2.8 EMERGENCY LIGHTING UNITS

- A. General Requirements for Emergency Lighting Units: Self-contained units complying with UL 924.
1. Battery: Sealed, maintenance-free, lead-acid type.
 2. Charger: Fully automatic, solid-state type with sealed transfer relay.
 3. Operation: Relay automatically turns lamp on when power-supply circuit voltage drops to 80 percent of nominal voltage or below. Lamp automatically disconnects from battery when voltage approaches deep-discharge level. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.

4. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
5. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
6. Wire Guard: Heavy-chrome-plated wire guard protects lamp heads or fixtures.
7. Integral Time-Delay Relay: Holds unit on for fixed interval of 15 minutes when power is restored after an outage.

2.9 FLUORESCENT LAMPS

- A. T8 rapid-start lamps, rated 32 W maximum, nominal length of 48 inches, 2800 initial lumens (minimum), CRI 75 (minimum), color temperature 4100 K, and average rated life 20,000 hours unless otherwise indicated.
- B. T8 rapid-start lamps, rated 17 W maximum, nominal length of 24 inches, 1300 initial lumens (minimum), CRI 75 (minimum), color temperature 4100K, and average rated life of 20,000 hours unless otherwise indicated.
- C. Compact Fluorescent Lamps: 4-Pin, CRI 80 (minimum), color temperature 4100K, average rated life of 10,000 hours at three hours operation per start unless otherwise indicated.
 1. 13 W: T4, double or triple tube, rated 900 initial lumens (minimum).
 2. 18 W: T4, double or triple tube, rated 1200 initial lumens (minimum).
 3. 26 W: T4, double or triple tube, rated 1800 initial lumens (minimum).
 4. 32 W: T4, triple tube, rated 2400 initial lumens (minimum).
 5. 42 W: T4, triple tube, rated 3200 initial lumens (minimum).
 6. 57 W: T4, triple tube, rated 4300 initial lumens (minimum).
 7. 70 W: T4, triple tube, rated 5200 initial lumens (minimum).

2.10 HID LAMPS

- A. High-Pressure Sodium Lamps: ANSI C78.42, CRI 21 (minimum), color temperature 1900K, and average rated life of 24,000 hours, minimum.
- B. Metal-Halide Lamps: ANSI C78.43, with minimum CRI 65, and color temperature 4000K.
- C. Pulse-Start, Metal-Halide Lamps: Minimum CRI 65, and color temperature 4000K.
- D. Ceramic, Pulse-Start, Metal-Halide Lamps: Minimum CRI **80**, and color temperature 4000K.
- E. Low-Pressure Sodium Lamps: ANSI 78.41, CRI 0, and color temperature 1800 K.

2.11 LIGHTING FIXTURE SUPPORT COMPONENTS

- A. Comply with Division 16 Section "Hangers and Supports for Electrical Systems" for channel- and angle-iron supports and nonmetallic channel and angle supports.
- B. Single-Stem Hangers: 1/2-inch steel tubing with swivel ball fittings and ceiling canopy. Finish same as fixture.
- C. Twin-Stem Hangers: Two, 1/2-inch steel tubes with single canopy designed to mount a single fixture. Finish same as fixture.

- D. Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated steel, 12 gage.
- E. Wires for Humid Spaces: ASTM A 580/A 580M, Composition 302 or 304, annealed stainless steel, 12 gage.
- F. Rod Hangers: 3/16-inch minimum diameter, cadmium-plated, threaded steel rod.
- G. Hook Hangers: Integrated assembly matched to fixture and line voltage and equipped with threaded attachment, cord, and locking-type plug.

2.12 RETROFIT KITS FOR FLUORESCENT LIGHTING FIXTURES

- A. Reflector Kit: UL 1598, Type I. Suitable for two- to four-lamp, surface-mounted or recessed lighting fixtures by improving reflectivity of fixture surfaces.
- B. Ballast and Lamp Change Kit: UL 1598, Type II. Suitable for changing existing ballast, lamps, and sockets.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Lighting fixtures: Set level, plumb, and square with ceilings and walls. Install lamps in each fixture.
- B. Comply with NFPA 70 for minimum fixture supports.
- C. Suspended Lighting Fixture Support:
 1. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.
 2. Stem-Mounted, Single-Unit Fixtures: Suspend with twin-stem hangers.
 3. Continuous Rows: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of fixture chassis, including one at each end.
- D. Air-Handling Lighting Fixtures: Install with dampers closed and ready for adjustment.
- E. Adjust aimable lighting fixtures to provide required light intensities.
- F. Connect wiring according to Division 26 Section "Conductors and Cables."

3.2 FIELD QUALITY CONTROL

- A. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery and retransfer to normal.
- B. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

END OF SECTION 265100

SECTION 28 00 01

OWNER'S SECURITY VENDOR

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Coordination w/ Owner's Security Vendor.

1.2 SYSTEM DESCRIPTION

- A. Security and Card Reader Access of Exterior and Interior Doors.

PART 2--VENDOR

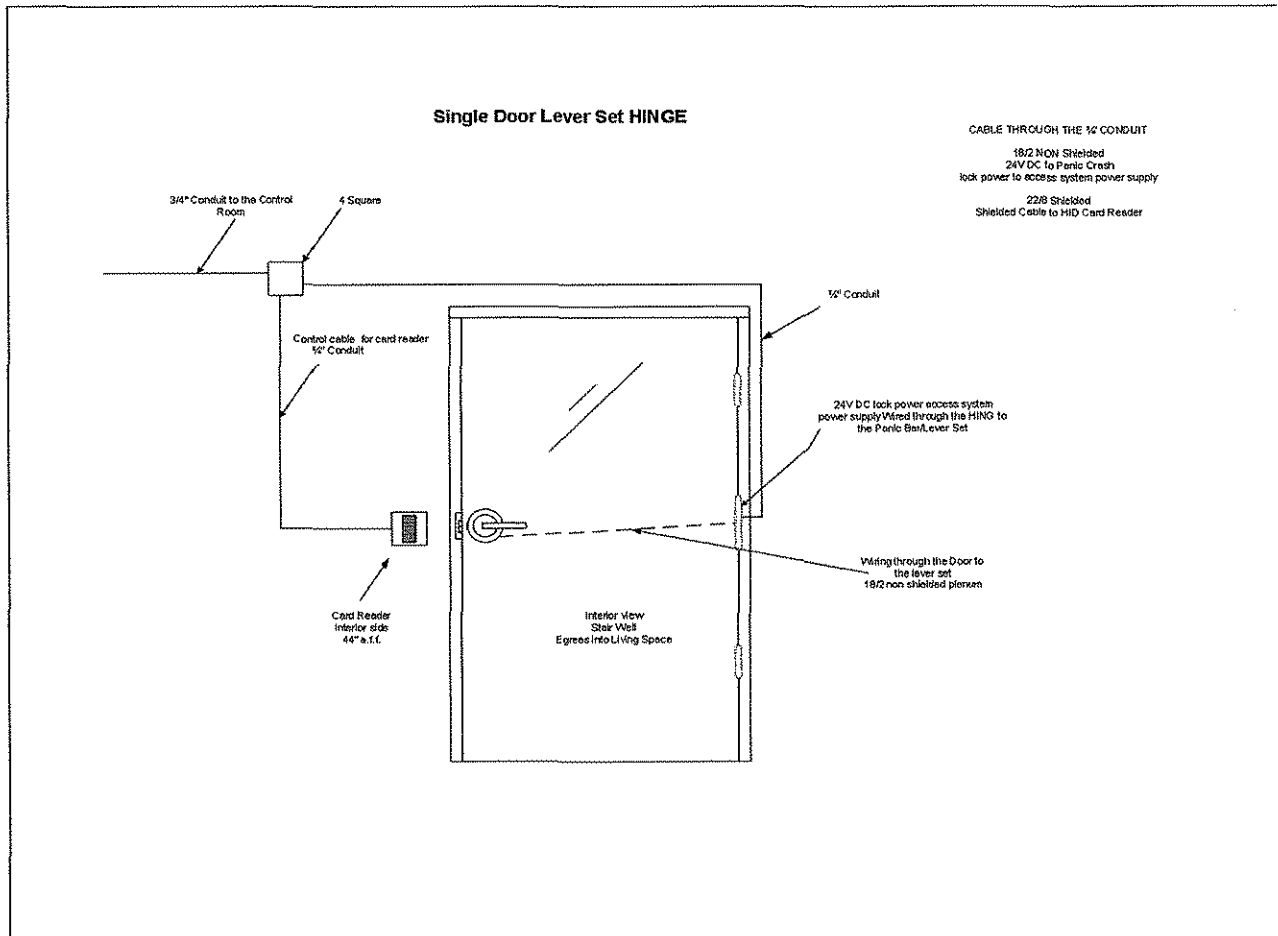
- 2.01 Mr. Terrence Kane, Frontier Communications.
frontiercommunications@msn.com

PART 3 - EXECUTION

3.1 EXAMINATION AND PREPARATION

- A. The following diagrams prepared by the Owner's Vendor are provided for coordination rough in power, door operators and door hardware.
- B. Provide power as required by Owner's Vendor for Security Control equipment at locations as directed by Owner's Vendor.

END OF SECTION



SECTION 283111 - DIGITAL, ADDRESSABLE FIRE-ALARM SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Fire-alarm control unit.
2. Manual fire-alarm boxes.
3. System smoke detectors.
4. Notification appliances.
5. Addressable interface device.
6. Digital alarm communicator transmitter.

1.2 SYSTEM DESCRIPTION

- A. Noncoded, networked, addressable system, with multiplexed signal transmission, peer to peer communications architecture, dedicated to fire-alarm service only.

1.3 SUBMITTALS

A. General Submittal Requirements:

1. Submittals shall be approved by authorities having jurisdiction prior to submitting them to Architect.
2. Shop Drawings shall be prepared by persons with the following qualifications:
 - a. Trained and certified by manufacturer in fire-alarm system design.
 - b. NICET-certified fire-alarm technician, Level III minimum.

B. Product Data: For each type of product indicated.

C. Shop Drawings: For fire-alarm system. Include plans, elevations, sections, details, and attachments to other work.

1. Comply with recommendations in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter in NFPA 72.
2. Include voltage drop calculations for notification appliance circuits.
3. Include battery-size calculations.
4. Include performance parameters and installation details for each detector, verifying that each detector is listed for complete range of air velocity, temperature, and humidity possible when air-handling system is operating.
5. Include plans, sections, and elevations of heating, ventilating, and air-conditioning ducts, drawn to scale and coordinating installation of duct smoke detectors and access to them. Show critical dimensions that relate to placement and support of sampling tubes, detector housing, and remote status and alarm indicators. Locate detectors according to manufacturer's written recommendations.
6. Include floor plans to indicate final outlet locations showing address of each addressable device. Show size and route of cable and conduits.

- D. Delegated-Design Submittal: For smoke and heat detectors indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
 - 1. Drawings showing the location of each smoke and heat detector, ratings of each, and installation details as needed to comply with listing conditions of the detector.
 - 2. Design Calculations: Calculate requirements for selecting the spacing and sensitivity of detection, complying with NFPA 72.
- E. Qualification Data: For qualified Installer.
- F. Field quality-control reports.
- G. Operation and Maintenance Data: For fire-alarm systems and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:
 - 1. Comply with the "Records" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.
 - 2. Provide "Record of Completion Documents" according to NFPA 72 article "Permanent Records" in the "Records" Section of the "Inspection, Testing and Maintenance" Chapter.
 - 3. Record copy of site-specific software.
 - 4. Provide "Maintenance, Inspection and Testing Records" according to NFPA 72 article of the same name and include the following:
 - a. Frequency of testing of installed components.
 - b. Frequency of inspection of installed components.
 - c. Requirements and recommendations related to results of maintenance.
 - d. Manufacturer's user training manuals.
 - 5. Manufacturer's required maintenance related to system warranty requirements.
 - 6. Abbreviated operating instructions for mounting at fire-alarm control unit.
 - 7. Copy of NFPA 25.
- H. Software and Firmware Operational Documentation:
 - 1. Software operating and upgrade manuals.
 - 2. Program Software Backup: On magnetic media or compact disk, complete with data files.
 - 3. Device address list.
 - 4. Printout of software application and graphic screens.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Personnel shall be trained and certified by manufacturer for installation of units required for this Project.
- B. Installer Qualifications: Installation shall be by personnel certified by NICET as fire-alarm Level II technician.
- C. Source Limitations for Fire-Alarm System and Components: Obtain fire-alarm system from single source from single manufacturer. Components shall be compatible with, and operate as, an extension of existing system.

- D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.5 SOFTWARE SERVICE AGREEMENT

- A. Comply with UL 864.
- B. Technical Support: Beginning with Substantial Completion, provide software support for two years.
- C. Upgrade Service: Update software to latest version at Project completion. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software shall include operating system. Upgrade shall include new or revised licenses for use of software.
 - 1. Provide 30 days' notice to Owner to allow scheduling and access to system and to allow Owner to upgrade computer equipment if necessary.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - 1. Amseco - a Potter brand; Potter Electric Signal Company.
 - 2. Bosch Security Systems.
 - 3. Commercial Products Group/CPG Life Safety Signals.
 - 4. Faraday; Siemens Building Technologies, Inc.
 - 5. Federal Signal Corporation.
 - 6. Fire Control Instruments, Inc.; a Honeywell company.
 - 7. Fire Lite Alarms; a Honeywell company.
 - 8. Gamewell; a Honeywell company.
 - 9. GE Infrastructure; a unit of General Electric Company.
 - 10. Gentex Corporation.
 - 11. Harrington Signal, Inc.
 - 12. NOTIFIER; a Honeywell company.
 - 13. Siemens Building Technologies, Inc.; Fire Safety Division.
 - 14. Silent Knight; a Honeywell company.
 - 15. SimplexGrinnell LP; a Tyco International company.

2.2 SYSTEMS OPERATIONAL DESCRIPTION

- A. Fire-alarm signal initiation shall be by one or more of the following devices:
 - 1. Manual stations.
 - 2. Heat detectors.
 - 3. Smoke detectors.
 - 4. Fire-extinguishing system operation.

- B. Fire-alarm signal shall initiate the following actions:
 - 1. Continuously operate alarm-notification appliances.
 - 2. Identify alarm at the fire-alarm control unit and remote annunciators.
 - 3. Transmit an alarm signal to the remote alarm receiving station.
 - 4. Record events in the system memory.

- C. Supervisory signal initiation shall be by one or more of the following devices and actions:
 - 1. Valve supervisory switch.
 - 2. Fire pump status.
 - 3. Low pressure switch of sprinkler system.

- D. System trouble signal initiation shall be by one or more of the following devices and actions:
 - 1. Open circuits, shorts, and grounds in designated circuits.
 - 2. Opening, tampering with, or removing alarm-initiating and supervisory signal-initiating devices.
 - 3. Loss of primary power at fire-alarm control unit.
 - 4. Ground or a single break in fire-alarm control unit internal circuits.
 - 5. Abnormal ac voltage at fire-alarm control unit.
 - 6. Break in standby battery circuitry.
 - 7. Failure of battery charging.
 - 8. Abnormal position of any switch at fire-alarm control unit or annunciator.

- E. System Trouble and Supervisory Signal Actions: Initiate notification appliance and annunciate at fire-alarm control unit and remote annunciators.

2.3 FIRE-ALARM CONTROL UNIT

- A. General Requirements for Fire-Alarm Control Unit:
 - 1. Field-programmable, microprocessor-based, modular, power-limited design with electronic modules, complying with UL 864 and listed and labeled by an NRTL.
 - a. System software and programs shall be held in flash electrically erasable programmable read-only memory (EEPROM), retaining the information through failure of primary and secondary power supplies.
 - b. Include a real-time clock for time annotation of events on the event recorder and printer.
 - 2. Addressable control circuits for operation of mechanical equipment.

- B. Alphanumeric Display and System Controls: Arranged for interface between human operator at fire-alarm control unit and addressable system components including annunciation and supervision. Display alarm, supervisory, and component status messages and the programming and control menu.
 - 1. Annunciator and Display: Liquid-crystal type, 2 lines of 80 characters, minimum.

- C. Circuits:
 - 1. Initiating Device, Notification Appliance, and Signaling Line Circuits: NFPA 72, Class A.
 - a. Initiating Device Circuits: Style D.
 - b. Notification Appliance Circuits: Style Z.

- c. Signaling Line Circuits: Style 6.
 - d. Install no more than 50 addressable devices on each signaling line circuit.
2. Initiating Device, Notification Appliance, and Signaling Line Circuits: NFPA 72, Class B.
- a. Initiating Device Circuits: Style B.
 - b. Notification Appliance Circuits: Style W.
 - c. Signaling Line Circuits: Style 4.
 - d. Install no more than 50 addressable devices on each signaling line circuit.
- D. Transmission to Remote Alarm Receiving Station: Automatically transmit alarm, supervisory, and trouble signals to a remote alarm station.
- E. Primary Power: 24-V dc obtained from 120-V ac service and a power-supply module. Initiating devices, notification appliances, signaling lines, trouble signals, supervisory and digital alarm communicator transmitters shall be powered by 24-V dc source.
- 1. Alarm current draw of entire fire-alarm system shall not exceed 80 percent of the power-supply module rating.
- F. Secondary Power: 24-V dc supply system with batteries, automatic battery charger, and automatic transfer switch.
- 1. Batteries: Sealed lead calcium.
- G. Instructions: Computer printout or typewritten instruction card mounted behind a plastic or glass cover in a stainless-steel or aluminum frame. Include interpretation and describe appropriate response for displays and signals. Briefly describe the functional operation of the system under normal, alarm, and trouble conditions.

2.4 MANUAL FIRE-ALARM BOXES

- A. General Requirements for Manual Fire-Alarm Boxes: Comply with UL 38. Boxes shall be finished in red with molded, raised-letter operating instructions in contrasting color; shall show visible indication of operation; and shall be mounted on recessed outlet box. If indicated as surface mounted, provide manufacturer's surface back box.
- 1. Double-action mechanism requiring two actions to initiate an alarm, pull-lever type; with integral addressable module arranged to communicate manual-station status (normal, alarm, or trouble) to fire-alarm control unit.
 - 2. Station Reset: Key- or wrench-operated switch.
 - 3. Indoor Protective Shield: Factory-fabricated clear plastic enclosure hinged at the top to permit lifting for access to initiate an alarm. Lifting the cover actuates an integral battery-powered audible horn intended to discourage false-alarm operation.
 - 4. Weatherproof Protective Shield: Factory-fabricated clear plastic enclosure hinged at the top to permit lifting for access to initiate an alarm.

2.5 SYSTEM SMOKE DETECTORS

- A. General Requirements for System Smoke Detectors:
- 1. Comply with UL 268; operating at 24-V dc, nominal.
 - 2. Detectors shall be four-wire type.

3. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.
4. Base Mounting: Detector and associated electronic components shall be mounted in a twist-lock module that connects to a fixed base. Provide terminals in the fixed base for connection to building wiring.
5. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
6. Integral Visual-Indicating Light: LED type indicating detector has operated and power-on status.

B. Photoelectric Smoke Detectors:

1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:
 - a. Primary status.
 - b. Device type.
 - c. Present average value.
 - d. Present sensitivity selected.
 - e. Sensor range (normal, dirty, etc.).

2.6 HEAT DETECTORS

- A. General Requirements for Heat Detectors: Comply with UL 521.
- B. Heat Detector, Combination Type: Actuated by either a fixed temperature of 200 deg F or a rate of rise that exceeds 15 deg F per minute unless otherwise indicated.
 1. Mounting: Twist-lock base interchangeable with smoke-detector bases.
 2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.

2.7 NOTIFICATION APPLIANCES

- A. General Requirements for Notification Appliances: Connected to notification appliance signal circuits, zoned as indicated, equipped for mounting as indicated and with screw terminals for system connections.
 1. Combination Devices: Factory-integrated audible and visible devices in a single-mounting assembly, equipped for mounting as indicated and with screw terminals for system connections.
- B. Chimes, Low-Level Output: Vibrating type, 75-dBA minimum rated output.
- C. Chimes, High-Level Output: Vibrating type, 81-dBA minimum rated output.
- D. Horns: Electric-vibrating-polarized type, 24-V dc; with provision for housing the operating mechanism behind a grille. Comply with UL 464. Horns shall produce a sound-pressure level of 90 dBA, measured 10 feet from the horn, using the coded signal prescribed in UL 464 test protocol.
- E. Visible Notification Appliances: Xenon strobe lights comply with UL 1971, with clear or nominal white polycarbonate lens mounted on an aluminum faceplate. The word "FIRE" is engraved in minimum 1-inch- high letters on the lens.

1. Rated Light Output:
 - a. 75 cd.
 - b. 15/30/75/110 cd, selectable in the field.
2. Mounting: Wall mounted unless otherwise indicated.
3. For units with guards to prevent physical damage, light output ratings shall be determined with guards in place.
4. Flashing shall be in a temporal pattern, synchronized with other units.
5. Strobe Leads: Factory connected to screw terminals.
6. Mounting Faceplate: Factory finished, red.

2.8 REMOTE ANNUNCIATOR

- A. Description: Annunciator functions shall match those of fire-alarm control unit for alarm, supervisory, and trouble indications. Manual switching functions shall match those of fire-alarm control unit, including acknowledging, silencing, resetting, and testing.
 1. Mounting: Flush cabinet, NEMA 250, Type 1.
- B. Display Type and Functional Performance: Alphanumeric display and LED indicating lights shall match those of fire-alarm control unit. Provide controls to acknowledge, silence, reset, and test functions for alarm, supervisory, and trouble signals.

2.9 ADDRESSABLE INTERFACE DEVICE

- A. Description: Microelectronic monitor module, NRTL listed for use in providing a system address for alarm-initiating devices for wired applications with normally open contacts.
- B. Integral Relay: Capable of providing a direct signal to elevator controller to initiate elevator recall, to circuit-breaker shunt trip for power shutdown.

2.10 DIGITAL ALARM COMMUNICATOR TRANSMITTER

- A. Digital alarm communicator transmitter shall be acceptable to the remote central station and shall comply with UL 632 and be listed and labeled by an NRTL.
- B. Functional Performance: Unit shall receive an alarm, supervisory, or trouble signal from fire-alarm control unit and automatically capture two telephone line(s) and dial a preset number for a remote central station. When contact is made with central station(s), signals shall be transmitted. If service on either line is interrupted for longer than 45 seconds, transmitter shall initiate a local trouble signal and transmit the signal indicating loss of telephone line to the remote alarm receiving station over the remaining line. Transmitter shall automatically report telephone service restoration to the central station. If service is lost on both telephone lines, transmitter shall initiate the local trouble signal.
- C. Local functions and display at the digital alarm communicator transmitter shall include the following:
 1. Verification that both telephone lines are available.
 2. Programming device.
 3. LED display.
 4. Manual test report function and manual transmission clear indication.
 5. Communications failure with the central station or fire-alarm control unit.

- D. Digital data transmission shall include the following:
 - 1. Address of the alarm-initiating device.
 - 2. Loss of ac supply or loss of power.
 - 3. Low battery.
 - 4. Abnormal test signal.
 - 5. Communication bus failure.
- E. Secondary Power: Integral rechargeable battery and automatic charger.
- F. Self-Test: Conducted automatically every 24 hours with report transmitted to central station.

PART 3 - EXECUTION

3.1 EQUIPMENT INSTALLATION

- A. Comply with NFPA 72 for installation of fire-alarm equipment.
- B. Equipment Mounting: Install fire-alarm control unit on concrete base with tops of cabinets not more than 72 inches above the finished floor. Comply with requirements for concrete base specified in Division 03 Section "Miscellaneous Cast-in-Place Concrete."
 - 1. Install seismic bracing. Comply with requirements in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."
 - 2. 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.
 - 3. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
 - 4. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 5. Install anchor bolts to elevations required for proper attachment to supported equipment.
- C. Equipment Mounting: Install fire-alarm control unit on finished floor with tops of cabinets not more than 72 inches above the finished floor.
 - 1. Comply with requirements for seismic-restraint devices specified in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."
 - 2. Comply with requirements for seismic-restraint devices specified in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."
- D. Connecting to Existing Equipment: Verify that existing fire-alarm system is operational before making changes or connections.
 - 1. Connect new equipment to existing control panel in existing part of the building.
 - 2. Connect new equipment to existing monitoring equipment at the supervising station.
 - 3. Expand, modify, and supplement existing monitoring equipment as necessary to extend existing monitoring functions to the new points. New components shall be capable of merging with existing configuration without degrading the performance of either system.
- E. Smoke- or Heat-Detector Spacing:
 - 1. Comply with NFPA 72, "Smoke-Sensing Fire Detectors" Section in the "Initiating Devices" Chapter, for smoke-detector spacing.

2. Comply with NFPA 72, "Heat-Sensing Fire Detectors" Section in the "Initiating Devices" Chapter, for heat-detector spacing.
 3. Smooth ceiling spacing shall not exceed 30 feet.
 4. Spacing of detectors for irregular areas, for irregular ceiling construction, and for high ceiling areas shall be determined according to Appendix A in NFPA 72.
 5. HVAC: Locate detectors not closer than 5 feet from air-supply diffuser or return-air opening.
 6. Lighting Fixtures: Locate detectors not closer than 12 inches from any part of a lighting fixture.
- F. Remote Status and Alarm Indicators: Install near each smoke detector and each sprinkler water-flow switch and valve-tamper switch that is not readily visible from normal viewing position.
- G. Audible Alarm-Indicating Devices: Install not less than 6 inches below the ceiling. Install bells and horns on flush-mounted back boxes with the device-operating mechanism concealed behind a grille.
- H. Visible Alarm-Indicating Devices: Install adjacent to each alarm bell or alarm horn and at least 6 inches below the ceiling.
- I. Device Location-Indicating Lights: Locate in public space near the device they monitor.
- J. Fire-Alarm Control Unit: Surface mounted, with tops of cabinets not more than 72 inches above the finished floor.
- K. Annunciator: Install with top of panel not more than 72 inches above the finished floor.

3.2 CONNECTIONS

- A. For fire-protection systems related to doors in fire-rated walls and partitions and to doors in smoke partitions, comply with requirements in Division 08 Section "Door Hardware." Connect hardware and devices to fire-alarm system.
1. Verify that hardware and devices are NRTL listed for use with fire-alarm system in this Section before making connections.
- B. Make addressable connections with a supervised interface device to the following devices and systems. Install the interface device less than 3 feet from the device controlled. Make an addressable confirmation connection when such feedback is available at the device or system being controlled.
1. Alarm-initiating connection to smoke-control system (smoke management) at firefighter smoke-control system panel.
 2. Alarm-initiating connection to elevator recall system and components.
 3. Alarm-initiating connection to activate emergency lighting control.
 4. Alarm-initiating connection to activate emergency shutoffs for gas and fuel supplies.
 5. Supervisory connections at valve supervisory switches.
 6. Supervisory connections at low-air-pressure switch of each dry-pipe sprinkler system.
 7. Supervisory connections at elevator shunt trip breaker.
 8. Supervisory connections at fire-pump power failure including a dead-phase or phase-reversal condition.
 9. Supervisory connections at fire-pump engine control panel.

3.3 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

- B. Install framed instructions in a location visible from fire-alarm control unit.

3.4 GROUNDING

- A. Ground fire-alarm control unit and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to fire-alarm control unit.

3.5 FIELD QUALITY CONTROL

- A. Field tests shall be witnessed by Architect and the authorities having jurisdiction.

- B. Tests and Inspections:

1. Visual Inspection: Conduct visual inspection prior to testing.
 - a. Inspection shall be based on completed Record Drawings and system documentation that is required by NFPA 72 in its "Completion Documents, Preparation" Table in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter.
 - b. Comply with "Visual Inspection Frequencies" Table in the "Inspection" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72; retain the "Initial/Reacceptance" column and list only the installed components.
2. System Testing: Comply with "Test Methods" Table in the "Testing" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.
3. Test audible appliances for the public operating mode according to manufacturer's written instructions. Perform the test using a portable sound-level meter complying with Type 2 requirements in ANSI S1.4.
4. Test audible appliances for the private operating mode according to manufacturer's written instructions.
5. Test visible appliances for the public operating mode according to manufacturer's written instructions.
6. Factory-authorized service representative shall prepare the "Fire Alarm System Record of Completion" in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter in NFPA 72 and the "Inspection and Testing Form" in the "Records" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.

- C. Reacceptance Testing: Perform reacceptance testing to verify the proper operation of added or replaced devices and appliances.
- D. Fire-alarm system will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.
- F. Maintenance Test and Inspection: Perform tests and inspections listed for weekly, monthly, quarterly, and semiannual periods. Use forms developed for initial tests and inspections.
- G. Annual Test and Inspection: One year after date of Substantial Completion, test fire-alarm system complying with visual and testing inspection requirements in NFPA 72. Use forms developed for initial tests and inspections.

END OF SECTION 283111