COLLEGE OF DuPAGE
REGULAR BOARD MEETING

BOARD APPROVAL

---

1. SUBJECT

General Contractor for HSC Cadaver Lab Renovation Supplemental HVAC.

2. REASON FOR CONSIDERATION

Construction projects that exceed the statutory limit of $50,000 must be approved by the Board of Trustees.

3. BACKGROUND INFORMATION

This past February 2017, the region experienced multiple consecutive days where outdoor temperatures reached approximately 70-degrees. During this time of year, all College mechanical systems are in the heating mode. As a result of the extended number of higher than normal temperatures, the building mechanical systems were not able to cool the Cadaver Lab to the necessary 66 to 67-degree range required for optimal preservation of the cadavers, even with the use of individual "spot coolers". Following consultation with in-house physical plant engineering staff and outside consultants, it was determined that a supplemental air conditioning system would be required to properly cool the Cadaver Lab during extended periods of abnormally high temperatures, when all building systems are normally in the heating mode.

A legal notice for an Invitation for Bid was published on August 25, 2017 in the Daily Herald and posted to the College of DuPage Purchasing Website. Forty (40) vendors were directly solicited. Fifty-four (54) vendors downloaded the bid documents. Eight (8) bids were received. No women/minority owned businesses submitted bids. A public opening and reading of the bids was held on September 19, 2017 at 10:00 a.m. in the College of DuPage Purchasing Department Conference Room (BIC1B03A). The following individuals were in attendance: Jacoby Radford (COD Purchasing Manager/Facilitator), John McGarry (COD Buyer/Recorder), Robert Hayley (COD Budget Manager/Agent of the Board), Don Inman (COD Senior Project Manager), and representatives from eight (8) firms.

The following is a recap of the bid tabulation.

General Contractor for HSC Cadaver Lab Renovation Supplemental HVAC	
Bidder	**Total Price**
Ideal Heating Company	$216,999.00
Integral Construction Inc.	$231,032.00
Amber Mechanical Contractors	$239,600.00
FE Moran, Inc.	$243,900.00
Voris Mechanical, Inc.	$244,900.00
Construction Solutions	$247,723.00
Quality Control Systems, Inc.	$284,000.00
Accel Construction Systems, Inc.	$285,899.00

Recommended award shaded and bold. No alternatives were requested in this bid package; therefore, none are offered in the bid responses.

A successful scope review meeting was conducted with the lowest bidder, Ideal Heating Company. This firm recently performed a successful chiller replacement project on campus.

Budget Status

	FY2017	FY2018		
GL Account	**Prior Year Spend**	**Annual Budget**	**YTD Spend**	**Available Balance**
03-90-39006-5804001	$ 12,777	$ 511,962	$ 263,073	$ 248,889
HSC Cadaver Lab : Building Remodeling Exps				
			FY2018 Request	**$ 216,999**

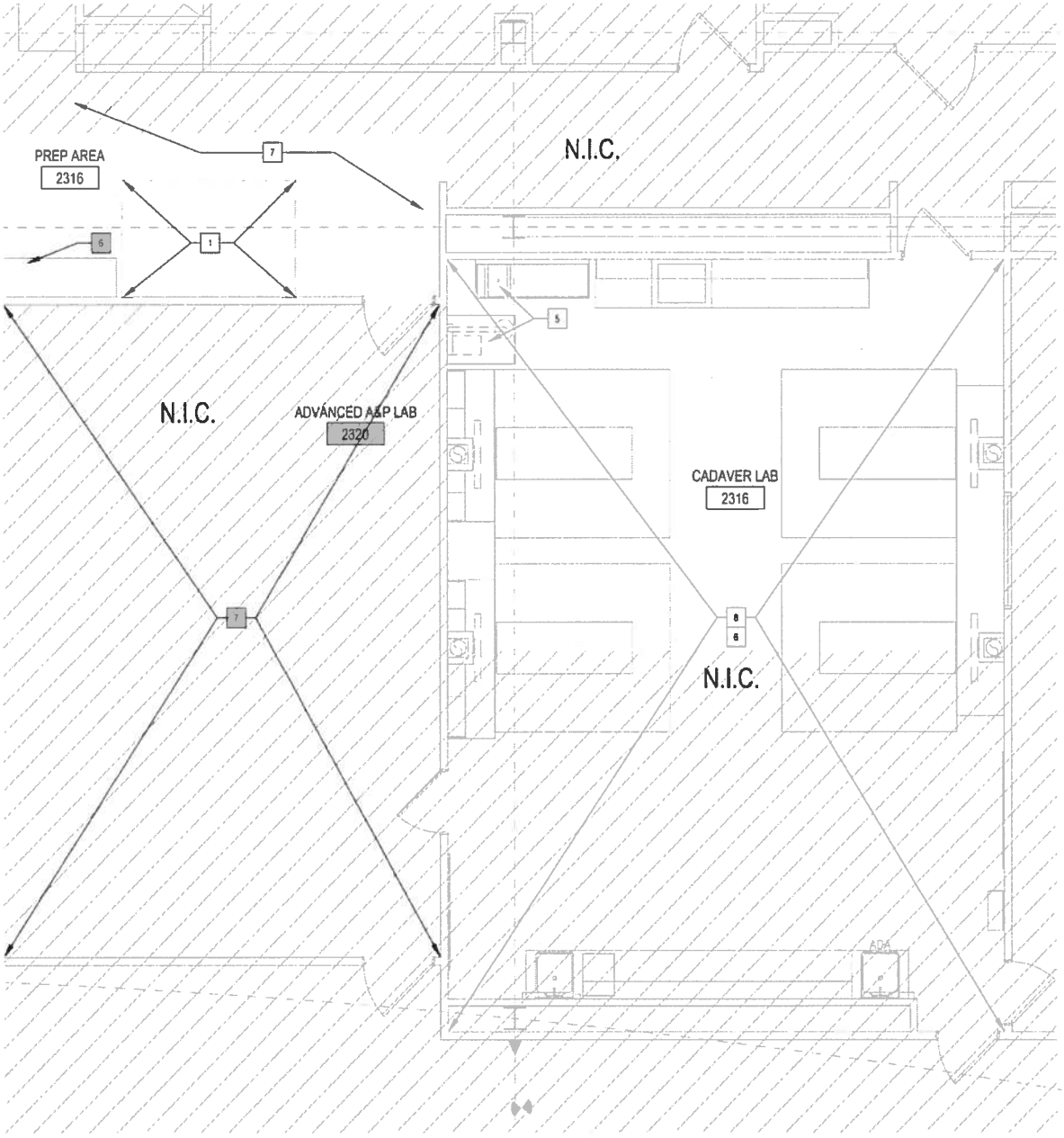
**YTD Spend equals actuals plus committed as of 10/04/2017.*

This purchase complies with State Statute, Board Policy and Administrative Procedures.

4. RECOMMENDATION

That the Board of Trustees awards the HSC Cadaver Lab Renovation Supplemental HVAC to the lowest responsible bidder, Ideal Heating Company, 9515 Southview Avenue, Brookfield, IL 60513 for the lump sum bid amount of $216,999.00.

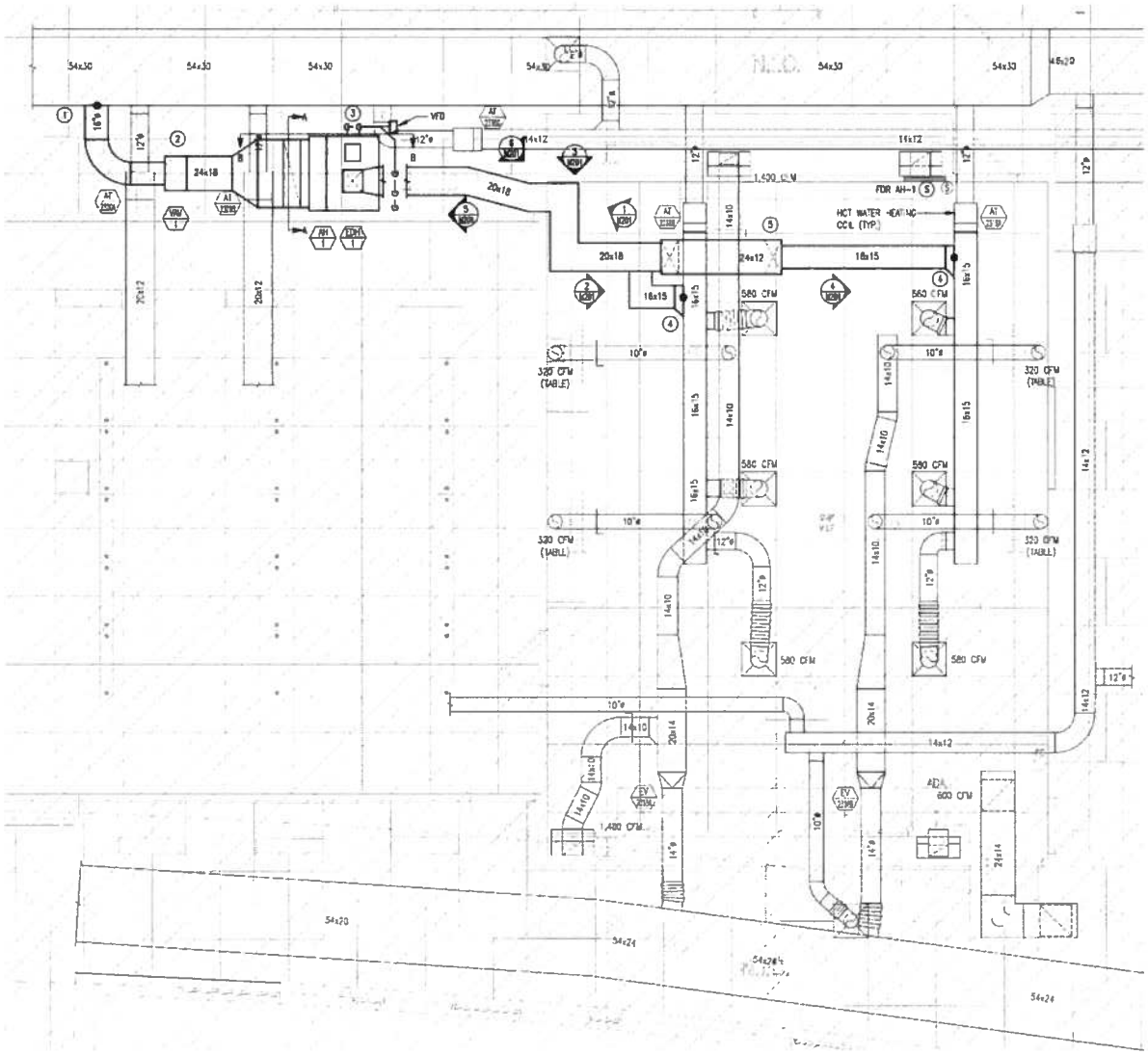
Staff Contact: Bruce Schmiedl – Director, Facilities Planning & Development



1 DEMOLITION 2nd FLOOR PLAN

SCALE 1/4" = 1'

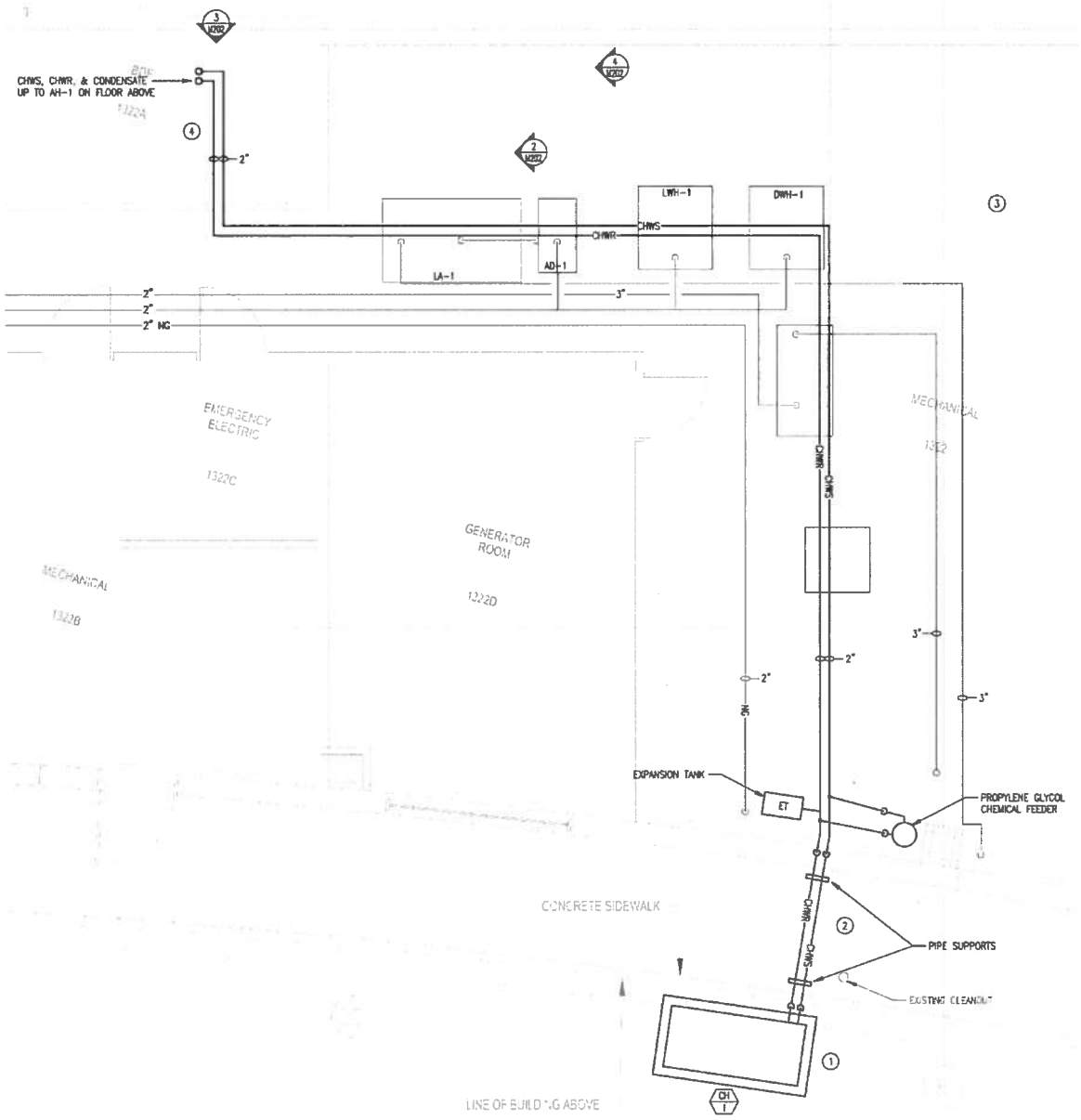
NORTH



1 MECHANICAL NEW WORK FLOOR PLAN

SCALE 1/4" = 1'

NORTH



1 MECHANICAL 1st FLOOR NEW WORK PLAN

0 2 4 8
SCALE: 1/4" = 1'

NORTH

Item 8j
October 19, 2017

BOARD APPROVAL

Signature Page

General Contractor for HSC Cadaver Lab Renovation Supplemental HVAC

ITEM(S) ON REQUEST

That the Board of Trustees awards the HSC Cadaver Lab Renovation Supplemental HVAC to the lowest responsible bidder, Ideal Heating Company, 9515 Southview Avenue, Brookfield, IL 60513 for the lump sum bid amount of $216,999.00.

Board Chairman	Date 10/19/17
Board Secretary	Date 10-19-17

College of DuPage

Purchasing Department

425 Fawell Boulevard
Glen Ellyn, Illinois 60137-6599
http://www.cod.edu

PHONE (630) 942-2813
FAX (630) 942-3750

2018-B0012 HEALTH SCIENCES CENTER (HSC) CADAVER LAB RENOVATION SUPPLEMENTAL HVAC

ADDENDUM #3

September 13, 2017

This addendum is issued to update the specifications and provide additional information.

This information becomes part of the Bid/RFP Documents upon receipt. Please review and incorporate into your Bid/Proposal accordingly

For which Bids were scheduled to be received on September 15, 2017 no later than 10:00 a.m., Central Time.

> Bids will be received by the College of DuPage, District 502, at the office of the Purchasing Manager, Berg Instructional Center (BIC) Building, **Room 1B03**, 425 Fawell Blvd., Glen Ellyn, IL 60137.

This signed Addendum acknowledgement is required to be returned with your Bid no later than the due date set forth for this Invitation to Bid.

Below are clarifications to this bid:

CURRENT BID DUE DATE:

BIDS DUE: Friday, September 15, 2017 at 10:00 a.m. Central Time

CHANGE TO:

BIDS DUE: Tuesday, September 19, 2017 at 10:00 a.m. Central Time

DRAWING M200 CURRENTLY READS:

Note:
EXISTING BAS SYSTEM IS A HONEYWELL PRODUCT. PLEASE CONTACT LOCAL HONEYWELL REPRESENTITIVE GIAN GIULIANI (847) 226-9534 Gian.Giuliani@Honeywell.com

CHANGE TO:

Note:
EXISTING BAS SYSTEM IS A HONEYWELL PRODUCT. PLEASE CONTACT LOCAL HONEYWELL REPRESENTITIVE Matt Szydlowski (847) 391-3165 matt.szydlowski@honeywell.com

End of Addendum

I HAVE RECEIVED ADDENDUM #3 _____
Authorized Signature

FIRM NAME & ADDRESS:

_____

_____

_____

Sincerely,

Purchasing Department
College of DuPage
425 Fawell Blvd. BIC 1540
Glen Ellyn, IL 60137

College of DuPage

Purchasing Department

425 Fawell Boulevard
Glen Ellyn, Illinois 60137-6599
PHONE (630) 942-2355
FAX (630) 942-4322

2018-B0012 HEALTH SCIENCES CENTER (HSC) CADAVER LAB RENOVATION SUPPLIMENTAL HVAC
ADDENDUM # 2

September 11, 2017

This addendum is being issued to update the specifications and provide additional information.

This information becomes part of the Bid/RFP Documents upon receipt. Please review and incorporate into your Bid/Proposal accordingly.

For which Bids are scheduled to be received on September 15, 2017 no later than 10:00 a.m., Central Time.

Bids will be received by the College of DuPage, District 502, at the office of the Purchasing Manager, Berg Instructional Center (BIC) Building, **Room 1B03**, 425 Fawell Blvd., Glen Ellyn, IL 60137.

The signed Addendum acknowledgment is required to be returned with your Bid no later than the due date set forth for this Invitation to Bid.

Below are clarifications to this bid:

GENERAL QUESTIONS AND RESPONSES

Q1 - Will we be given an area to use as a temporary office and use of the facility bathrooms during this project? If not, where would the area be that these would need to be placed.

A1 - COD will not provide space for a temporary office. Contractors may use facility restrooms provided they conduct themselves in a clean and respectful manner.

Q2 - Is there a fire protection subcontractor, temperature control subcontractor or fire alarm subcontractor that has maintenance/support contracts for this building? If so, can you provide the contact information for our use?

A2 – Controls Contractor is Honeywell, see Item 12 Exhibit A and Notes M200, Fire Alarm Contractor is Commercial Alarm Systems, Elmhurst Illinois (847 553 7994). Note that the successful bidder will be responsible to update the college head end equipment for any

graphics/programming related to FA or Control revisions under this bid package. The College does not have a contracted maintenance firm for Fire Protection.

Q3 - On sheet P101, it shows that we are adding two sprinkler heads in the new room; but during the site visit, it appears that the existing head in the corridor will be in the new wall or right next to it. The drawings also don't show any work in the corridor area for sprinkler coverage after the room is added. Please clarify the scope for the fire protection changes, or provide a drawing with the existing layout in the corridor area that affects our work.

A3 – See Revised drawing P101, Addendum 2.

Q4 - Who will be responsible for the fire alarm revisions for the project? The mechanical plans note adding smoke detectors at the new V.A.V. equipment in the new room, but no indication of tying them into the fire alarm panel or if there is any other work to be providing for this phase of the project. Please clarify the work we are to provide for this trade item.

A4 – For Fire Alarm system, the General Contractor is responsible to include this work in his bid. See Keynote #3 on drawing E201 for the work included. Please note that the work must be performed by the Colleges maintenance contractor, CAC as noted in Answer 2.

Q5 - There isn't anything shown for the landscape restoration work for the new condenser area; during the site visit. We found out that this is actually a planting area and not a grass area. Can you provide an allowance for the restoration of this planting bed or supply a scope of work for this area?

A5 – Allowances will not be provided. The bidder should include in his bid removing plants from site/pruning back plants that are within a 2-foot perimeter from edge of pad, soil fill to level/recontour the surface to drain and filling the area with mulch (to match existing).

Q6 – Where holes are drilled in the slab, are any special measures required to locate reinforcement, etc.?

A6 – See Sheet D100, General Demo, Note 21, which covers non-destructive testing (xray/other)

Revised Drawings (5 pages).

Attachments:

1. Sheet D100, "Demo Floor Plan and Demo RCP- 2nd Floor", dated 09/08/2017
2. Sheet A101, "New Work Floor Plan and RCP- 2nd Floor", dated 09/08/2017
3. Sheet P100, "Plumbing 1st Floor New Work Plan", dated 09/08/2017
4. Sheet P101, "Plumbing and Fire Protection 2nd Floor New Work Plan", dated 09/08/2017
5. Sheet M101, "Mechanical 2nd Floor New Work Plan", dated 09/08/2017

Changes to Construction Documents:

1. Sheet D100, "Demo Floor Plan and Demo RCP- 2nd Floor", Existing mechanical diffusers and sprinkler heads shown.

2. Sheet A101, “New Work Floor Plan and RCP0- 2nd Floor”, Mechanical diffuser and sprinkler head relocations as indicated in the MEP Drawings.
3. Sheet P100, “Plumbing 1st Floor New Work Plan”, Provide a new 2” connection in existing acid waste piping, Run the sanitary vent piping up through the Second Floor fire rated deck as indicated and noted
4. Sheet P101, “Plumbing and Fire Protection 2nd Floor New Work Plan”, Route sanitary vent piping through new partition wall and connect to existing sanitary vent piping above ceiling. Relocate existing sprinkler head.
5. Sheet M101, “Mechanical 2nd Floor New Work Plan”, Relocate existing return grill.

GENERAL DEMOLTION NOTES

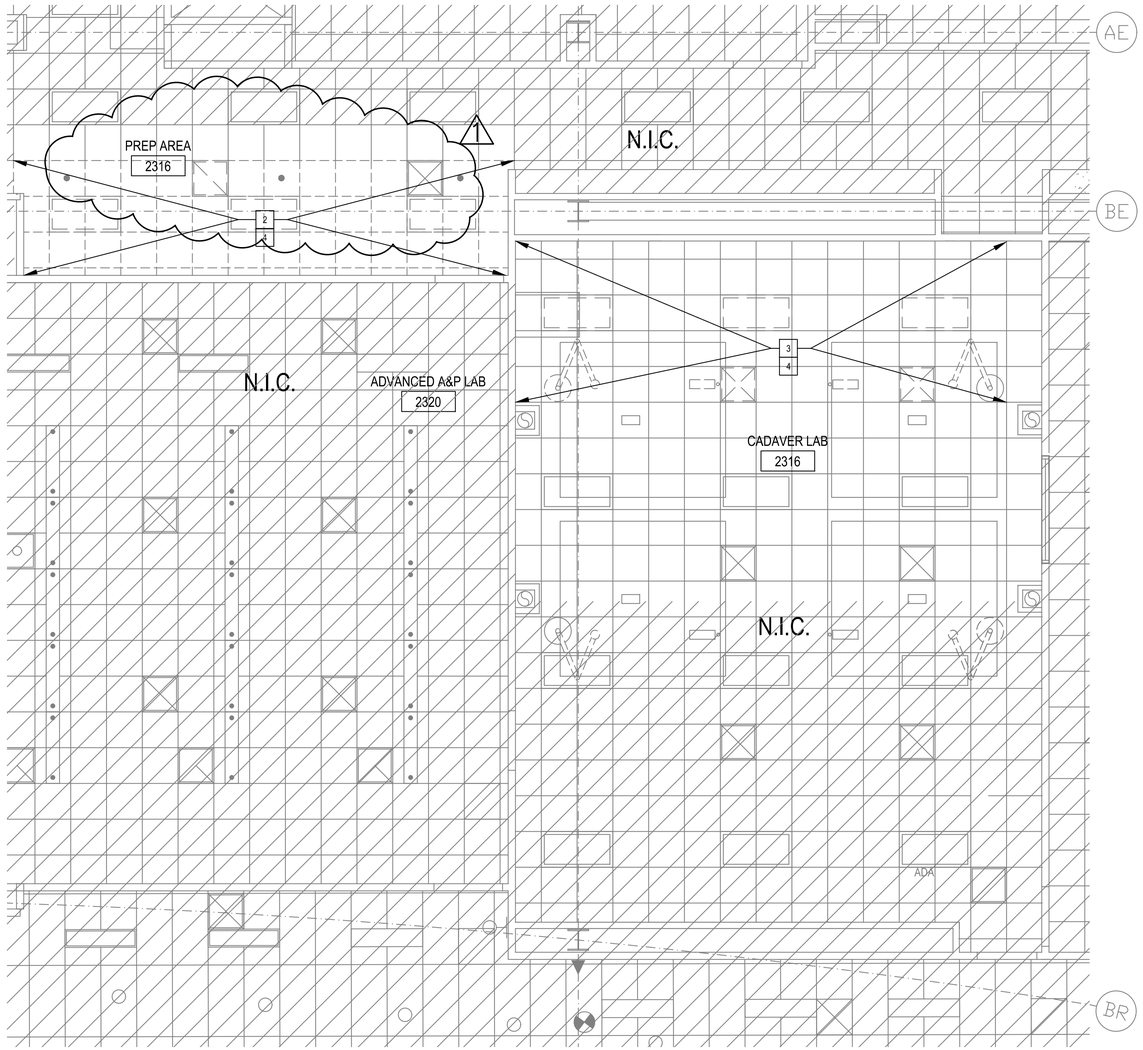
1. CONTRACTOR SHALL VISIT THE SITE AND BECOME FAMILIAR WITH THE EXISTING CONDITIONS PRIOR TO COMMENCING THE WORK.
2. CONTRACTOR SHALL NOTIFY THE ARCHITECT OF ANY AND ALL DISCREPANCIES BETWEEN THE DEMOLITION DRAWINGS AND ACTUAL CONDITIONS PRIOR TO PROCEEDING WITH THE WORK.
3. THE OWNER HAS NOT IDENTIFIED HAZARDOUS MATERIALS IN THE EXISTING SPACES. CONTRACTOR TO NOTIFY THE ARCHITECT IMMEDIATELY IF HAZARDOUS MATERIALS ARE IDENTIFIED. DO NOT PROCEED WITH THE WORK UNTIL THE HAZARDOUS MATERIALS HAVE BEEN REMOVED.
4. REFER TO MEP AND FP DEMOLITION AND NEW WORK DRAWINGS FOR ADDITIONAL REQUIREMENTS.
5. PROVIDE PROTECTION AGAINST MOISTURE, IMPACT, AND OTHER TYPES OF DAMAGE AT ALL OPENINGS CREATED BY SELECTIVE DEMOLITION. PROTECT EXISTING CONSTRUCTION FROM DAMAGE DURING THE DEMOLITION AND NEW CONSTRUCTION WORK. REPAIR OR REPLACE AS REQUIRED EXISTING CONSTRUCTION DAMAGED AT NO COST TO THE OWNER.
6. ALL PENETRATIONS OF EXISTING PARTITIONS SHALL BE PATCHED AND REPAIRED AS REQUIRED TO MAINTAIN THE EXISTING INTEGRITY OF THE WALL. ALL SLEEVES, WIREWAYS, CABLE TRAYS, PIPES, DUCTWORK, ETC. SHALL BE SEALED TIGHT TO THE WALL PENETRATIONS.
7. EXISTING FLOOR PENETRATIONS, WHERE PIPING, DUCTWORK, CONDUIT OR OTHER ITEMS HAVE BEEN REMOVED DURING REMOVAL ARE TO BE FILLED WITH CONCRETE TO MATCH THE EXISTING SURROUNDING FLOOR AND REQUIRED FIRE RATINGS.
8. CONTRACTOR TO PROVIDE ALL REQUIRED OPENINGS IN EXISTING WALLS AND FLOORS FOR PENETRATION OF MECHANICAL, PLUMBING, FIRE PROTECTION, COMMUNICATIONS, AND ALL OTHER REQUIRED BUILDINGS SYSTEMS. MAINTAIN EXISTING SMOKE AND FIRE RATINGS AS REQUIRED.
9. PROTECT EXISTING INTERIOR WALLS DURING REMOVAL AND CONSTRUCTION. PROVIDE TEMPORARY PROTECTION FROM DUST, NOISE, DAMAGE, ETC. AND CONSTRUCTION BARRIERS AND OTHER SITE PROTECTION REQUIREMENTS CONSISTENT WITH THE SPECIFICATIONS SECTION, AND DIVISION 1, GENERAL REQUIREMENTS.
10. REFER TO THE PROJECT MANUAL, SPECIFICATIONS DIVISION 1, AND GENERAL REQUIREMENTS, FOR RELATED PROJECT, DEMOLITION, CONSTRUCTION AND PROTECTION REQUIREMENTS.
11. PLANS ARE DIAGRAMMATIC AND PROVIDED TO SHOW INTENT ONLY, UNLESS SPECIFICALLY NOTED. V.I.F.
12. SALVAGED MATERIALS INDICATED ARE PROPERTY OF THE OWNER, TEMPORARILY STORE MATERIALS ON THE SITE AS DIRECTED BY THE OWNER. PROVIDE ALL NECESSARY PROTECTION AGAINST MOISTURE, IMPACT, AND ANY OTHER TYPE OF POTENTIAL DAMAGE.
13. CONTRACTOR SHALL OBTAIN ALL NECESSARY PERMITS, WORK ORDERS REQUIRED AND SHALL NOTIFY ALL UTILITIES HAVING SERVICE CONNECTIONS WITHIN THE SITE.
14. CONTRACTOR SHALL REMOVE REMOVE ALL TRASH AND DEBRIS DAILY. DEMOLITION WORK SHALL REMAIN SAFE AND CLEAN FOR THE BUILDING'S OCCUPANTS AND CONSTRUCTION WORKERS. OCCUPIED AREAS ADJACENT TO THE PROJECT WORK AREAS SHALL BE KEPT CLEAN AT ALL TIMES DURING THE WORK.
15. ROOM LAYOUTS AND CONFIGURATIONS AND FOR AREAS OUTSIDE OF THE CURRENT PHASE OF WORK ARE SHOWN FOR REFERENCE ONLY. VERIFY EXISTING CONSTRUCTION AS REQUIRED.
16. IN AREA OF REMOVAL AND WHERE NEW FINISHES ARE NOT SCHEDULED, CONTRACTOR SHALL REPAIR WALLS, FLOORS, WALL BASES, AND CEILING AS REQUIRED TO MATCH EXISTING FINISHES TO BE FLUSH, SMOOTH, AND MATCH ADJACENT MATERIALS IN ALL RESPECTS.
17. THE CONTRACTOR SHALL PROVIDE TEMPORARY PROTECTION, SUPPORT, BRACING SEALING AND CAPPING OF EXISTING PARTITIONS, CEILINGS, PIPES, DUCTS, CONDUITS, ETC. SHOWN TO BE PARTIALLY DEMOLISHED IN THIS PHASE OF WORK. THE TEMPORARY WORK SHALL KEEP THE PARTIALLY DEMOLISHED WORK STABILIZED. WHERE EXISTING CONSTRUCTION IS SHOWN TO BE PARTIALLY DEMOLISHED IN THIS PHASE OF WORK, EXTEND DEMOLITION A MINIMAL DISTANCE AS REQUIRED TO INSTALL NEW WORK INDICATED.
18. PREPARE ALL EXISTING SURFACES TO REMAIN. PROVIDE CLEAN SMOOTH SURFACES TO RECEIVE SCHEDULED FINISHES. LEVEL FLOOR SLAB SURFACES AS REQUIRED TO PROVIDE A FLAT, LEVEL SURFACE FOR FLOORING INSTALLATIONS. REFERENCE THE FINISH SCHEDULE SHEET AND THE FINISH PLANS SHEETS FOR RELATED REQUIREMENTS.
19. WHERE EXISTING PARTITIONS ARE REMOVED FOR NEW OPENINGS AND WHERE EXISTING OPENINGS ARE ENLARGED, PATCH AND FINISH NEW OPENINGS AS REQUIRED TO MATCH EXISTING PARTITIONS.
20. CLEAN AND PREPARE FOR NEW FINISHES EXISTING SURFACES INDICATED TO REMAIN. COORDINATE WITH THE FACILITY REMOVAL AND DISPOSAL OF UNWANTED SIGNAGE, FIXTURES, HARDWARE, ETC. ON EXISTING SURFACES TO MATCH EXISTING SUBSTRATES AND PROVIDE AN ADDITIONAL PRIME PAINTED COATING ON ALL REPAIRS PRIOR TO REFINISHING AS SCHEDULED. COORDINATE WITH THE REQUIREMENT OF THE FINISH SCHEDULE.
21. SURVEY AND DOCUMENT EXISTING REINFORCING IN FLOOR SLABS, ROOF SLABS AND BEAMS, USING NON-DESTRUCTIVE METHODS, PRIOR TO CUTTING FOR OPENINGS OR CORING OPENINGS.
22. REMOVE ALL DEBRIS FROM WORK AREA IN CLEAN, COVERED CONTAINERS.
23. COORDINATE WITH OWNER. MINIMUM (I) WEEK PRIOR TO DISTURBING ANY UTILITIES, EQUIPMENT SHUT DOWNS.
24. THESE NOTES APPLY TO ALL FLOORS, ALL SHEETS THIS SET.
25. EXISTING ADJACENT LABS, CLASS ROOMS AND CORRIDORS TO REMAIN IN OPERATION. PROVIDE PROTECTION OF ALL CONSTRUCTION AND EQUIPMENT, COORDINATE WITH THE OWNER AS REQUIRED.
26. EXISTING CADAVER LAB TO BE UNDER CONSTRUCTION OR OCCUPIED.
27. PROVIDE PROTECTION OF ALL EXISTING CONSTRUCTION AND EQUIPMENT, COORDINATE WITH OWNER AND CONTRACTOR AS REQUIRED.
28. BUILDING WILL BE OCCUPIED AND IN OPERATION DURING CONSTRUCTION.

KEYNOTE LEGEND

1. DEMO EXIST VCT FLOOR FINISH AND RESILIENT BASE AS INDICATED
2. DEMO CEILING TILES AND GRID AS INDICATED. COORDINATE WITH MECHNICAL DRAWINGS.
3. CEILING GRID IN CADAVER LAB TO REMAIN. REMOVE AND REPLACE CEILING TILES AS REQUIRED FOR MEP, SEE MEP DRAWINGS. REPLACE TO MATCH ANY DAMAGED TILE OR GRID AS REQUIRED.
4. REMOVE AND REINSTALL CEILING MOUNTED DEVICES AS REQUIRED. SEE ELECTRICAL DRAWINGS.
5. EXIST SINK AND FIXTURES TO REMAIN. PROTECT AS REQUIRED.
6. EXIST MILLWORK, BASE CABINETS, COUNTERS, OVERHEAD CABINETS, CASEWORK AND EQUIPMENT TO REMAIN, V.I.F. PROTECT AS REQUIRED.
7. EXISTING SPACES TO REMAIN IN OPERATION. PROTECT AND COORDINATE AS REQUIRED
8. EXISTING CADAVER LAB TO BE UNDER CONSTRUCTION UNDER A SEPARATE CONTRACT OR IN OPERATION. PROTECT AND COORDINATE AS REQUIRED

DRAWING LEGEND

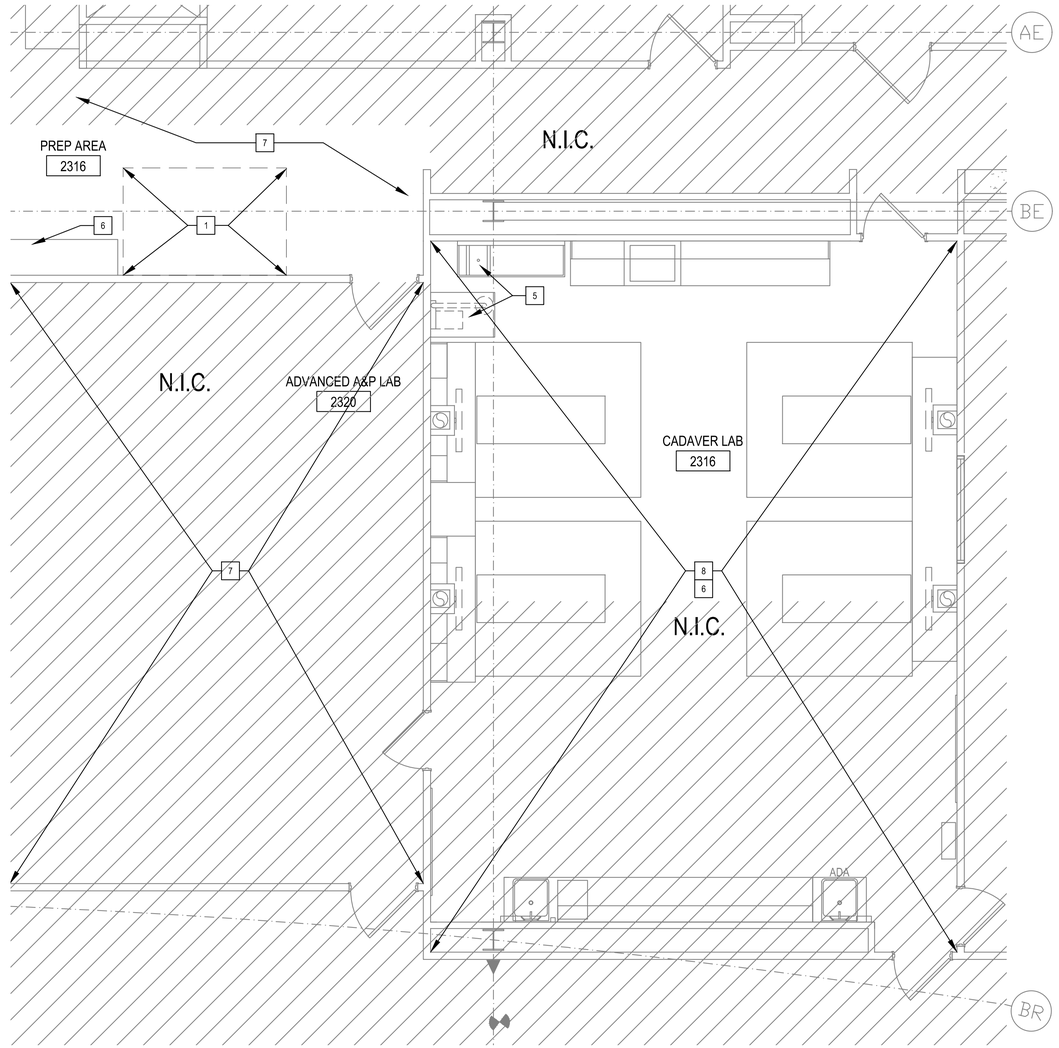
- 2' x 4' LIGHT TO REMAIN
- 2' x 4' LIGHT TO DEMOLISH
- DIFFUSERS TO REMAIN
- DIFFUSERS TO DEMOLISH
- CEILING GRID TO REMAIN
- FIXTURES, EQUIPMENT TO REMAIN
- FIXTURES, EQUIPMENT TO REMOVE
- DOOR TO DEMO
- DOOR TO REMAIN
- WALL TO DEMO
- WALL TO REMAIN
- X — AREA OF DEMO PER KEYNOTE



2 DEMOLITION 2nd FLOOR REFLECTED CEILING PLAN

SCALE: 1/4" = 1' (0, 2', 4', 8')

NORTH



1 DEMOLITION 2nd FLOOR PLAN

SCALE: 1/4" = 1' (0, 2', 4', 8')

NORTH

bailey edward

t 312.440.2300
f 312.440.2303
www.baileyedward.com

35 East Wacker Dr
Suite 2800
Chicago, IL
60601-2308

Owner
College of DuPage
425 Fawell Blvd.
Glen Ellyn, IL 60137

Issue Date	Title
06/26/2017	ISSUE FOR PERMIT
07/20/2017	ISSUE FOR BID
09/082017	ADDENDUM #2 ⚠1

COLLEGE OF DUPAGE
CADAVER LAB
PHASE 2

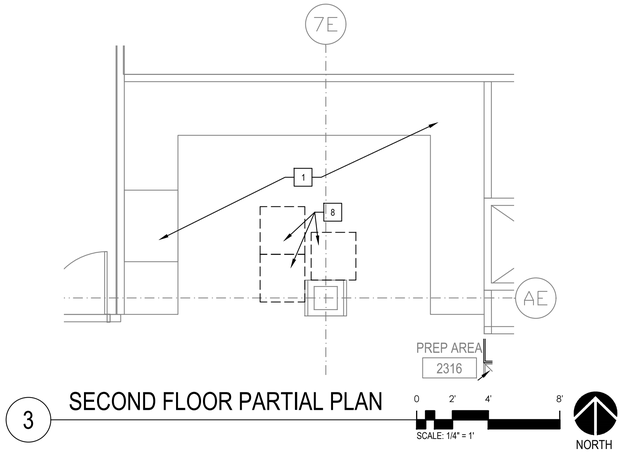
Drawing Title

DEMO FLOOR PLAN AND DEMO RCP- 2nd FLOOR

BE Project No. 15044-15-03

Drawn By: PK

Drawing No. D100



3 SECOND FLOOR PARTIAL PLAN

0 2' 4' 8'

SCALE: 1/4" = 1'

NORTH

GENERAL NOTES

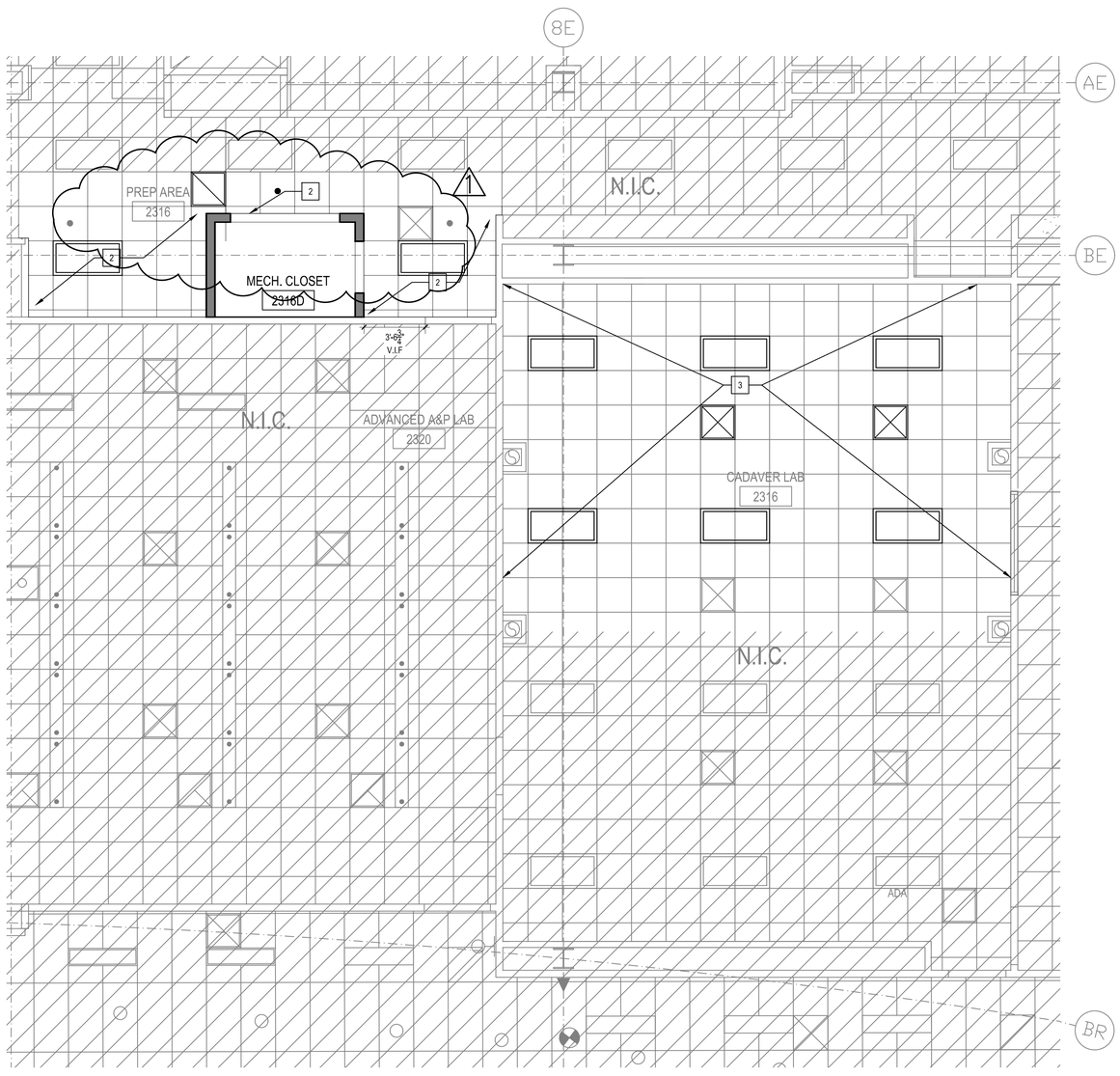
1. REFER TO SHEET G001 FOR ADDITIONAL WORK REQUIRED IN AREAS SHOWN.
2. CONTRACTOR SHALL VISIT THE SITE AND BECOME FAMILIAR WITH THE EXISTING CONDITIONS PRIOR TO COMMENCING THE WORK. EXISTING CONDITIONS SHOWN ARE FROM INFORMATION PROVIDED BY THE GOVERNMENT. VERIFY IN FIELD ALL EXISTING CONDITIONS, DIMENSIONS, ELEVATION HEIGHTS, CONSTRUCTION AND BUILDING SYSTEMS PRIOR TO PROCEEDING WITH THE WORK.
3. CONTRACTOR SHALL NOTIFY THE ARCHITECT OF ANY AND ALL DISCREPANCIES BETWEEN THE CONTRACT DOCUMENTS AND EXISTING CONDITIONS PRIOR TO PROCEEDING WITH THE WORK.
4. PATCH AND PREPARE EXISTING WALLS AS NECESSARY TO RECEIVE NEW FINISHES WHERE SCHEDULED.
5. ROOM LAYOUTS AND CONFIGURATIONS FOR AREAS OUTSIDE OF THE CURRENT WORK ARE SHOWN FOR REFERENCE ONLY. EXISTING CONSTRUCTION IS BASED UPON LIMITED SURVEYS BY THE ARCHITECT AND INFORMATION PROVIDED BY THE GOVERNMENT. FIELD VERIFICATION PRIOR TO COMMENCEMENT OF CONSTRUCTION IS REQUIRED.
6. APPLY NEW FINISHES TO EXISTING WALL AND CEILING MOUNTED COVER PLATES, ITEMS, ETC, LOCATED ON EXISTING SURFACES SCHEDULED TO BE REFINISHED. EXISTING ITEMS THAT ARE NOT REMOVABLE SHALL BE CAREFULLY TAPED, OR OTHERWISE COVERED DURING REFINISHING.

KEYNOTE LEGEND - PLAN

1. CABINETS, CASEWORK FIXTURES AND EQUIPMENTS TO REMAIN - PROTECT AS REQUIRED.
2. NEW CEILING TILES AND GRID AS SCHEDULED. REMOVE AND REINSTALL ALL CEILING MOUNTED FIXTURES AND DEVICES AS REQUIRED. SEE ELECTRICAL AND MECHANICAL DRAWINGS.
3. REMOVE AND REPLACE CEILING TILES AS REQUIRED FOR MEP. REMOVE AND REINSTALL ALL CEILING MOUNTED FIXTURES AND DEVICES AS REQUIRED. SEE MEP DRAWINGS.
4. 2-LAYER 5/8" GYPSUM BOARD FULL HEIGHT AND FULL WIDTH. LAMINATE TO EXISTING PARTITION. TAPE, FLOAT AND SAND TO MATCH NEW PARTITIONS.
5. MINIMUM CLEAR INSIDE DIMENSIONS. V.I.F WITH FINAL EQUIPMENT SELECTION AND DUCTS, SEE MECHANICAL DRAWINGS.
6. CAST IN PLACE CONCRETE HOUSE KEEPING PAD, REINFORCED WITH 4 x 4 W.W.F. MIN. SEE MECHANICAL DRAWINGS.
7. MECHANICAL AHU UNIT AND DUCTS, SEE MECHANICAL DRAWINGS.
8. 3 EXISTING REFRIGERATORS RELOCATED TO HERE BY OWNER. SEE ELECTRICAL.

DRAWING LEGEND

- NEW 2' x 4' LIGHT
- EXISTING 2' x 4' LIGHT
- EXISTING DIFFUSERS
- NEW CEILING GRID
- CEILING GRID TO REMAIN
- NEW DOOR
- DOOR TO REMAIN
- NEW EQUIPMENT
- PARTITION TO REMAIN
- NEW PARTITION INFILL

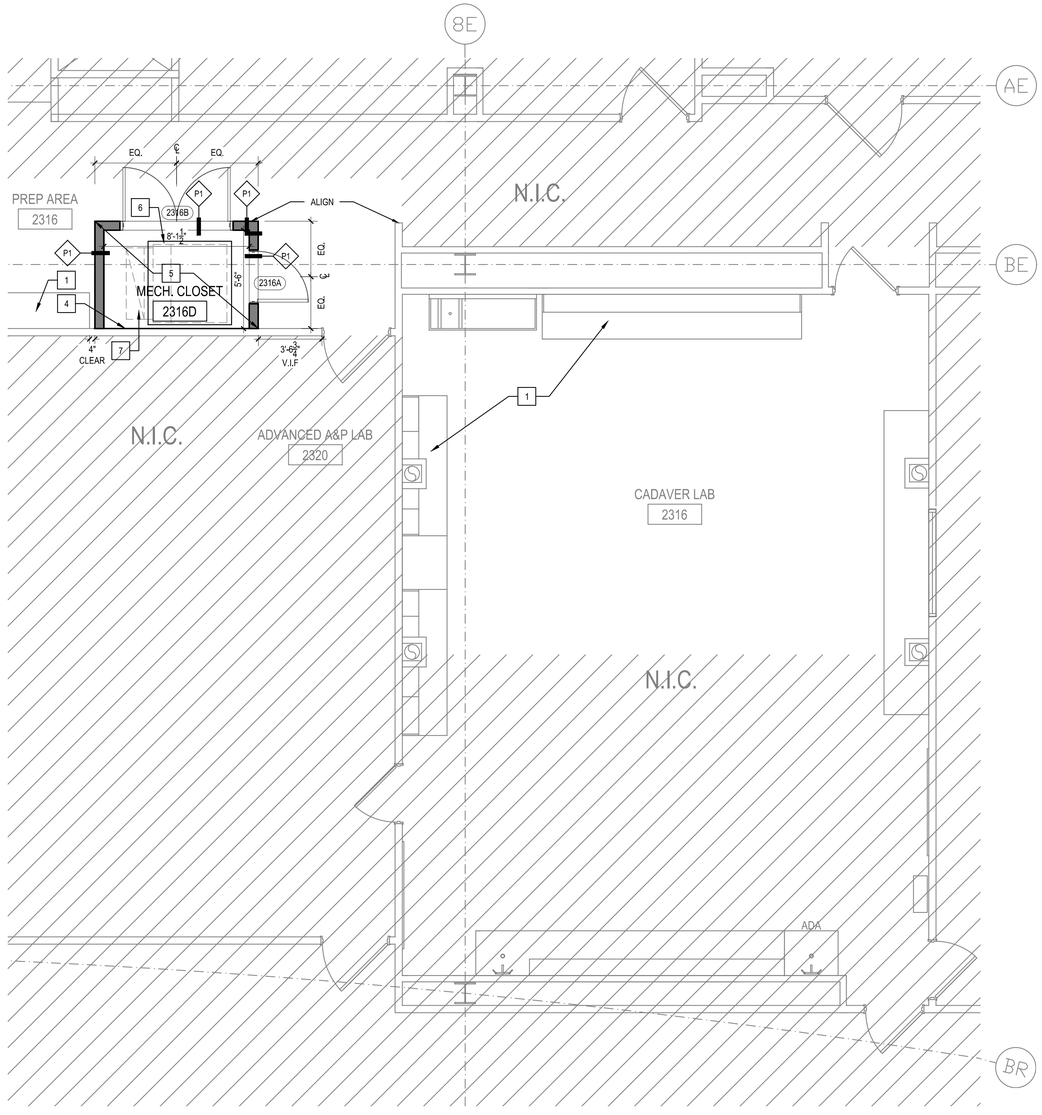


2 NEW WORK REFLECTED CEILING PLAN - 2nd FLOOR

0 2' 4' 8'

SCALE: 1/4" = 1'

NORTH



1 NEW WORK FLOOR PLAN- 2nd FLOOR

0 2' 4' 8'

SCALE: 1/4" = 1'

NORTH

bailey edward

t 312.440.2300
f 312.440.2303
www.baileyedward.com

35 East Wacker Dr
Suite 2800
Chicago, IL
60601-2308

Owner
College of DuPage
425 Fawell Blvd.
Glen Ellyn, IL 60137

Issue Date	Title
06/26/2017	ISSUE FOR PERMIT
07/20/2017	ISSUE FOR BID
09/082017	ADDENDUM #2 ⚠1

COLLEGE OF DUPAGE
CADAVER LAB
PHASE 2

Drawing Title

NEW WORK FLOOR PLAN AND RCP- 2nd FLOOR

BE Project No. 15044-15-03

Drawn By: PK

Drawing No. A101

GENERAL NOTES:

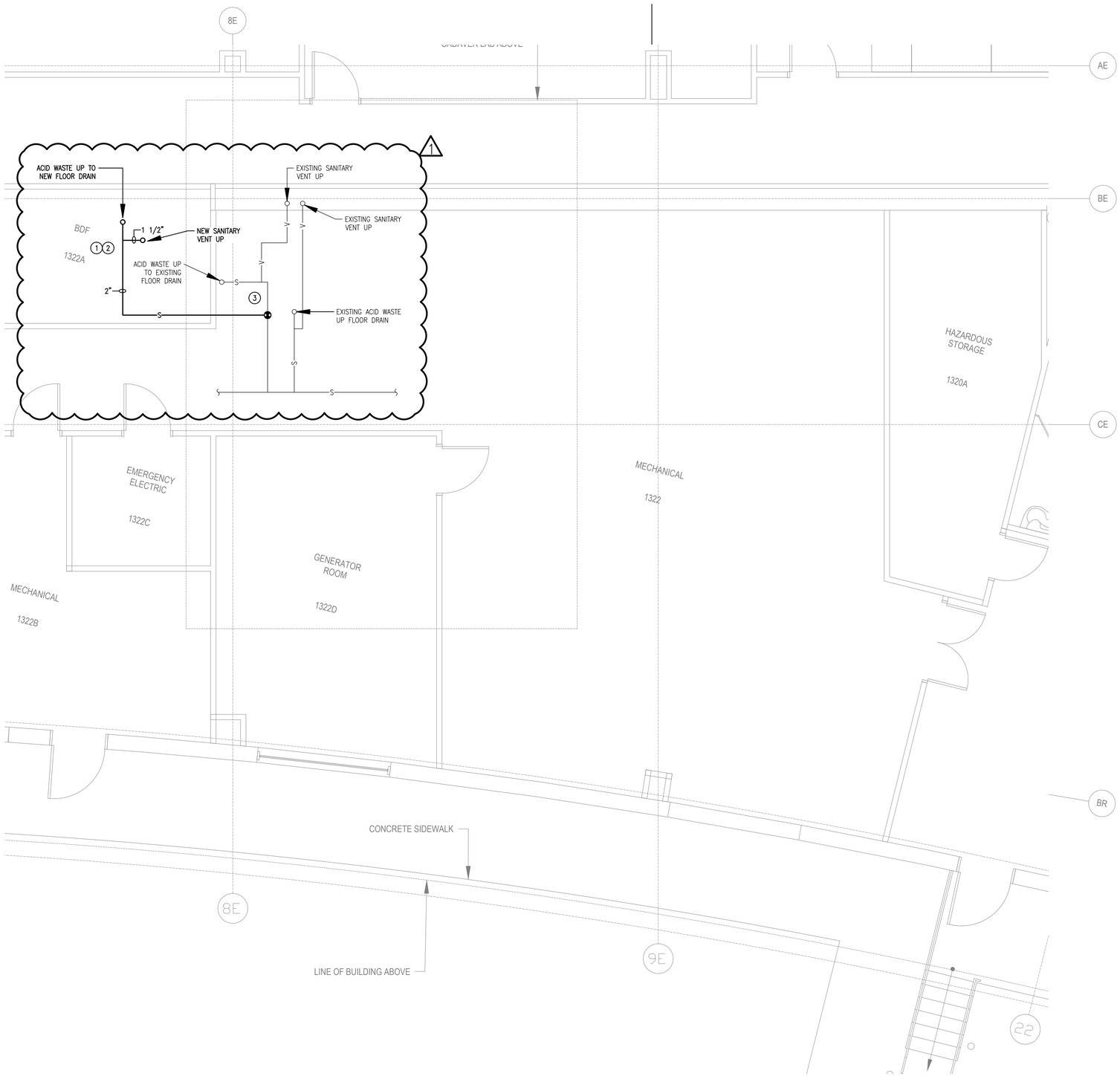
1. FIELD VERIFY EXACT LOCATION OF EXISTING PIPING.
2. PROVIDE HANGERS AND SUPPORTS FOR ALL PIPES FROM CONCRETE DECK ABOVE AS REQUIRED.
3. ACID WASTE AND VENT PIPING SHALL BE BLUE (CLAMP-FREE) ELECTROFUSION POLYPROPYLENE PIPING.

PLUMBING KEY NOTES:

1. ROUTE PIPING PARALLEL TO EXISTING PIPING IN ROOM 1322A. DON'T INSTALL NEW PIPING OVER EXISTING ELECTRICAL EQUIPMENT IN ROOM.
2. PROVIDE FIRESTOPPING AT ALL FLOOR AND WALL PENETRATIONS.
3. CONNECT ACID WASTE PIPING TO EXISTING.

PLUMBING FIXTURE SCHEDULE

TAG NO.	DESCRIPTION	FIXTURE CONNECTIONS		
		HOT	COLD	SANITARY
FD	FLOOR DRAIN, JAY R SMITH MODEL NUMBER 2005. WITH HEEL PROOF STRAINER, TRAP, 5" BRASS ROUND COVER.	–	–	2"



1 PLUMBING 1st FLOOR NEW WORK PLAN

SCALE: 1/4" = 1'

NORTH

bailey edward

t 312.440.2300
f 312.440.2303
www.baileyedward.com

35 East Wacker Dr
Suite 2800
Chicago, IL
60601-2308

Owner
College of DuPage
425 Fawell Blvd.
Glen Ellyn, IL 60137

Issue Date	Title
06/26/2017	ISSUE FOR PERMIT
07/20/2017	ISSUE FOR BID
09/08/2017	ADDENDUM #2 ⚠1

COLLEGE OF DUPAGE
CADAVER LAB
PHASE 2

Drawing Title

PLUMBING 1st FLOOR NEW WORK PLAN

BE Project No. 15044-15-03

Drawn By: JPB/NPT

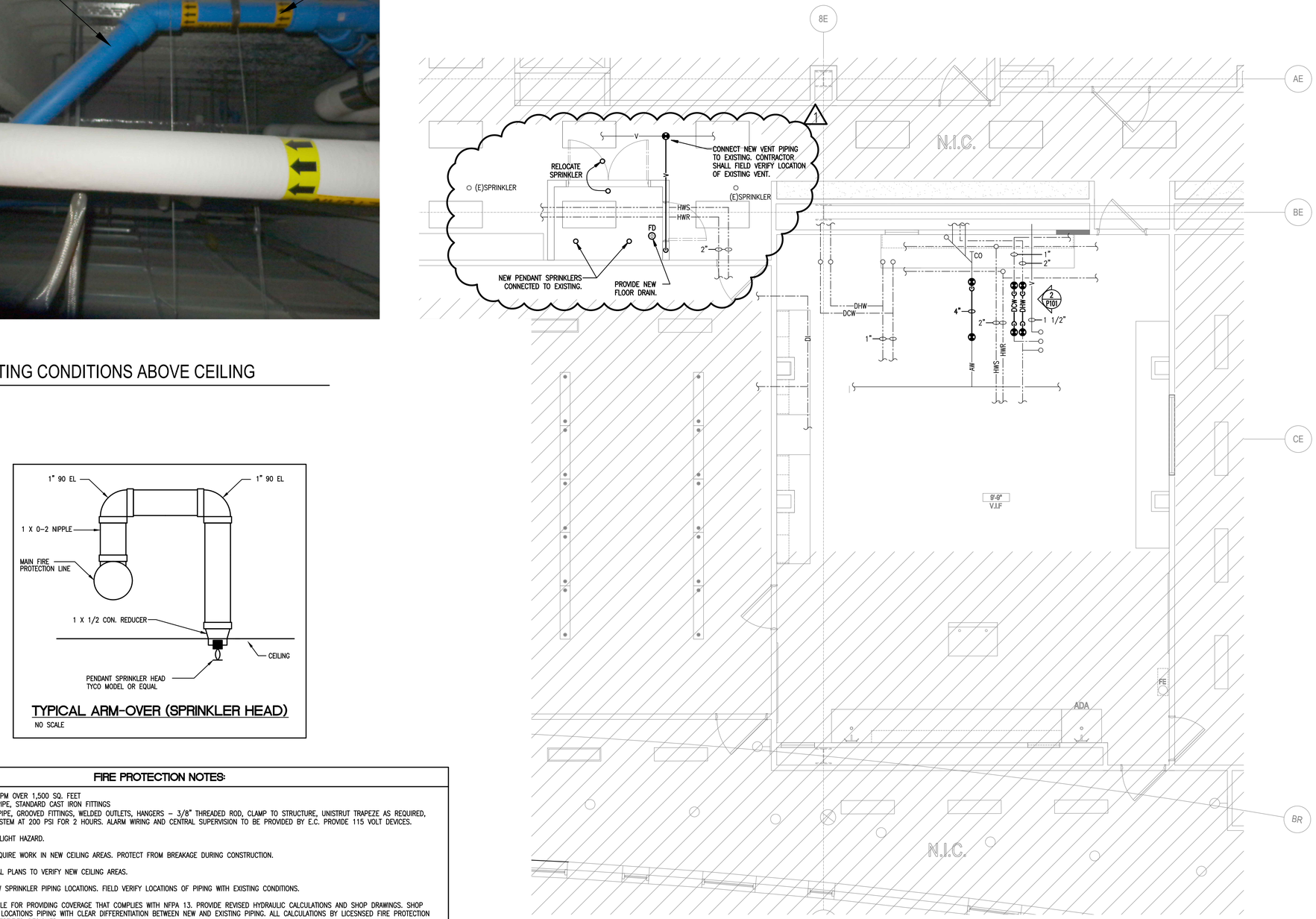
Drawing No. P100

REMOVE EXISTING ACID WASTE (BLUE PIPE) PIPE AND PROVIDE NEW PIPE AT LOWER ELEVATION, ALLOWING M.C. TO INSTALL NEW DUCTWORK. FIELD VERIFY EXACT LOCATIONS. COORDINATE WITH M.C.

PROVIDE FITTINGS AND NEW CONNECTION TO EXISTING PIPE. MATCH EXISTING MATERIALS AND PIPE HANGERS.

RECONNECT TO EXISTING ACID WASTE (BLUE PIPE) PIPE AT LOWER ELEVATION.

2 EXISTING CONDITIONS ABOVE CEILING



1 PLUMBING 2nd FLOOR NEW WORK PLAN

SCALE: 1/4" = 1' (0, 2', 4', 8')

NORTH

TYPICAL ARM-OVER (SPRINKLER HEAD)

NO SCALE

FIRE PROTECTION NOTES:

AREAS SHOWN: LIGHT HAZARD, 0.10 GPM OVER 1,500 SQ. FEET
LINE PIPING – SCHEDULE 40 STEEL PIPE, STANDARD CAST IRON FITTINGS
MAIN PIPING – SCHEDULE 10 STEEL PIPE, GROOVED FITTINGS, WELDED OUTLETS, HANGERS – 3/8" THREADED ROD, CLAMP TO STRUCTURE, UNISTRUT TRAPEZE AS REQUIRED, HYDROSTATICALLY TEST COMPLETED SYSTEM AT 200 PSI FOR 2 HOURS. ALARM WIRING AND CENTRAL SUPERVISION TO BE PROVIDED BY E.C. PROVIDE 115 VOLT DEVICES.

1. ALL AREAS ARE CLASSIFIED AS LIGHT HAZARD.
2. ALL SPRINKLER HEADS WILL REQUIRE WORK IN NEW CEILING AREAS. PROTECT FROM BREAKAGE DURING CONSTRUCTION.
3. COORDINATE WITH ARCHITECTURAL PLANS TO VERIFY NEW CEILING AREAS.
4. EXTEND BRANCH PIPING TO NEW SPRINKLER PIPING LOCATIONS. FIELD VERIFY LOCATIONS OF PIPING WITH EXISTING CONDITIONS.
5. THE CONTRACTOR IS RESPONSIBLE FOR PROVIDING COVERAGE THAT COMPLIES WITH NFPA 13. PROVIDE REVISED HYDRAULIC CALCULATIONS AND SHOP DRAWINGS. SHOP DRAWINGS SHALL DEMONSTRATE LOCATIONS PIPING WITH CLEAR DIFFERENTIATION BETWEEN NEW AND EXISTING PIPING. ALL CALCULATIONS BY LICESNSED FIRE PROTECTION ENGINEER OR NICET LEVEL III CERTIFIED DESIGNER.
6. NEW SUPPORTS SHALL BE INDEPENDENT OF ALL OTHER TRADES.
7. COORDINATE PIPE ROUTING, SPRINKLER LOCATION AND WORK SCHEDULE WITH OTHER TRADES.
8. TEST NEW PIPING WITH AIR PRIOR TO FILLING WITH WATER.

GENERAL NOTES:

1. COORDINATE WORK WITH MECHANICAL CONTRACTOR.
2. VERIFY PIPE SIZES IN FIELD PRIOR TO ORDERING MATERIALS.
3. PROVIDE INSULATION FOR NEW PIPING TO MATCH EXISTING.

bailey edward

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Issue Date	Title
06/26/2017	ISSUE FOR PERMIT
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09/08/2017	ADDENDUM #2 ⚠1

COLLEGE OF DUPAGE
CADAVER LAB
PHASE 2

Drawing Title

PLUMBING AND FIRE PROTECTION 2nd FLOOR NEW WORK PLAN

BE Project No. 15044-15-03

Drawn By: JPB/NPT

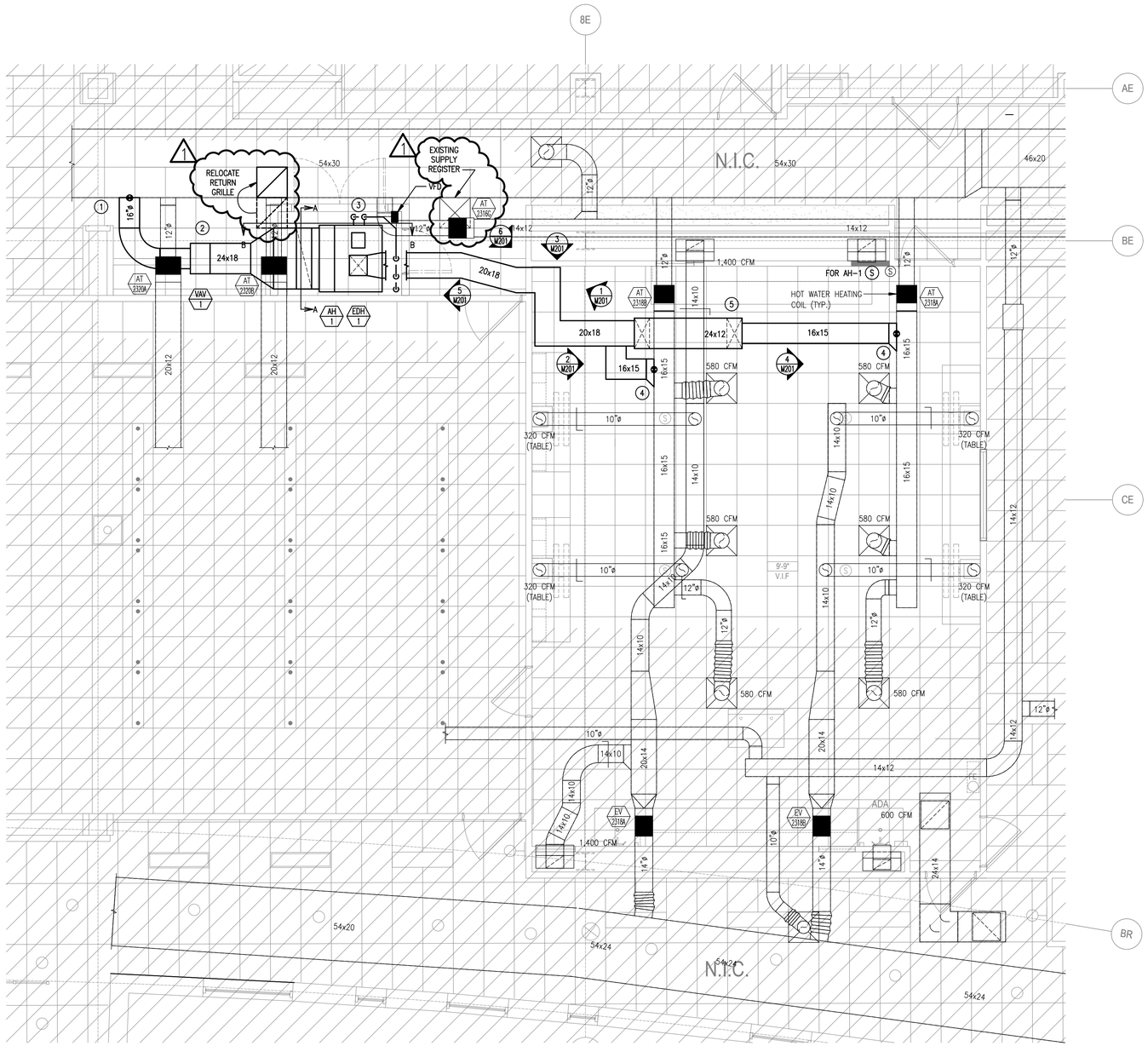
Drawing No. P101

GENERAL NOTES:

1. EXISTING CEILING GRID MAIN TO REMAIN DURING CONSTRUCTION. CONTRACTOR SHALL BE RESPONSIBLE FOR ANY DAMAGES TO GRID OCCURRED DURING CONSTRUCTION. COORDINATE WITH G.C.
2. FIELD VERIFY PLUMBING PIPING AND EQUIPMENT LOCATIONS TO AVOID CONFLICTS WITH PROPOSED DUCTWORK ROUTING.
3. PROVIDE TEST AND BALANCING FOR VAV-1, AH-1, & CH-1. A COPY OF THE TEST AND BALANCE REPORT SHALL BE SUBMITTED TO DUPAGE COUNTY PRIOR TO FINAL INSPECTION.
4. ALL NEW DUCTWORK SHALL BE INSULATED WITH 2" THICK DUCT WRAP. REINSULATE EXISTING DUCT AFTER CONNECTION.

MECHANICAL KEY NOTES:

1. CONNECT TO EXISTING HIGH PRESSURE SUPPLY DUCT.
2. PROVIDE VAV BOX SUSPENDED FROM CONCRETE DECK. PROVIDE CONTROL POWER.
3. PROVIDE AIR HANDLER UNIT AND VFD. FIELD VERIFY PIPE PENETRATIONS. COORDINATE ELECTRICAL REQUIREMENTS WITH E.C.
4. CONNECT TO EXISTING SUPPLY DUCTWORK.
5. PROVIDE TRANSITIONS AND FITTING AS REQUIRED TO ROUTE OVER EXISTING DUCTWORK. PROVIDE NEW HANGERS FOR ALL EXISTING PIPING AND DUCTWORK AS REQUIRED TO INSTALL NEW DUCT.



1 MECHANICAL NEW WORK FLOOR PLAN

SCALE: 1/4" = 1'

NORTH

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COLLEGE OF DUPAGE
CADAVER LAB
PHASE 2

Drawing Title

MECHANICAL 2nd FLOOR NEW WORK PLAN

BE Project No. 15044-15-03

Drawn By: JPB/NPT

Drawing No. M101

Attachment A

Pre-Bid Attendees

COLLEGE OF DUPAGE

DATE: Thursday, August 31, 2017
LOCATION: *Purchasing Conference Room 1B03A*

PRE BID OPENING ATTENDEES

Title: 2018-B0012 Health Science Center (HSC) Cadaver Lab Renovation Supplemental HVAC

Name	Company	Phone	E-mail
Jacoby Radford	College of DuPage	X4535	radfordj@cod.edu
Frank Parise	The YMI Group	847-258-4650	estimating@theYMIGroup.com
~~Matty~~ Andy Usher	Ideal Heating	708-680-5000	ausher@ameritech.net
Janine Perez	Madison Construction	708-789-2242	janine.perez@madisonconstruction.net
DON INMAN	COD	630 942 4046	inmand860@cod.edu
DAVE TABEL	AMBER MECHANICAL	708/597-9700	JMAJOR@AMBERMECH.CO
Matt Voris	Voris Mechanical Inc.	(630) 469-7800	mjvoris@vorismechanical.com
Edith De La Cruz	Rutiguia, IAC	(708) 439-1174	edelacruz@Rutiguac.co
MIKE GERHARDSTEIN	TROOP CONTRACTING	630-568-5252	MIKE@TROOPCONTRACTING.COM
RANDY BUTLER	ACCEL CONSTRUCTION	773.231.5930	rbutler@acceldevgroup.com
Joe DiMaria	Reef, LLC	630-379-4079	joerocco@reefequity.com

2018-B0012 HEALTH SCIENCES CENTER (HSC) CADAVER LAB RENOVATION SUPPLIMENTAL HVAC
ADDENDUM # 2

September 11, 2017

All issued addenda must be signed and returned to the College as per the instructions in the addenda or bid will not be accepted.

ACKNOWLEDGMENT
You can submit this completed addendum to the Purchasing Office by one of the means below:

1. If you have not yet submitted your bid, please sign this addendum and include with your sealed bid**.**
2. If you have already submitted your bid, please sign and return to the Purchasing office via email at purchasing@cod.edu no later than the scheduled bid deadline. We will make sure it accompanies your bid.

You also have the option of withdrawing your proposal, if necessary.

ACKNOWLEDGEMENT:

I HAVE RECEIVED THIS ADDENDUM #_____

Company Name: _____

Address: _____

Authorized Signature: _____

College of DuPage

Purchasing Department

425 Fawell Boulevard
Glen Ellyn, Illinois 60137-6599
PHONE (630) 942-2355
FAX (630) 942-4322

2018-B0012 HEALTH SCIENCES CENTER (HSC) CADAVER LAB RENOVATION SUPPLIMENTAL HVAC
ADDENDUM # 1

September 7, 2017

This addendum is being issued to update the specifications and provide additional information.

This information becomes part of the Bid/RFP Documents upon receipt. Please review and incorporate into your Bid/Proposal accordingly.

For which Bids are scheduled to be received on September 11, 2017 no later than 10:00 a.m., Central Time.

Bids will be received by the College of DuPage, District 502, at the office of the Purchasing Manager, Berg Instructional Center (BIC) Building, **Room 1B03**, 425 Fawell Blvd., Glen Ellyn, IL 60137.

The signed Addendum acknowledgment is required to be returned with your Bid no later than the due date set forth for this Invitation to Bid.

Below are clarifications to this bid:

Section I. Clarification

CURRENTLY READS:

BIDS DUE: Monday, September 11, 2017 at 10:00 a.m. Central Time

CHANGE TO:

BIDS DUE: Friday, September 15, 2017 at 10:00 a.m. Central Time

2018-B0012 HEALTH SCIENCES CENTER (HSC) CADAVER LAB RENOVATION SUPPLIMENTAL HVAC
ADDENDUM # 1

September 7, 2017

This signed Addendum is required to be returned with your Bid no later than the due date set forth for this Invitation to Bid. If you have already submitted your Bid, please submit this signed form via email to purchasing@cod.edu.

You can submit this completed addendum to the Purchasing Office by one of the means below:

All issued addenda must be signed and returned to the College as per the instructions in the addenda or bid will not be accepted.

ACKNOWLEDGMENT
You can submit this completed addendum to the Purchasing Office by one of the means below:

1. If you have not yet submitted your bid, please sign this addendum and include with your sealed bid**.**
2. If you have already submitted your bid, please sign and return to the Purchasing office via email at purchasing@cod.edu no later than the scheduled bid deadline. We will make sure it accompanies your bid.

You also have the option of withdrawing your proposal, if necessary.

ACKNOWLEDGEMENT:

I HAVE RECEIVED THIS ADDENDUM #_____

Company Name: _____

Address: _____

Authorized Signature: _____

BIDDER: _____

College of DuPage

COMMUNITY COLLEGE DISTRICT NO. 502

BID NUMBER: 2018-B0012

HEALTH AND SCIENCE CENTER (HSC) CADAVER LAB RENOVATION SUPPLEMENTAL HVAC

BIDS DUE: **Monday, September 11, 2017 at 10:00 a.m. Central Time**

In the event of College closure due to inclement weather, bid deadline will be extended to the next business day at the same time.

RETURN BIDS TO:

COLLEGE OF DUPAGE
PURCHASING DEPARTMENT
BIC BUILDING, ROOM 1B03
425 FAWELL BLVD.
GLEN ELLYN, ILLINOIS 60137

ISSUED BY THE COLLEGE OF DUPAGE PURCHASING DEPARTMENT

Bid No. 2018-B0012

COLLEGE OF DUPAGE

Purchasing Department

425 Fawell Boulevard
Glen Ellyn, Illinois 60137-6599
http://www.cod.edu

PHONE (630) 942-2217

August 14, 2017

INVITATION TO BID

Sealed bids for **Health and Science Center (HSC) Cadaver Lab Renovation Supplemental HVAC** will be received by the College of DuPage, District 502, at the office of the Purchasing Manager, Berg Instructional Center (BIC) Building, Room 1B03, 425 Fawell Blvd., Glen Ellyn, IL 60137, until **10:00 a.m. Central Time, Monday, September 11, 2017,** at which time they will be publicly opened. In the event of College closure due to inclement weather, bid deadline will be extended to the next business day at the same time.

A pre-bid conference and site visit is scheduled for Thursday, August 31, 2017 at 10:00 a.m. in the Purchasing Office, BIC 1B03 at 425 Fawell Blvd, Glen Ellyn Il 60137. A site visit will immediately follow. The pre-bid conference is not mandatory, but highly recommended.

A Bid Security in the form of a bid bond, cashier's check or certified check in the amount of 10% of the total base bid is required for this project.

Any bid received after the date and time stated above will be returned unopened. College of DuPage shall not be responsible for bids that are not received at the specific office location indicated above by the stated deadline. It is solely, the bidder's responsibility, to ensure that adequate time is allowed for timely and accurate delivery.

Prices offered shall be F.O.B. Destination, College of DuPage, 425 Fawell Blvd., Glen Ellyn, IL 60137. Prices must be firm. No bids will be accepted on the basis of a price prevailing at the time of shipment.

The award(s) of the contract will be made to the lowest responsible and qualified bidder whose bid complies with all the requirements prescribed. Brand or trade names in bid specifications are used for identification purpose only.

No bid shall be withdrawn for a period of ninety (90) days after the bid opening date without the consent of the College.

LEGAL NOTICE

BID NOTICE

No. 2018-B0012

The College of DuPage is accepting sealed bids for **Health and Science Center (HSC) Cadaver Lab Renovation Supplemental HVAC.** Bid documents may be downloaded from the Purchasing Website at www.cod.edu/about/purchasing/requests/ by clicking on the link for this bid and following the instructions.

Bids are due to the College of DuPage Purchasing Department in the Berg Instructional Center (BIC) Building, Room 1B03, 425 Fawell Blvd., Glen Ellyn, IL 60137 up to and no later than **10:00 a.m. Central Time, Monday, September 11, 2017,** at which time they will publicly opened.

A Bid Security in the form of a bid bond, cashier's check or certified check in the amount of 10% of the total base bid is required for this project.

A pre-bid conference and site visit is scheduled for Thursday, August 31, 2017 at 10:00 a.m. in the Purchasing Office, BIC 1B03 at 425 Fawell Blvd, Glen Ellyn Il 60137. A site visit will immediately follow. The pre-bid conference is not mandatory, but highly recommended.

College of DuPage Board of Trustees Reserves the right to reject any and all responses. This invitation is issued in the name of the Board of Trustees of College of DuPage, Community College District 502, Glen Ellyn, Illinois.

Table of Contents

BID SUBMISSION CHECKLIST

Things to Remember When Submitting a Response to an Invitation to Bid for the College of DuPage

1. ☐ **Read the *entire* document.** In your review, note critical items such as: blackout period, required goods and services, submittal dates, submission requirements, etc.

2. ☐ **Note the contact information provided.** The Purchasing Office Buyer at purchasing@cod.edu is the single point of contact for this Invitation to Bid and is the only person with whom you are allowed to communicate regarding this bid. This person is an excellent source of information for any questions you may have.

3. ☐ **Take advantage of the "question and answer" period.** Submit your questions to the Purchasing Department by the date in the Invitation to Bid and view the answers given in the formal addenda issued for the Invitation to Bid. All addenda issued for an Invitation to Bid will be emailed to each company that downloaded the bid documents and will include all questions asked and answered concerning the Invitation to Bid. Please ensure when downloading the bid documents, you use a valid email address.

4. ☐ **Do not alter, add to, or delete and part of the Bid documents without prior approval.** Please refer to the section titled *Exceptions* for instruction on how to request a deviation to the original Invitation to Bid.

5. ☐ **Ensure all Addenda are signed.** Before submitting your response, check the College Purchasing website at http://www.cod.edu/about/purchasing/requests/index.aspx to see whether any addenda were issued for this Bid request. If so, you must submit a signed copy of the addenda along with your bid response.

6. ☐ **Review and read the bid document again to make sure you have addressed all requirements.**
*Your original response and the requested electronic copy (flash drive) must be identical and be complete.
*Bids will not be accepted if Sections 5, 6, and 7 are not completed. (Please note there are two (2) signature lines in Section 7 that must be signed.)
*If your company is a Certified Women-Owned, Minority-owned, or Persons with Disability-owned business, please include a copy of any and all certifications.

7. ☐ **Submit your response on time.** Note the date and time listed on the front page of the Invitation to Bid and be sure to submit all required items on time. Late responses will not be accepted and will be returned, unopened. Ensure the box (s) containing your proposal is appropriately labeled. Please allow adequate time for delivery to the Purchasing Department.

8. ☐ **Important dates to know:**

   - Bid Publication Date – 8/25/17
   - Pre-Bid Meeting – 8/31/17 at 10:00 am
   - Questions Due – on or before 12:00 p.m. on 9/1/17
   - Bids Opening – 9/11/17 at 10:00 a.m.
   - Target Board Approval Date – 9/21/17
   - Purchase Order Issued once contract is finalized and all required documentation is on file.

1.0 GENERAL INFORMATION

1.1 DEFINITIONS

A. **BIDDER** shall mean the individual or business entity submitting a Bid to supply any or all of the services or goods required by the Bid Documents.

B. **BID** shall mean the Bid Documents as completed by the Bidder which constitutes the Bidder's offer.

C. **CONTRACT** shall mean the agreement between the College and Contractor as set forth in the Bid Documents and as awarded by the College of DuPage Board of Trustees.

D. **BID DOCUMENTS** shall mean collectively the Instructions to Bidders, General Conditions, Special Conditions, Specifications, Attachments, and Addenda, if any, Bid, Site Inspection Certificate, Contractor Certifications and Forms for Minority Participation. The above documents shall be considered as one integrated document setting forth the obligations of the parties.

E. **CONTRACTOR** shall mean the individual or business entity submitting a Bid and to whom the College of DuPage Board of Trustees awards the Contract.

F. **COLLEGE** shall mean the College of DuPage, Community College District No. 502, a body politic and corporate of the State of Illinois.

G. **DIRECTOR** shall mean the person or persons authorized by the College to act in connection with this Contract. Such authorization shall not include any power to change the scope of the Contract or to obligate the College to pay additional sums beyond the amount of the Contract awarded by the College of DuPage Board of Trustees.

H. **PURCHASING MANAGER** shall mean the Purchasing Manager of the College of DuPage.

I. **SPECIFICATIONS** shall mean the description of the required services, Contract Goods, equipment, personnel, volume and use statistics and all requirements for the scope of work set forth in the Bid Documents.

1.2 BIDS TO CONFORM TO REQUIREMENTS OF LEGAL ADVERTISING

The College will not entertain or consider any Bid responses: (i) received after the exact time specified in the legal advertisements; (ii) not accompanied by the required bid deposit/bond, if required; or (iii) in any other way failing to comply fully with the conditions stated in the legal advertisement.

1.3 COMPLIANCE

Submissions under this Invitation to Bid shall be for items at least equal to or better than the quality and performance characteristics stated herein. The burden of proof that product and services meet specifications shall be documented by the bidder and be provided as part of the submitted bid. Failure to provide complete documentation of the product compliance with specifications required may result in bid rejection.

1.4 COMPLIANCE WITH LAWS - PUBLIC CONTRACTS

This Contract is a competitively bid public contract of the College of DuPage subject to laws and ordinances governing public contracts. The Bidder shall at all times observe and comply with all laws, ordinances, regulations and codes of the Federal, State and other local government agencies which may in any manner affect the preparation of the Bid or the performance of the Contract. If the Bidder observes that any of the Bid Documents are at variance therewith, it shall promptly notify the Purchasing Manager in writing and necessary changes shall be effected by appropriate modification.

1.5 REGULATIONS

The Contractor or Subcontractor, warrants that they are familiar with and they shall comply with all Federal, State, and Local Laws, statutes, ordinances, rules and regulations and the orders and decrees of any courts or administrative bodies or tribunals in any manner affecting the performance of the Contract, including, without limitation, Workmen's Compensation Laws, minimum salary and wage statutes and regulations, laws with respect to permits and licenses and fees in connection therewith, laws regarding maximum working hours and regulations with respect to use of explosives. No plea of misunderstanding or ignorance thereof will be considered. Whenever required, the Contractor, or Subcontractor, shall furnish the college with satisfactory proof of compliance with said Federal, State and Local Laws, statutes, ordinances, rules, regulations, orders, and decrees.

1.6 BID MODIFICATIONS

Unless indicated, it is understood that bids are in strict accordance with specification requirements. Bids shall be deemed final, conclusive, and irrevocable. No bid shall be subject to correction or amendment for any error or miscalculation. Bid prices shall include cost of materials as specified, any applicable discounts and shipping. Installation costs shall be included only when indicated on page one. Installation shall include, but is not limited to, all assembly required, setting in place, and mounting all materials at various campus locations.

1.7 PRICES FIRM

All prices quoted in the Bid shall be firm and will not be subject to increase during the term of the Contract awarded to the Contractor, except as otherwise provided in the Bid Documents.

1.8 AWARD OF CONTRACT

The award of the contract will be made within ninety (90) calendar days after the opening of bids to the lowest responsible and qualified bidder whose bid complies with all the requirements prescribed. The successful bidder will be notified by electronic mail that their bid has been accepted and that they have been awarded the contract. Notification will also be posted on the College's Purchasing website at http://www.cod.edu/about/purchasing/ . Failure to execute performance as per accepted bid may result in legal action by the College of DuPage to recover damages.

If a contract is not awarded within ninety (90) days after the opening of bids, a bidder may file a written request with the Purchasing Manager on the withdrawal of their bid and the Purchasing Manager will permit such withdrawal.

The bid security (if required) of all except the three (3) low bidders will be returned promptly after the bids have been checked, tabulated, and the relation of the bids established. Bid security of the three (3) lowest bidders, if required in legal notice, will be returned as soon as the contract and the bond of the successful bidder have been promptly executed and approved. If contracts cannot be awarded promptly, the College may permit the three (3) lowest bidders to substitute bid bonds for bank cashier's checks, bank drafts or certified checks submitted with their bids. Bid bonds executed by corporate surety companies shall be satisfactory to the Owner, but such substitution shall not be made until a period of fifteen (15) days has elapsed after the date of opening of bids and bond forms furnished by the College shall be used.

1.9 CONSIDERATION OF BIDS

The College reserves the right to reject or accept any or all Bid responses, to extend the bidding period, to waive technicalities in the documents and/or to direct that the project be abandoned or rebid prior to award of the Contract.

1.10 COMPETENCY OF BIDDER

No Bid will be accepted from or Contract awarded to a Bidder that is in arrears or is in default to the College upon any debt or Contract, or that is a defaulter, as surety or otherwise upon any obligation to said College, or has failed to perform faithfully any previous contract with the College.

1.11 BIDDER WARRANTIES

The submission of a Bid shall constitute a warranty that: (i) Bidder has carefully and thoroughly reviewed the Bid Documents and has found them complete and free from ambiguities and sufficient to describe the Contract work; (ii) Bidder and all workmen and/or employees it intends to use in the performance of this Contract are skilled and experienced in the type of work or services called for by the Bid Documents; and (iii) neither the Bidder nor any of its employees, agents, suppliers or subcontractors have relied on any verbal representations from the College, or any of the College's employees, agents, or consultants, in preparing the Bid.

1.12 PAYMENT REMITTANCE

All College vendors are required to receive payment from the College via an Automated Clearing House (ACH) transfer. Instructions to register for ACH payments will be sent, upon request, to successful bidders. Failure to comply with the ACH requirements may result in termination of the contract or purchase order. College ACH transfers typically occur the third week of each month. Invoices must be received at least 3 weeks prior to each ACH payment release. You are strongly encouraged to set up your account upon notice of award to avoid a delay payment.

1.13 CASH BILLING DISCOUNTS

Cash billing or percentage discounts for payment will not be considered in evaluating Bids.

1.14 LOCAL BUSINESS PREFERENCE

When two (2) or more responsible bidders submit the same low bid, the contract award will be determined by drawing lots in a public meeting unless one bidder is a local bidder within the District boundaries and one is a non-local bidder, in which event the local bidder will be awarded the contract.

1.15 EQUAL EMPLOYMENT OPPORTUNITY

In the hiring of employees for the performance of work under the Contract and any subcontract thereunder, no Contractor or Subcontractor shall, by reason of race, color, sex, religion, national origin, ancestry, age, marital status, disability, unfavorable military discharge or sexual orientation discriminate against any citizen of the United States, in the employment of Labor or workers, who are qualified and available to perform work to which the employment is related. Neither shall any Contractor or Subcontractor, or any person on behalf of either, discriminate against or intimidate any employee hired for the performance of work under this Contract on account of race, color, sex, religion, national origin, ancestry, age, marital status, disability, unfavorable military discharge or sexual orientation.

1.16 TAX EXEMPTION

College of DuPage District #502 is exempt from Federal, State and Municipal taxes. Exemption certificates will be furnished upon request.

1.17 HOLD HARMLESS CLAUSE

The Respondent agrees to indemnify, hold harmless and defend College of DuPage, its agents, servants, and employees, and each of them against, and hold it and them harmless from, any and all lawsuits, claims, demands, liabilities, losses and expenses, including court costs and attorney's fees, for or on account of any injury to any person, or any death at any time resulting from such injury, or any damage to property, which may arise or which may be alleged to have arisen out of or in connection with the work covered by this contract.

1.18 INSURANCE

Insurance requirements for this project are described in Exhibit D**.**

1.19 PREVAILING WAGE ACT:

When applicable, and as a condition of receiving payment, Contractor must pay its employees prevailing wages in the locality in which the work is to be performed as establish for Public Works (construction and maintenance of a public work) prevailing wage and other requirements under Contract for Public Workers 820 ILCS 130/4. When required by the College Contractor shall provide a copy of the certified payroll on request. Contractor is responsible for contacting the Illinois Department of Labor to ensure understanding of prevailing wage requirements.

The prevailing rates of wages are determined by the Illinois Department of Labor and are available on the Department's official website: http://www.illinois.gov/idol/Laws- Rules/CONMED/Pages/prevailing-wage-rates.aspx. The College of DuPage has adopted the resolution regarding the prevailing wage rates for DuPage County in accordance with Illinois Prevailing Wage Act and are available the College's website: http://www.cod.edu/about/purchasing/illinois_prevailing_wage_act.aspx .

1.20 BUSINESS ENTERPRISE PROGRAM

The College of DuPage encourages the participation of qualified minorities, females, and persons with disabilities owned businesses in public contracts. It is the practice of the College to ensure full and equitable economic opportunities to persons and businesses that compete for business with the College of DuPage, including minorities, females, and persons with disabilities owned business enterprises The College is committed to the economic development of disadvantaged business enterprises and the award of contracts to businesses owned by minorities, females, and persons with disabilities for services to the extent provided by the Business Enterprise for Minorities, Females and Persons with Disabilities Act ("Act"), 30 ILCS 575.

END OF SECTION

2.0 INSTRUCTIONS TO BIDDERS

2.1 OUTSIDE DOCUMENT DISCLAIMER

The College of DuPage cannot warrant, represent, or guarantee the accuracy or completeness of documents which have not been obtained directly from the College. If you have obtained these documents from a third party source, the College is not responsible for any loss or damage including, but not limited to, time, money, or goodwill arising from errors, inaccuracies or omissions in any third party bid documents.

To obtain official documents, please visit: https://www.cod.edu/about/purchasing/requests/index.aspx . Click on the link for this project, and follow the prompts to enter your information onto our vendor list and download the original documents. This will ensure your contact information is registered on our vendor list, and we can send you any addenda that may be issued. This website is the only official website for prospective bidders to obtain digital copies of bid documents. It is the responsibility of each prospective bidder to verify the completeness of their printed bid documents before submitting a bid and accompanying executed addenda acknowledgement, and other required forms.

2.2 BLACKOUT PERIOD

Under no circumstances are respondents to contact or discuss this Invitation to Bid, or any of the information contained herein or about this project in general, with any College of DuPage trustee, employee, vendor, contractor or subcontractor, other than using the methods outlined in this bid. Respondents are strictly forbidden from visiting the College's locations or approaching any College trustee, employee, vendor, contractor or subcontractor for any information related to this Invitation to Bid or this project without the direct knowledge and authorization in writing in advance from the Purchasing Manager or Buyer. Violation of these provisions may subject the respondent to immediate disqualification.

Initial your understanding of this requirement_____

2.3 ERROR IN BID

Where a bidder claims to have made a mistake, such mistake must be called to the attention of the Purchasing Manager within twenty-four (24) hours after the opening of bids. Within forty-eight (48) hours of the bid opening, bidder shall submit to the College's designated contracting officer original documentary evidence and a detailed explanation of how the mistake was made. Failure to conform to this requirement precludes the bidder from withdrawing its bid based upon a bid mistake. If such notice, proof and explanations have been tendered, and the contracting officer is convinced that a bona fide mistake has been made, the contracting officer may recommend to the Board of Trustees that the bidder be allowed to withdraw its bid and recommend that the bid be awarded to the next lowest responsible, responsive bidder. If the Board determines by majority vote, that the bidder has made a bona fide error, no award will be made upon such bid and the bid security will be returned.

2.4 REQUESTS FOR INFORMATION/CLARIFICATION

If any firm submitting a bid for this project is in doubt as to the true meaning of the specifications or other documents or any part thereof, bidder shall request clarification from the Purchasing Department. Questions must be submitted in writing and be directed via email to the Purchasing Department at purchasing@cod.edu no later **than Friday, September 1, 2017 at 12:00 p.m. Central Time**. Questions for which answers are provided will be communicated to all registered recipients of bid documents via addendum. All issued addenda must be signed and returned to the College as per the instructions in the addenda or bid will not be accepted.

2.5 SUBMISSION OF BIDS

All Bidders shall submit:

One (1) ***sealed*** original copy of the Bid;
and one flash drive containing all completed documents

Bids must be in a sealed envelope and delivered to:

Purchasing Manager
ATTN: Bid No. 2018-B0012
College of DuPage
BIC Building - Room 1B03
425 Fawell Blvd.
Glen Ellyn, Illinois 60137

Bids must be received by the date and hour of the Bid Opening as shown in the legal advertisement. The sealed envelope submitted by the Bidder shall carry the following information on the face of the envelope: Bidder's name, address, Bid Notice Number, advertised date of Bid Opening and the hour designated for Bid Opening as shown in the legal advertisement. Unless otherwise stated, all blank spaces on the bid forms shall be fully completed. Bidder bears all responsibility for error or omissions in the submission of the Bid.

2.6 EXCEPTIONS

If any Respondent intends to take any deviations or exceptions from the Specifications or other bid Documents, Respondent shall submit to the Purchasing Manager/Buyer a written request for a deviation or exception at least 5 business days prior to the date and time of advertised bid opening date. If the Project Manager considers such deviation or exception acceptable, the Purchasing Manager/Buyer shall issue an Addendum setting forth such deviation or exception from the Specifications or other which shall be applicable to all Respondents submitting a response.

If no Addendum is issued by the Purchasing Manager/Buyer, then such deviation or exception shall be deemed rejected.

The College may reject any response containing deviations or exceptions not previously accepted through a written Addendum. A copy of such Addendum will be e-mailed or delivered to each Respondent receiving a set of such bid Documents. Respondent shall acknowledge receipt of each Addendum issued in the space provided on the bid form or via a signed addendum. Failure to acknowledge receipt of addenda may result in disqualification of the Bid. All written requests for deviations or exceptions shall be sent to purchasing@cod.edu.

Initial understanding of this requirement: _____

2.7 WITHDRAWAL OF BIDS

Bidders may withdraw their Bids at any time prior to the time specified in the legal advertisement as the date and hour set for the Bid Opening. However, no Bidder shall withdraw, cancel or modify its Bid response for a period of ninety (90) calendar days after said advertised Bid Opening.

2.8 NOTICES

All communications and notices between the College and Bidders regarding the Bid Documents shall be in writing and hand delivered or delivered via United States mail, postage prepaid, or via email. Notices to the Bidders shall be addressed to the name and address or email address provided by the Bidders; notices to the Purchasing Manager shall be addressed to Purchasing Department, College of DuPage, BIC Building - Room 1B03, 425 Fawell Blvd., Glen Ellyn, Illinois 60137, or purchasing@cod.edu.

2.9 BID DEPOSIT

When required in the legal notice, the Bid shall be accompanied by cashier's check, certified check or surety bond in the amount shown in the legal advertisement or as may be prescribed in these Bid Documents. A certified or cashier's check shall be drawn on a responsible bank doing business in the United States and shall be made payable to the order of the College of DuPage. The Surety issuing the bond must have a general rating of "A", and shall be a Class V or higher in the financial size category as defined by Best's Key Rating Guide - Property and Casualty. Failure to submit the bid deposit shall constitute an informal Bid and such Bid shall be rejected.

The Bidder hereby agrees that the bid deposit shall be forfeited to the College as liquidated damages and not as penalty in the event Bidder fails to comply with the terms of this invitation to bid, or otherwise fails or refuses to honor the Bid upon award of the Contract by the College.

The bid deposit of all bidders will be returned, with the exception of the winning Contractor, after the College has awarded the Contract. The bid deposit of the Contractor will be returned after the Contract has been awarded and the Contractor has submitted all insurance documentation and the Performance and Payment Bond, as required by the Bid Documents.

***This project requires a bid deposit in the amount of 10% of the total base bid.**

2.10 PERFORMANCE AND PAYMENT BOND

The successful Bidder shall furnish a Performance and Payment Bond in the full amount of the Contract. The Surety issuing the Performance and Payment Bond must have a general rating of "A" and shall be a Class V or higher in the financial size category as defined by Best's Key Rating Guide-Property and Casualty.

In the event that the Bidder fails to furnish the Performance and Payment Bond within fourteen (14) calendar days after service of the Notice of Award, the College may elect to retain Bidder's bid deposit as liquidated damages and not as a penalty and the Contract may be terminated. The parties agree that the sum of the bid deposit is a fair estimate of the amount of damages that the College will sustain due to the Bidder's failure to furnish the Performance and Payment Bond and the termination of the Contract.

END OF SECTION

3.0 SPECIFICATIONS

See Exhibit A, Exhibit B, and Exhibit C.

END OF SECTION

4.0 BID FORM

Bid Form for 2018-B0012 – Health and Science Center (HSC) Cadaver Lab Renovation Supplemental HVAC

FIRM NAME, CONTACT NAME and PHONE NUMBER

_____

_____

_____

The below prices include all stipulations and requirements of Addenda No(s). _____

Proposes to furnish all labor, materials, equipment and services as required to satisfactorily complete all work described here in as required for the construction and completion of the project where bid below.

Health and Science Center (HSC) Cadaver Lab Renovation Supplemental HVAC	
Base Bid	$

Submitted by: _____(printed)

Submitted by: _____(signed)

END OF SECTION

5.0 CERTIFICATIONS **Required**

IMPORTANT: All bidders are required to complete and sign this form. Completed form must be returned with bid no later than the advertised bid deadline. Failure to return this completed form may result in disqualification of bid.

THE UNDERSIGNED IS CAUTIONED TO CAREFULLY READ THESE CERTIFICATIONS PRIOR TO SIGNING THE SIGNATURE PAGE. SIGNING THE SIGNATURE PAGE SHALL CONSTITUTE A WARRANTY BY THE UNDERSIGNED THAT ALL THE STATEMENTS, CERTIFICATIONS AND INFORMATION SET FORTH WITHIN THESE CERTIFICATIONS ARE TRUE, COMPLETE AND CORRECT AS OF THE DATE THE SIGNATURE PAGE IS SIGNED. THE UNDERSIGNED IS NOTIFIED THAT IF THE COLLEGE LEARNS THAT ANY OF THE FOLLOWING CERTIFICATIONS WERE FALSELY MADE, THAT ANY CONTRACT ENTERED INTO WITH THE UNDERSIGNED SHALL BE SUBJECT TO TERMINATION.

A. Prevailing Wage Act. To the extent required by law, Contractor shall not pay less than the prevailing wage as established pursuant to an Act Regulating the Wages of Laborers, Mechanics, and Other Workman employed under Contract for Public Workers 820 ILCS 130/1 *et seq.* Our company certifies that it is eligible for bidding on public contracts and has complied with section 11a of the Prevailing Wage Act, 820 ILCS 130.01-12. **Yes**_____ **No** _____

B. Human Rights Act. To the extent required by law, Contractor shall abide by the Illinois Human Rights Act, 775 ILCS 10/0.01 *et seq.*

C. Drug Free Workplace. To the extent required by law, Contractor shall abide with the requirements of the Drug Free Workplace Act 30 ILCS 580.1 *et seq.*

D. Sexual Harassment Policy. Contractor represents by the signing of this agreement that it has a written sexual harassment policy that is in accordance with 775 ILCS 5/2-105 (A) (4).

E. Non-debarment. By executing this agreement Contractor certifies that it has not been debarred from public contracts in the State of Illinois for violating either 33E-3 or 33E-4 of the Public Contracts Act, 720 ILCS 5/33E-1 *et seq.*

F. Fair Employment Practice: Company is in compliance with all State and Federal laws regarding Fair Employment Practice as well as all rules and regulations**. Yes** _____ **No** _____

G. Our company has an Equal Employment Opportunity and Affirmative Action Program which complies with Executive Order 11246, the Vietnam Era Veterans' Readjustment Assistance Act of 1974, and the Rehabilitation Act of 1973.

Yes _____ **No** _____

H Our company certifies that it is eligible for bidding on public contracts and is not in violation of either paragraph 33E-3 or 33-E-4 of Public Act 86-150, 720ICLS 5 with regards to bid rigging/bid rotating. **Yes**_____ **No** _____

I When required by law, the bidder and all bidder's subcontractors must participate in applicable apprenticeship and training programs approved by and registered with the United States Department of Labor's Bureau of Apprenticeship and Training as required by Illinois Public Act 093-0642.

ADVICE

A. MINORITY/WOMAN-OWNED, DISADVANTAGED BUSINESS? YES_____ NO _____. If yes, please attach copy of certification and advise certification number and expiration date below:

Name of Certifying Entity: _____

Certification #: _____ Expiration Date: _____

B. STATE NEGOTIATED COOPERATIVE AGREEMENT: YES _____ NO _____ Contract No. _____

Signature

Respondent/Company Official: _____Date: _____

6.0 SIGNATURE PAGE **Required**

IMPORTANT: All bidders are required to complete and sign this form. Completed form must be returned with bid to purchasing@cod.edu no later than the advertised bid deadline. Failure to return this completed form may result in disqualification of bid.

Check One:

☐ **SOLE PROPRIETOR** ☐ **PARTNERSHIP** (and/or JOINT VENTURE) ☐ **LIMITED LIABILITY COMPANY**

☐ **CORPORATION**

The undersigned acknowledges receipt of a full set of Bid Documents and Addenda Numbers _____ (None unless indicated here). **All issued addenda must be signed and returned to the College as per the instructions in the addenda or bid will not be accepted.**

The undersigned makes the foregoing Bid subject to all of the terms and conditions of the Bid Documents. The undersigned certifies that all of the foregoing statements of the Vendor Certifications are true and correct. The undersigned warrants that all of the facts and information submitted by the undersigned in connection with this Bid are true and correct. Upon award and execution of this Contract by the College of DuPage Board of Trustees, the undersigned agrees that execution of this Bid shall stand as the undersigned's execution of this Contract.

BUSINESS NAME:_____

BUSINESS ADDRESS:_____

_____

BUSINESS TELEPHONE:_____ FAX NUMBER:_____

EMAIL ADDRESS:_____

CELLULAR TELEPHONE NUMBER:_____

FEIN/SSN:_____

AUTHORIZED SIGNATURE: _____

PRINT NAME: _____

TITLE: _____

DATE: _____

Subscribed to and sworn before me this

_____ Day of _____, 2016. My commission expires: _____

X_____ _____

Notary Public Signature Notary Seal

*** Attach hereto a partnership resolution or other document authorizing the individual signing this Signature Page to so sign on behalf of the Partnership.**

**** If the LLC is not registered in the State of Illinois, a copy of a current Certificate of Good Standing from the state of incorporation must be submitted with this Signature Page.**

***** Attach either a certified copy of the by-laws, articles, resolution or other authorization demonstrating such persons to sign the Signature Page on behalf of the LLC.**

***** If the corporation is not registered in the State of Illinois, a copy of the Certificate of Good Standing from the state of incorporation must be submitted with this Signature Page.**

******* In the event that this Signature Page is signed by any persons other than the President and Secretary, attach either a certified copy of the corporate by-laws, a resolution or other authorization by the corporation, authorizing such persons to sign the Signature Page on behalf of the corporation.**

7.0 CONFLICT OF INTEREST DISCLOSURE AND NON-COLLUSION FORM **Required**

IMPORTANT: All bidders are required to complete and sign this form. Completed form must be returned with bid no later than the advertised bid deadline. Failure to return this completed form may result in disqualification of bid.

BID #: _____ DATE: _____

CONFLICT OF INTEREST DISCLOSURE

College of DuPage (COD) reserves the right, at its sole discretion, to reject any and all bids, revise the submission timeline as described in the solicitation, and to discontinue at any time the submission process as described in the solicitation. College of DuPage is requiring that any and all relationships with the College, its Administrators, Trustees, Committee members, COD Foundation Trustees, or any other Employee of the College be disclosed in writing as a part of any bid submitted. Contact with any employee of the College of DuPage during the pre-award period, except as noted in the solicitation, is strictly forbidden and is considered sufficient grounds for dismissal from the Bid/RFP process.

VENDOR CONFLICT OF INTEREST DISCLOSURE

Define the relationship with any College of DuPage Administrator, Trustee, Employee, COD Foundation Board member, Committee member, or their immediate family member, with which your company or any of its owners, officers, Trustees, employees, or their immediate family, does business or is likely to do business with, or for which there is an opportunity to influence a related College decision; include the name and relationship to any immediate family member.

_____
_____
_____
_____

☐ Vendor certifies that there is no known conflict of interest with any COD Administrator, Employee, Trustee, Committee member, or COD Foundation Trustee, or their immediate family.

Vendor Printed Name: _____Title: _____

Signature: _____ Date: _____

NON-COLLUSION STATEMENT

The undersigned affirms that he/she is duly authorized to execute this contract and that this company, corporation, firm, partnership or individual has not prepared this bid in collusion with any other bidder, and that the contents of this bid as to prices, terms or conditions of said bid have not been Communicated by the undersigned nor by any employee or agent to any other person engaged in this type of business prior to the official opening of this bid.

Company Name: _____ Owners/Principal(s) Name(s)/Title(s): _____
_____

Vendor Address: _____ City, State, Zip: _____
Phone Number: _____ Fax Number: _____
Email Address: _____

Signature
Bidder/Company Official: _____Date: _____

EXHIBIT A - Scope of Work

A. GENERAL

1. This project is located on the second floor of the HSC, primarily in the “Prep Area 2316”, immediately adjacent to prep area door 2320D leading from Advanced AP Lab HSC 2320 into the Prep Area.

2. This project includes selective demolition and rebuilding as noted on the drawings and specs. Proper disposal of all waste materials and associated dumpsters is included in this bid.

3. This project excludes relocation of existing furniture, supplies, etc., but does include coordination of new electrical receptacles to serve the relocation of existing refrigerators that currently occupy the project work area.

4. Generally, the Board is anticipated to approve the bids for this work at its regular September 2017 Board Meeting. The work is scheduled to begin as soon after the September Board meeting as possible, and be completed during or before December 2017.

5. This work is permitted by DuPage County, and successful bidder, and appropriate subcontractors, will need to be registered with the County before the work begins. All registration costs are to be included in the bid.

6. This project must be performed in compliance with the Illinois Prevailing Wage Act and requires all employers to pay prevailing wage. The successful bidder will provide company contact information for itself and all subcontractors prior the commence of work and as a precondition to release of final payment in order for the College to comply with state survey information requirements.

7. Certified payrolls for each employee or subcontracted employee who has worked on the College campus are required to accompany all pay applications and will be required for releasing payments to contractors.

8. This contractor shall maintain service to College facilities as College will be fully operational during the construction duration. Work will be performed during normal business hours.

9. Access to the HSC Loading Dock must be coordinated with the COD Facilities Dept. All deliveries, loading and unloading are the responsibility of the contractor. If College elevator is to be used for project loading/unloading, protection must be provided by the contractor.

10. College of DuPage is a Non-Smoking campus. Smoking is not allowed within or adjacent to any College facility. Contact COD Senior Project Manager for campus regulations.

11. Provide a utility locate for any excavation to be performed on COD property.

12. Provide programming updates and graphics updates for all additions or alteration to COD smoke alarms, VAV boxes and fire alarms, as required to updated COD master control/monitoring station. All updates to be performed by Honeywell, COD approved vendor.

B. DEMOLITION

1. Capping or removal of any services is the responsibility of the trade having jurisdiction.

2. Maintain safe access for all College students, faculty and staff at all times.

3. Remove all waste materials from the site and dispose of properly. The work area and site shall be kept neat and orderly at all times.

4. Remove existing landscaping as required to provide proper clearances for new HVAC equipment. All landscape removal to be coordinated with COD Buildings & Grounds department.

C. CONCRETE

1. Protect all access routes, corridors, finishes, etc. during all concrete operations for equipment pads, including transporting concrete into and within the building, finishing, clean-up, etc.

2. Concrete truck wash-out shall not be performed on site unless a wash-out disposal container is used and removed from site at conclusion of wash-out operations. Wash-out materials shall not be deposited on site, grounds or in COD dumpsters. If wash-out materials are discovered an any of the aforementioned locations, that contractor will be back-charged by COD for removal of materials.

D. FINISHES

1. The contractor is responsible for all acoustic tile systems and finishes and replacement of all ceiling systems and finishes required as a result of the work. All ceiling systems shall match existing unless specifically noted otherwise.

2. Repair any spray fireproofing damaged during the work of this contract.

3. Cut ceiling tiles as necessary to accommodate sprinkler heads and other devices as necessary.

4. Protect existing casework during construction.

E. PLUMBING

1. Verify existing conditions and confirm routing for all new and relocated piping to avoid all conflicts.

2. Coordinate work with other trades to avoid conflicts.

3. Provide fire code approved fire safe sealant or materials around all penetrations through fire walls or rated partitions.

4. Furnish and install access panels for all valves scheduled to be covered by other construction.

5. Install all valves for convenient access by service personnel.

6. Provide all necessary coring, holes, access locations, sealant, etc.

7. Provide pipe labels to match existing.

F. SPRINKLERS

1. New sprinkler heads shall be code worthy and shall match the style of other nearby heads in the same room or space unless specifically noted otherwise.

2. New heads shall be located as shown on drawings. Relocated heads shall be located as shown on drawings and shall be centered in ceiling tiles unless specifically noted as otherwise to provide proper coverage.

3. Coordinate work with other trades to avoid conflicts.

G. HVAC

1. Verify existing conditions and confirm routing for all new and relocated piping to avoid all conflicts.

2. Code compliance; include all accessories, etc. whether or not shown as required to comply with local codes.

3. Coordinate work with other trades to avoid conflicts.

4. Provide all necessary coring, holes, access locations, sealant, etc.

5. Provide fire code approved fire safe sealant or materials around all penetrations through fire walls or rated partitions.

6. Provide all necessary duct mounted smoke detectors and sensors.

7. Install valves for convenient access by service personnel.

8. Provide testing and balancing of completed systems.

9. Provide for expansion, etc. as required by good practice whether or not shown on drawings.

10. Controls: provide all controls, wiring and testing as necessary to confirm proper and optimal operation. Confirm sequence of operations with design engineers.

11. Provide system training to COD Engineering staff.

12. Confirm access for loading equipment into building and work site. All work shall fit through existing openings, doors, hallways, elevators, etc.

13. Provide clean filters for all systems upon turn-over to owner.

H. ELECTRICAL

1. Verify existing conditions and confirm routing for all new and relocated piping to avoid all conflicts.

2. Coordinate work with other trades to avoid conflicts.

3. Provide all necessary coring, holes, access locations, sealant, etc.

4. Provide fire code approved fire safe sealant or materials around all penetrations through fire walls or rated partitions.

5. Provide colored conduits in compliance with COD design standards.
    a. Power = Blue
    b. Lighting = Yellow
    c. Emergency circuits = Orange
    d. Fire Alarm = Red
    e. Low voltage = Green

6. Furnish and install disconnects for HVAC equipment.

EXHIBIT B - Drawing - HSC Cadaver Lab Renovation, Phase II Supplemental Cooling

COLLEGE OF DUPAGE

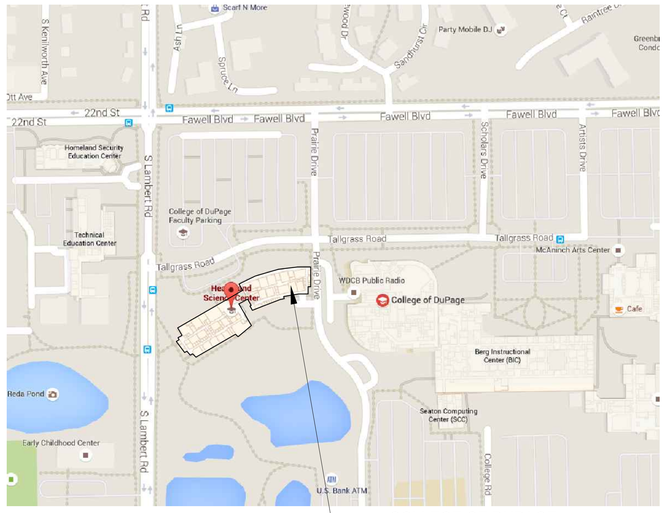
CADAVER LAB- PHASE 2,SUPPLEMENTAL COOLING

425 FAWELL BLVD.
GLEN ELLYN, IL 60137

ISSUE FOR BID

JULY 20, 2017

LOCATION MAP



COLLEGE OF DUPAGE
CADAVER LAB RENOVATION
425 FAWELL BLVD,
GLEN ELLYN, IL 60137

DRAWING INDEX

1 **SECOND FLOOR OVERALL FLOOR PLAN**

0 16' 32' 64'
SCALE: 1/32" = 1'-0"

bailey edward

t 312.440.2300
f 312.440.2303
www.baileyedward.com

35 East Wacker Dr
Suite 2800
Chicago, IL
60601-2308

Owner
College of DuPage
425 Fawell Blvd.
Glen Ellyn, IL 60137

Issue Date	Title
06/26/2017	ISSUE FOR PERMIT
07/20/2017	ISSUE FOR BID

COLLEGE OF DUPAGE
CADAVER LAB
PHASE 2

Drawing Title

COVER SHEET

BE Project No. 15044-15-03

Drawn By: PK

Drawing No. G000

FINISH SCHEDULE

ROOM #	ROOM NAME	FLOORING	WALLS				WALL BASE	CEILING		REMARKS
			N	E	S	W		MAT./FINISH	HEIGHT	
2316 D	MECH. CLOSET	CS-1	LPT-1	LPT-1	LPT-1	LPT-1	RB-1	EXC	EXIST.	
2316	PREP AREA	- -	- -	LPT-1	LPT-1	LP-1	RB-1	- -	- -	

DOOR SCHEDULE

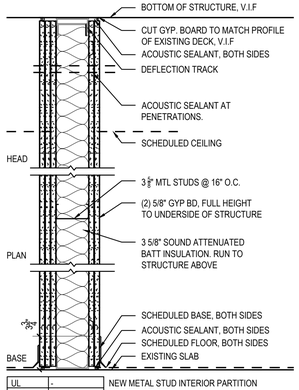
DOOR NO.	ROOM NO.	ROOM NAME	DOOR						FRAME				HARDWARE GROUP	REMARKS
			WIDTH	HEIGHT	THICKNESS	MATERIAL	FINISH	TYPE	RATING	MATERIAL	FINISH	TYPE		
2316-A	2316-D	MECH. CLOSET	3'-0"	7'-0"	1-3/4"	HM	LPT-1	A	-	HM	LPT-2	A	-	-
2316-B	2316-D	MECH. CLOSET	(2) 3'-0"	7'-0"	1-3/4"	HM	LPT-1	B	-	HM	LPT-2	A	-	-

FINISH MATERIAL LEGEND

MATERIAL TYPE/ CODE	MATERIAL DESRIPTION	MANUFACTURER MODEL, SIZE AND COLOR	LOCATION	REMARKS
CS-1	SEALER	LOW V.O.C ACRYLIC CONCRETE	MECH. CLOSET	_
EXC	EXPOSED CONSTRUCTION	_	_	_
RB-1	RESILIENT BASE	JOHNSONITE, MATCH EXISTING	MECH. CLOSET	_
LPT-1	LATEX PAINT	MATCH EXISTING COLOR - SEE SPECS	MECH. CLOSET	1
LPT-2	LATEX PAINT	MATCH EXISTING COLOR - SEE SPECS	MECH. CLOSET , DOOR FRAMES	2

FINISH MATERIAL LEGEND NOTES & REMARKS

GENERAL	ALL WALL FINISHES SHALL BE CLASS 'A' FLAM SPREAD INDEX LESS THAN OR EQUAL TO 25. SMOKE DEVELOPED LESS THAN OR EQUAL TO 450.
GENERAL	ALL FLOOR FINISHES SHALL BE RATED FOR RADIANT FLUX OF CLASS I, 0.45 WATT S/CM SQUARED.
1	PROVIDE SAMPLES OF FINISH MATERIALS AND PAINT DRAW-DOWN SAMPLES DEMONSTRATING A MATCH TO EXISTING FOR THE OWNER'S REVIEW PRIOR TO PROCURMENT.
2	MATCH EXISTING DOOR FRAME COLOR AND SHEEN

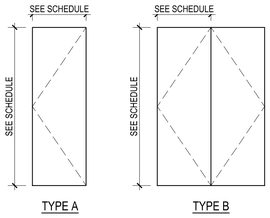


UL	-
STC	61
R-VALUE	-

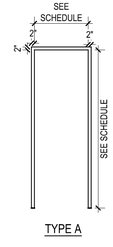
NEW METAL STUD INTERIOR PARTITION TO STRUCTURE

WALL TYPE	STUD TYPE	STUD GAUGE	WALL WIDTH	FIRE RATING	NOTES
P1	3-5/8"	25	6-3/4"	N/A	

P1 PARTITION WALL
1 1/2" = 1'-0"

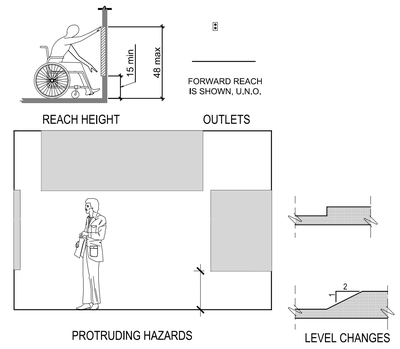


DOOR TYPE
NTS

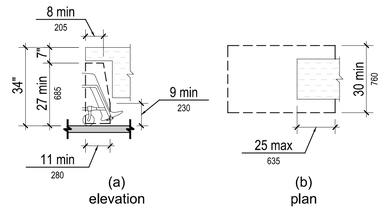


DOOR FRAME TYPE
NTS

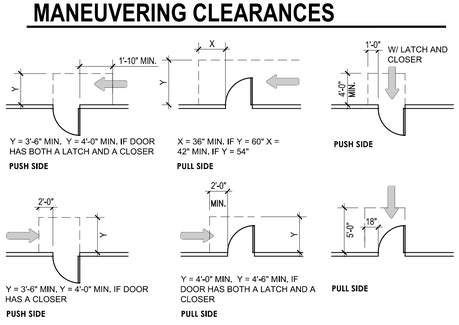
STANDARD MOUNTING HEIGHTS

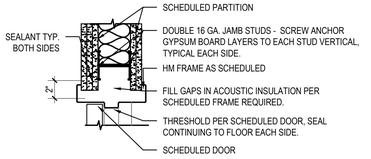


STANDARD MOUNTING HEIGHTS

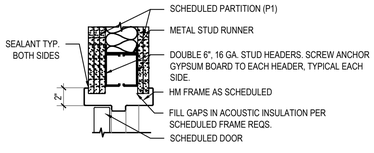


MANEUVERING CLEARANCES





DOOR JAMB DETAIL
NTS



DOOR HEAD DETAIL
NTS

CODE INFORMATION

AUTHORITY HAVING JURISDICTION:
THE COUNTY OF DUPAGE
421 N. COUNTY FARM ROAD,
WHEATON, IL 60187
630-407-6500

APPLICABLE CODES:

MUNICPAL CODE, BUILDING CODE REQUIREMENTS FOR DUPAGE COUNTY, ILLINOIS

- **2015 INTERNATIONAL BUILDING CODE (IBC) W/AMENDMENTS**
- **2014 NATIONAL ELECTRICAL CODES (NEC) W/AMENDMENTS**
- **2015 INTERNATIONAL ENERGY CONSERVATION CODE (IECC)**
- **2015 INTERNATIONAL MECHANICAL CODE (IMC) W/AMENDMENTS**

*** ALL INTERIOR FINISH MATERIALS TO BE CLASS A FRAME SPREAD RATING (0-25) PER LIFE SAFETY CODE NFPA 101 AND SECTION 803.1 OF THE INTERNATIONAL BUILDING CODE**

***ALL INTERIOR FINISH MATERIALS TO BE CLASS 1 PER NFPA 260/UFAC FABRIC CLASSIFICATION AND CLASS 1 OR A ASTM E34**

EXISTING BUILDING:
- 3 - STORIES
- APPROXIMATELY 200,000 SQFT
- STRUCTURE STEEL SPRAY FIREPROOFED
- CONSTRUCTION TYPE: IB, FULLY SPRINKLERED
- USE GROUP: BUSINESS GROUP 'B', EDUCATIONAL COLLEGE
- OCCUPANT LOAD : ACCESSORY STORAGE AREAS, MECHANICAL EXUIPMENT ROOMS: 300 PP/SF.
  MECH.CLOSET 2316D: 5SSF/ 300SF /PP = .2 PP; ASSUME 1PP.
  1 EXIT DOORS REQ'D: 3 - EXIT DOORS PROVIDED
  NEW IS O.K.
- FIRE RATED ASSEMBLIES (TYPE I)
  PRIMARY STRUCTURAL FRAME: 2- HOURS
  NON-BEARING WALLS: NO EXISTING FIRE RATION
  PARTITION IN THE AREA OF RENOVATION, NONE REQUIRED

FIRE RESISTANCE RATINGS, TYPE IB :
- STRUCTURAL FRAME: 2 HOURS (EXISTING)
- NON-BEARING WALLS(INTERIOR): 0 HOURS- NONE (EXISTING)
- FLOOR CONSTRUCTION: 2-HOURS (EXISTING)

ACCESSIBILITY:

ADA STANDARDS FOR ACCESSIBLE DESIGN, DEPARTMENT OF JUSTICE - ISSUED SEPTEMBER 15,2010 TITLE II/28 CFR 35.151

ADAAG 36CFR, 2004 WITH APPENDICES B AND D ICC/ANSI A117.1-2003

ICC/ANSI A 117.1 ACCESSIBLE AND USABLE BUILDING AND FACILITIES

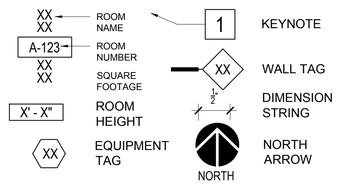
ILLINOIS ACCESSIBILITY CODE (IAC) 1997

ILLINOIS ENVIRONMENTAL BARRIERS ACT - IEBA

ABBREVIATIONS

A		MTL	METAL
ACT	ACOUSTICAL CEILING TILE	N	
AFF	ABOVE FINISHED FLOOR	NIC	NOT IN CONTRACT
ALUM	ALUMINUM	NO	NUMBER
C		NOM	NOMINAL
CJ	CONTROL JOINT	O	
CLG	CEILING	OC	ON CENTER
CLR	CLEAR	OFCI	OWNER FURNISHED CONTRACTOR INSTALLED
CMU	CONCRETE MASONRY UNIT	OFOI	OWNER FURNISHED OWNER INSTALLED
COL	COLUMN	OH	OPPOSITE HAND
CONC	CONCRETE	OZ	OUNCE
CONT	CONTINUOUS	P	
D		PLUMB	PLUMBING
DBL	DOUBLE	PNT	PAINT/PAINTED
DEMO	DEMOLISH	PSI	POUNDS PER SQUARE INCH
DIA	DIAMETER	PVC	POLYVINYL CHLORIDE
DIMS	DIMENSIONS	R	
DN	DOWN	R	RADIUS
DWG	DRAWING	RBR	RUBBER
E		RCP	REFLECTED CEILING PLAN
EA	EACH	REINF	REINFORCED
EL	ELEVATION	REQD	REQUIRED
ELEC	ELECTRICAL	RM	ROOM
EQ	EQUAL	S	
EXIST	EXISTING	SF	SQUARE FOOT
EXT	EXTERIOR	SIM	SIMILIAR
F		SPEC	SPECIFIED OR SPECIFICATION
FD	FLOOR DRAIN	SPK	SPRINKLER
FFE	FINISHED FLOOR ELEVATION	SQ	SQUARE
FIN	FINISH	SS	STAINLESS STEEL
FLR	FLOOR	STC	SOUND TRANSMISSION COEFFICIENT
FO	FACE OF	STL	STEEL
G		STRUCT	STRUCTURAL
GA	GAUGE	T	
GALV	GALVANIZED	T/D	TELEPHONE/DATA
GWB	GYPSUM WALL BOARD	TELE	TELEPHONE
H		TO	TOP OF
HC	HOLLOW CORE	TYP	TYPICAL
HM	HOLLOW METAL	U	
HVAC	HEATING, VENTILATING, AND AIR CONDITIONING	VIF	VERIFY IN FIELD
I			
INT	INTERIOR		
M			
MAX	MAXIMUM		

SYMBOLS



GENERAL PROJECT NOTES

1. THESE DRAWINGS INDICATE THE GENERAL SCOPE OF THE PROJECT IN TERMS OF THE ARCHITECTURAL DESIGN CONCEPT, DIMENSIONS, MAJOR ELEMENTS AND MATERIALS. THESE DRAWINGS DO NOT NECESSARILY INDICATE OR DESCRIBE ALL WORK REQUIRED FOR THE FULL COMPLETION OF THE PROJECT. ALL CONTRACTORS SHALL FURNISH ALL OF THOSE ITEMS AND LABOR REQUIRED FOR THE FULL COMPLETION OF THIS PROJECT IN A FIRST CLASS WORKMANSHIP-LIKE MANNER.
2. ALL WORK IS TO BE PERFORMED FROM FINAL CONSTRUCTION DOCUMENTS ONLY AND A COPY OF THE APPROVED FINAL SET MUST BE LOCATED ON THE SITE AT ALL TIMES. ALL CONTRACTOR'S SUBCONTRACTORS SHALL BE GIVEN FULL SETS OF FINAL CONSTRUCTION DOCUMENTS WITH NO SHEETS EXCLUDED.
3. DO NOT SCALE DRAWINGS. WRITTEN DIMENSIONS HOLD PRIORITY OVER APPARENT SCALE. ANY DISCREPANCIES SHOULD BE BROUGHT TO THE ATTENTION OF THE ARCHITECT IN WRITING.
4. EXISTING CONDITIONS AND DIMENSIONS SHOWN ON THE DRAWINGS HAVE BEEN COMPILED BY THE ARCHITECT FROM EXISTING DRAWINGS PROVIDED BY THE OWNER AND FIELD MEASURING AND SHALL BE USED BY THE CONTRACTOR ONLY AS A GUIDE. ALL CONTRACTORS SHALL BE RESPONSIBLE FOR FIELD VERIFICATION OF ALL DIMENSIONS AND CONDITIONS AND SHALL REPORT ANY DISCREPANCIES IN THE SITE CONDITIONS OR THE DOCUMENTS TO THE ARCHITECT IN WRITING.
5. CONTRACTORS SHALL BE HELD RESPONSIBLE FOR THE ADHERENCE AND COMPLIANCE TO ALL APPLICABLE CITY, STATE AND NATIONAL CODES, ORDINANCES, AND ACCESSIBILITY REQUIREMENTS, INCLUDING BUT NOT LIMITED TO THOSE OF THE STATE ADA. ANY DISCREPANCIES SHOULD BE BROUGHT TO THE ATTENTION OF THE ARCHITECT IN WRITING.
6. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE COORDINATION OF ALL UTILITIES AFFECTED BY PROJECT.
7. THE CONTRACTOR SHALL VERIFY ALL PARTITION LAYOUTS WITH ARCHITECT BEFORE CONSTRUCTION.
8. THE PROJECT SHALL BE ENTIRELY CLEANED BY THE GENERAL CONTRACTOR BEFORE OWNER OCCUPATION INCLUDING ALL WINDOW GLASS, MIRRORS, FLOORS, WALL TILES AND ELECTRICAL PLATES.
9. THE WORK AREAS SHALL BE KEPT IN BROOM-SWEPT FINISH CONDITION. ALL CONTRACTORS AND SUBCONTRACTORS SHALL BE RESPONSIBLE FOR CLEANING UP AND DISPOSING OF THEIR LITTER AND LEFT OVER MATERIALS ON A REGULAR BASIS AND BE RESPONSIBLE FOR LEAVING THE PROJECT IN A BROOMSWEPT FINISH CONDITIONS UPON COMPLETION OF THEIR PORTION OF THE PROJECT.
10. THE ELECTRICAL AND HVAC CONTRACTORS SHALL VERIFY ALL UTILITY CHASES AND EQUIPMENT LOCATION AND REPORT ANY DISCREPANCIES OR CONFLICTS TO THE OWNER PRIOR TO SUBMITTING HIS / HER BID. UNLESS THE OWNER AND THE ARCHITECT ARE NOTIFIED IN WRITING OF THE CONFLICTS OR ADDITIONAL SPACE REQUIREMENTS BEFORE THE START OF CONSTRUCTION, ALL CORRECTIVE MEASURES WILL BE MADE BY THE CONTRACTORS AT NO ADDITIONAL COST TO THE OWNER.
11. THE OWNER'S WRITTEN AUTHORIZATION MUST BE OBTAINED PRIOR TO THE ORDERING OF ANY MATERIAL, AWARDING OF ANY CONTRACTS OR THE EXECUTION OF ANY WORK WHICH INVOLVES EXTRA COST.
12. THE OWNER HAS NOT IDENTIFIED ASBESTOS CONTAINING MATERIALS ARE PRESENT ON-SITE. NOTIFY THE OWNER IMMEDIATE IF ANY OTHER HAZARDOUS MATERIALS ARE IDENTIFIED. DO NOT PROCEED WITH THE WORK UNTIL THE HAZARDOUS MATERIALS HAVE BEEN REMOVED.
13. REFER TO DRAWINGS OF OTHER DISCIPLINES FOR ADDITIONAL INFORMATION AND COORDINATION OF WORK. INCLUDING M/E/P/FP AND A/V DRAWINGS.
14. DETAILS SHOWN ARE INDICATIVE OF THE CHARACTER, PROFILES, MATERIALS AND SYSTEMS REQUIRED FOR THE WORK INCLUDING THOSE CONDITIONS NOT COVERED BY SPECIFIC DETAILS.
15. WHERE THE DESIGN INTENT CANNOT BE DETERMINED FROM THE DRAWINGS OR SPECIFICATIONS. CONSULT THE ARCHITECT BEFORE PROCEEDING WITH THE WORK.
16. DIMENSIONS SHALL GOVERN. DO NOT SCALE DRAWINGS. WHERE THERE APPEARS TO BE A CONFLICT BETWEEN DIMENSIONS OR WHERE DIMENSIONS CANNOT BE DETERMINED FROM THE DRAWINGS, CONSULT THE ARCHITECT BEFORE PROCEEDING WITH THE WORK.
17. NO WOOD OR WOOD COMPOSITE PRODUCTS ARE ACCEPTABLE, U.N.O.

ARCHITECTURAL PROJECT NOTES

1. THE FOLLOWING GENERAL NOTES APPLY TO ALL ARCHITECTURAL DRAWINGS
2. THE ARCHITECTURAL DRAWINGS ARE PART OF A LARGER SET OF DRAWINGS WHICH, WHEN COMPLETE, CONSIST OF SPECIFICATIONS AND ALL DRAWINGS LISTED BY THE INDEX OF DRAWINGS. THE WORK DESCRIBED BY THE DRAWINGS OF ANY ONE DISCIPLINE MAY BE AFFECTED BY THE WORK DESCRIBED ON DRAWINGS OF ANOTHER DISCIPLINE AND MAY REQUIRE REFERENCE TO DRAWINGS OF ANOTHER DISCIPLINE. PARTIAL SETS OF DRAWINGS OR DRAWINGS WITHOUT SPECIFICATIONS ARE INCOMPLETE AND SHALL NOT BE DISTRIBUTED AND UTILIZED.
3. THE ARCHITECTURAL FLOOR PLANS AND REFLECTED CEILING PLANS SHOW THE EXACT LOCATION OF MANY – BUT NOT ALL – EXPOSED PARTS OF THE WORK. FOR ITEMS NOT LOCATED EXACTLY, APPLY THE RULES INDICATED BY G001 FOR TYPICAL RULES FOR DETERMINING MOUNTING HEIGHTS AND LOCATIONS TO DETERMINE THE EXACT LOCATION OF EACH EXPOSED PART OF THE WORK.
4. DESIGN REFERENCE ELEVATION +0'-0" AS SHOWN ON THE ARCHITECTURAL DRAWINGS CORRESPONDS TO THE FINISH FLOOR ELEVATION OF THE FLOOR ILLUSTRATED.
5. FOR GENERAL NOTES AND SYMBOLS APPLICABLE ONLY TO THE DRAWINGS OF DISCIPLINES OTHER THAN ARCHITECTURE, REFER TO THE SPECIFIC DRAWINGS OF THAT DISCIPLINE.
6. THE CONTRACTOR IS RESPONSIBLE FOR COORDINATING THE WORK OF ALL SUBCONTRACTORS, TRADES, AND SUPPLIERS. THE CONTRACTOR SHALL ENDEAVOR TO IDENTIFY AND NOTIFY THE OWNER OF ANY CONFLICTS BETWEEN THE WORK OF DIFFERENT PARTIES AT THE EARLIEST POSSIBLE DATE SO AS TO ALLOW REASONABLE AND ADEQUATE TIME FOR THE CONFLICT TO BE RESOLVED WITHOUT DELAYING THE WORK. ALL DEVIATIONS FROM THAT WHICH IS REQUIRED BY THE CONTRACT DOCUMENTS MUST BE APPROVED IN ADVANCE BY THE OWNER.

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t 312.440.2300
f 312.440.2303
www.baileyedward.com

35 East Wacker Dr
Suite 2800
Chicago, IL
60601-2308

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College of DuPage
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Issue Date	Title
06/26/2017	ISSUE FOR PERMIT
07/20/2017	ISSUE FOR BID

COLLEGE OF DUPAGE
CADAVER LAB
PHASE 2

Drawing Title

GENERAL NOTES, ABBREVIATIONS, SYMBOLS AND SCHEDULES

BE Project No. 15044-15-03

Drawn By: PK

Drawing No. G001

GENERAL DEMOLTION NOTES

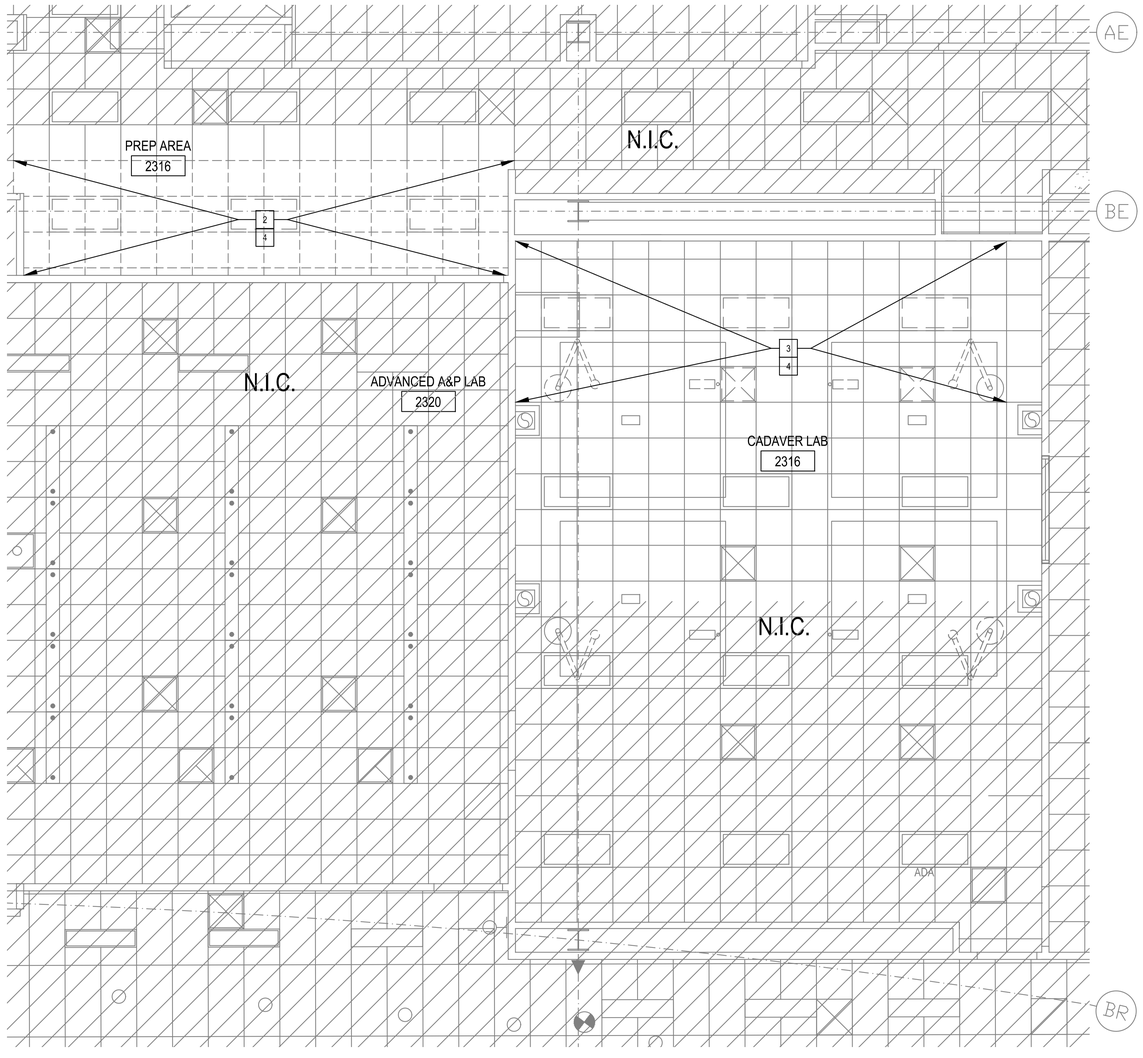
1. CONTRACTOR SHALL VISIT THE SITE AND BECOME FAMILIAR WITH THE EXISTING CONDITIONS PRIOR TO COMMENCING THE WORK.
2. CONTRACTOR SHALL NOTIFY THE ARCHITECT OF ANY AND ALL DISCREPANCIES BETWEEN THE DEMOLITION DRAWINGS AND ACTUAL CONDITIONS PRIOR TO PROCEEDING WITH THE WORK.
3. THE OWNER HAS NOT IDENTIFIED HAZARDOUS MATERIALS IN THE EXISTING SPACES. CONTRACTOR TO NOTIFY THE ARCHITECT IMMEDIATELY IF HAZARDOUS MATERIALS ARE IDENTIFIED. DO NOT PROCEED WITH THE WORK UNTIL THE HAZARDOUS MATERIALS HAVE BEEN REMOVED.
4. REFER TO MEP AND FP DEMOLITION AND NEW WORK DRAWINGS FOR ADDITIONAL REQUIREMENTS.
5. PROVIDE PROTECTION AGAINST MOISTURE, IMPACT, AND OTHER TYPES OF DAMAGE AT ALL OPENINGS CREATED BY SELECTIVE DEMOLITION. PROTECT EXISTING CONSTRUCTION FROM DAMAGE DURING THE DEMOLITION AND NEW CONSTRUCTION WORK. REPAIR OR REPLACE AS REQUIRED EXISTING CONSTRUCTION DAMAGED AT NO COST TO THE OWNER.
6. ALL PENETRATIONS OF EXISTING PARTITIONS SHALL BE PATCHED AND REPAIRED AS REQUIRED TO MAINTAIN THE EXISTING INTEGRITY OF THE WALL. ALL SLEEVES, WIREWAYS, CABLE TRAYS, PIPES, DUCTWORK, ETC. SHALL BE SEALED TIGHT TO THE WALL PENETRATIONS.
7. EXISTING FLOOR PENETRATIONS, WHERE PIPING, DUCTWORK, CONDUIT OR OTHER ITEMS HAVE BEEN REMOVED DURING REMOVAL ARE TO BE FILLED WITH CONCRETE TO MATCH THE EXISTING SURROUNDING FLOOR AND REQUIRED FIRE RATINGS.
8. CONTRACTOR TO PROVIDE ALL REQUIRED OPENINGS IN EXISTING WALLS AND FLOORS FOR PENETRATION OF MECHANICAL, PLUMBING, FIRE PROTECTION, COMMUNICATIONS, AND ALL OTHER REQUIRED BUILDINGS SYSTEMS. MAINTAIN EXISTING SMOKE AND FIRE RATINGS AS REQUIRED.
9. PROTECT EXISTING INTERIOR WALLS DURING REMOVAL AND CONSTRUCTION. PROVIDE TEMPORARY PROTECTION FROM DUST, NOISE, DAMAGE, ETC. AND CONSTRUCTION BARRIERS AND OTHER SITE PROTECTION REQUIREMENTS CONSISTENT WITH THE SPECIFICATIONS SECTION, AND DIVISION 1, GENERAL REQUIREMENTS.
10. REFER TO THE PROJECT MANUAL, SPECIFICATIONS DIVISION 1, AND GENERAL REQUIREMENTS, FOR RELATED PROJECT, DEMOLITION, CONSTRUCTION AND PROTECTION REQUIREMENTS.
11. PLANS ARE DIAGRAMMATIC AND PROVIDED TO SHOW INTENT ONLY, UNLESS SPECIFICALLY NOTED. V.I.F.
12. SALVAGED MATERIALS INDICATED ARE PROPERTY OF THE OWNER, TEMPORARILY STORE MATERIALS ON THE SITE AS DIRECTED BY THE OWNER. PROVIDE ALL NECESSARY PROTECTION AGAINST MOISTURE, IMPACT, AND ANY OTHER TYPE OF POTENTIAL DAMAGE.
13. CONTRACTOR SHALL OBTAIN ALL NECESSARY PERMITS, WORK ORDERS REQUIRED AND SHALL NOTIFY ALL UTILITIES HAVING SERVICE CONNECTIONS WITHIN THE SITE.
14. CONTRACTOR SHALL REMOVE REMOVE ALL TRASH AND DEBRIS DAILY. DEMOLITION WORK SHALL REMAIN SAFE AND CLEAN FOR THE BUILDING'S OCCUPANTS AND CONSTRUCTION WORKERS. OCCUPIED AREAS ADJACENT TO THE PROJECT WORK AREAS SHALL BE KEPT CLEAN AT ALL TIMES DURING THE WORK.
15. ROOM LAYOUTS AND CONFIGURATIONS AND FOR AREAS OUTSIDE OF THE CURRENT PHASE OF WORK ARE SHOWN FOR REFERENCE ONLY. VERIFY EXISTING CONSTRUCTION AS REQUIRED.
16. IN AREA OF REMOVAL AND WHERE NEW FINISHES ARE NOT SCHEDULED, CONTRACTOR SHALL REPAIR WALLS, FLOORS, WALL BASES, AND CEILING AS REQUIRED TO MATCH EXISTING FINISHES TO BE FLUSH, SMOOTH, AND MATCH ADJACENT MATERIALS IN ALL RESPECTS.
17. THE CONTRACTOR SHALL PROVIDE TEMPORARY PROTECTION, SUPPORT, BRACING SEALING AND CAPPING OF EXISTING PARTITIONS, CEILINGS, PIPES, DUCTS, CONDUITS, ETC. SHOWN TO BE PARTIALLY DEMOLISHED IN THIS PHASE OF WORK. THE TEMPORARY WORK SHALL KEEP THE PARTIALLY DEMOLISHED WORK STABILIZED. WHERE EXISTING CONSTRUCTION IS SHOWN TO BE PARTIALLY DEMOLISHED IN THIS PHASE OF WORK, EXTEND DEMOLITION A MINIMAL DISTANCE AS REQUIRED TO INSTALL NEW WORK INDICATED.
18. PREPARE ALL EXISTING SURFACES TO REMAIN. PROVIDE CLEAN SMOOTH SURFACES TO RECEIVE SCHEDULED FINISHES. LEVEL FLOOR SLAB SURFACES AS REQUIRED TO PROVIDE A FLAT, LEVEL SURFACE FOR FLOORING INSTALLATIONS. REFERENCE THE FINISH SCHEDULE SHEET AND THE FINISH PLANS SHEETS FOR RELATED REQUIREMENTS.
19. WHERE EXISTING PARTITIONS ARE REMOVED FOR NEW OPENINGS AND WHERE EXISTING OPENINGS ARE ENLARGED, PATCH AND FINISH NEW OPENINGS AS REQUIRED TO MATCH EXISTING PARTITIONS.
20. CLEAN AND PREPARE FOR NEW FINISHES EXISTING SURFACES INDICATED TO REMAIN. COORDINATE WITH THE FACILITY REMOVAL AND DISPOSAL OF UNWANTED SIGNAGE, FIXTURES, HARDWARE, ETC. ON EXISTING SURFACES TO MATCH EXISTING SUBSTRATES AND PROVIDE AN ADDITIONAL PRIME PAINTED COATING ON ALL REPAIRS PRIOR TO REFINISHING AS SCHEDULED. COORDINATE WITH THE REQUIREMENT OF THE FINISH SCHEDULE.
21. SURVEY AND DOCUMENT EXISTING REINFORCING IN FLOOR SLABS, ROOF SLABS AND BEAMS, USING NON-DESTRUCTIVE METHODS, PRIOR TO CUTTING FOR OPENINGS OR CORING OPENINGS.
22. REMOVE ALL DEBRIS FROM WORK AREA IN CLEAN, COVERED CONTAINERS.
23. COORDINATE WITH OWNER. MINIMUM (I) WEEK PRIOR TO DISTURBING ANY UTILITIES, EQUIPMENT SHUT DOWNS.
24. THESE NOTES APPLY TO ALL FLOORS, ALL SHEETS THIS SET.
25. EXISTING ADJACENT LABS, CLASS ROOMS AND CORRIDORS TO REMAIN IN OPERATION. PROVIDE PROTECTION OF ALL CONSTRUCTION AND EQUIPMENT, COORDINATE WITH THE OWNER AS REQUIRED.
26. EXISTING CADAVER LAB TO BE UNDER CONSTRUCTION OR OCCUPIED.
27. PROVIDE PROTECTION OF ALL EXISTING CONSTRUCTION AND EQUIPMENT, COORDINATE WITH OWNER AND CONTRACTOR AS REQUIRED.
28. BUILDING WILL BE OCCUPIED AND IN OPERATION DURING CONSTRUCTION.

KEYNOTE LEGEND

1. DEMO EXIST VCT FLOOR FINISH AND RESILIENT BASE AS INDICATED
2. DEMO CEILING TILES AND GRID AS INDICATED. COORDINATE WITH MECHNICAL DRAWINGS.
3. CEILING GRID IN CADAVER LAB TO REMAIN. REMOVE AND REPLACE CEILING TILES AS REQUIRED FOR MEP, SEE MEP DRAWINGS. REPLACE TO MATCH ANY DAMAGED TILE OR GRID AS REQUIRED.
4. REMOVE AND REINSTALL CEILING MOUNTED DEVICES AS REQUIRED. SEE ELECTRICAL DRAWINGS.
5. EXIST SINK AND FIXTURES TO REMAIN. PROTECT AS REQUIRED.
6. EXIST MILLWORK, BASE CABINETS, COUNTERS, OVERHEAD CABINETS, CASEWORK AND EQUIPMENT TO REMAIN, V.I.F. PROTECT AS REQUIRED.
7. EXISTING SPACES TO REMAIN IN OPERATION. PROTECT AND COORDINATE AS REQUIRED
8. EXISTING CADAVER LAB TO BE UNDER CONSTRUCTION UNDER A SEPARATE CONTRACT OR IN OPERATION. PROTECT AND COORDINATE AS REQUIRED

DRAWING LEGEND

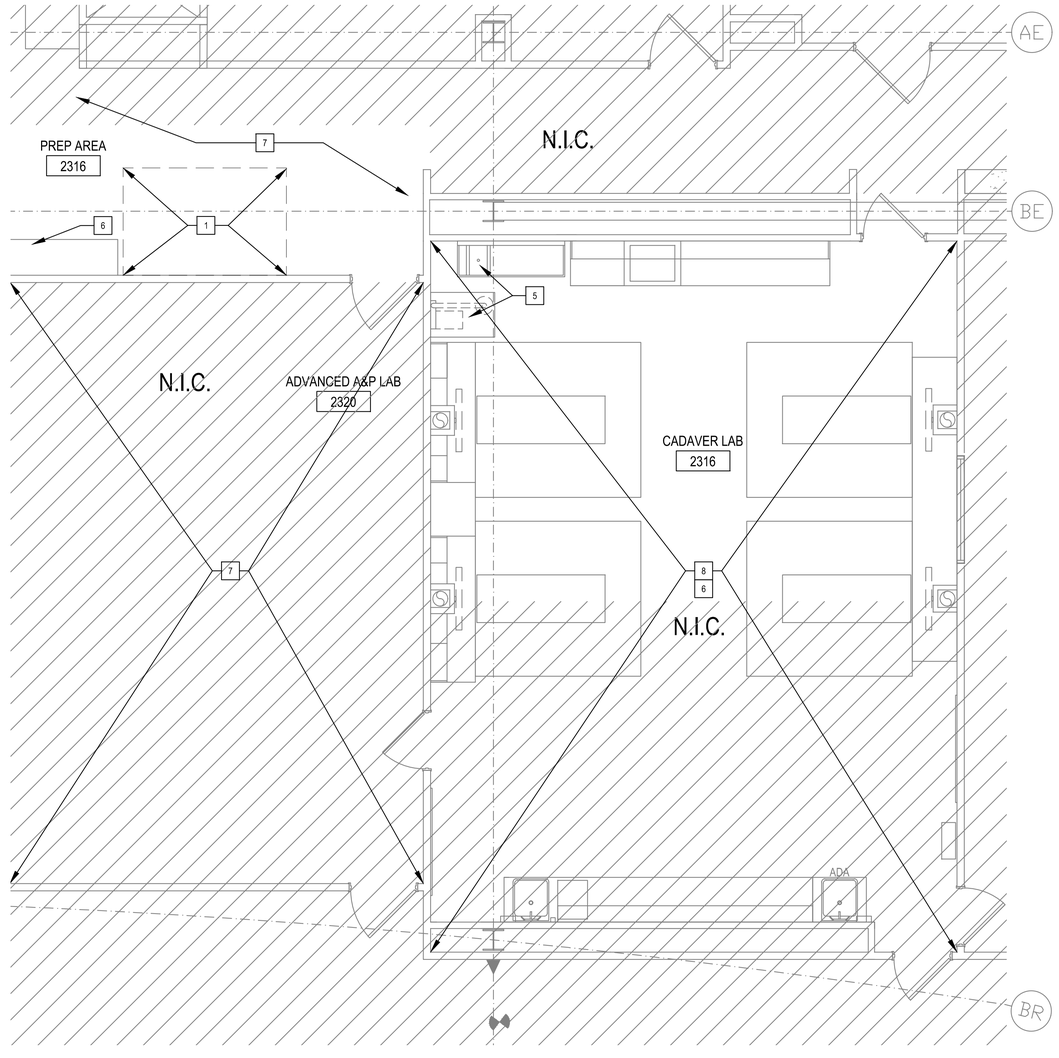
- 2' x 4' LIGHT TO REMAIN
- 2' x 4' LIGHT TO DEMOLISH
- DIFFUSERS TO REMAIN
- DIFFUSERS TO DEMOLISH
- CEILING GRID TO REMAIN
- FIXTURES, EQUIPMENT TO REMAIN
- FIXTURES, EQUIPMENT TO REMOVE
- DOOR TO DEMO
- DOOR TO REMAIN
- WALL TO DEMO
- WALL TO REMAIN
- X — AREA OF DEMO PER KEYNOTE



2 DEMOLITION 2nd FLOOR REFLECTED CEILING PLAN

SCALE: 1/4" = 1' (0, 2', 4', 8')

NORTH



1 DEMOLITION 2nd FLOOR PLAN

SCALE: 1/4" = 1' (0, 2', 4', 8')

NORTH

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PHASE 2

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DEMO FLOOR PLAN AND DEMO RCP- 2nd FLOOR

BE Project No. 15044-15-03

Drawn By: PK

Drawing No. D100

GENERAL NOTES

1. REFER TO SHEET G001 FOR ADDITIONAL WORK REQUIRED IN AREAS SHOWN.
2. CONTRACTOR SHALL VISIT THE SITE AND BECOME FAMILIAR WITH THE EXISTING CONDITIONS PRIOR TO COMMENCING THE WORK. EXISTING CONDITIONS SHOWN ARE FROM INFORMATION PROVIDED BY THE GOVERNMENT, VERIFY IN FIELD ALL EXISTING CONDITIONS, DIMENSIONS, ELEVATION HEIGHTS, CONSTRUCTION AND BUILDING SYSTEMS PRIOR TO PROCEEDING WITH THE WORK.
3. CONTRACTOR SHALL NOTIFY THE ARCHITECT OF ANY AND ALL DISCREPANCIES BETWEEN THE CONTRACT DOCUMENTS AND EXISTING CONDITIONS PRIOR TO PROCEEDING WITH THE WORK.
4. PATCH AND PREPARE EXISTING WALLS AS NECESSARY TO RECEIVE NEW FINISHES WHERE SCHEDULED.
5. ROOM LAYOUTS AND CONFIGURATIONS FOR AREAS OUTSIDE OF THE CURRENT WORK ARE SHOWN FOR REFERENCE ONLY, EXISTING CONSTRUCTION IS BASED UPON LIMITED SURVEYS BY THE ARCHITECT AND INFORMATION PROVIDED BY THE GOVERNMENT, FIELD VERIFICATION PRIOR TO COMMENCEMENT OF CONSTRUCTION IS REQUIRED.
6. APPLY NEW FINISHES TO EXISTING WALL AND CEILING MOUNTED COVER PLATES, ITEMS, ETC, LOCATED ON EXISTING SURFACES SCHEDULED TO BE REFINISHED, EXISTING ITEMS THAT ARE NOT REMOVABLE SHALL BE CAREFULLY TAPED, OR OTHERWISE COVERED DURING REFINISHING.
7. PATCH TO MATCH EXISTING SOIL AND SLOPE TO MAINTAIN EXISTING DRAINAGE AS REQUIRED, PATCH TO MATCH EXISTING GROUND COVER AS REQUIRED BY THE WORK

KEYNOTE LEGEND - PLAN

1 PROTECT EXISTING LANDSCAPE DURING CONSTRUCTION.

2 SEAL NEW PIPE PENETRATIONS IN WALL TO MATCH EXISTING PENETRATIONS AND SEALS THIS WALL. REFER TO MECHANICAL PLANS.

- REMOVE EXISTING RAIN SCREEN PANEL AND CUT MINIMUM OPENINGS AS REQUIRED.

- SEAL PIPE PENETRATION AT WALL BACKUP WATER PROOFING SYSTEM, MAINTAIN EXISTING WALL WATER PROOFING, V.I.F.

- PROVIDE COMPREHENSIVE FOAM AND SEALANT AT PHASE OF EXTERIOR PANEL. COLOR TO MATCH EXISTING.

- SPLICE PIPES FOR INSTALLATION THROUGH PANEL AS REQUIRED.

3 SEE MECHANICAL PIPING PLANS AND ELECTRICAL PLANS FOR WORK AT THIS AREA. PROVIDE SUPPORTS AND PROTECTION AGAINST IMPACT FOR PIPING AND CONDUITS. SEE MECHANICAL DRAWING DETAIL. PAINT EXPOSED METAL. ARCHITECT TO SELECT COLOR.

4 6" T. C.I.P CONCRETE EQUIPMENTS PAD WITH #3 REINFORCED BARS AT 8" O.C. EACH WAY ON 6" COMPACT GRANULAR FILL. FILL LEVEL WITH EXISTING GRADE. LEVEL PAD AND SIZE AS REQUIRED FOR MECHANICAL EQUIPMENT. SEE MECHANICAL DRAWINGS.

5 PAINT SLOPED-TOP METAL STEPPING COVER OVER PIPING AND CONDUITS. CUSTOM COLOR TO BE SELECTED BY THE ARCHITECT. SEE MECH. DETAIL "EXTERIOR PIPE AND CONDUIT DETAIL," SHEET M300. WALL OPENING AND PIPE/CONDUIT LOCATIONS TO BE CLOSELY SPACED TO AVOID EXCESSIVE COVER SIZE. SEE MECH. AND ELEC. DRAWINGS.

DRAWING LEGEND

NEW 2' x 4' LIGHT

EXISTING 2' x 4' LIGHT

EXISTING DIFFUSERS

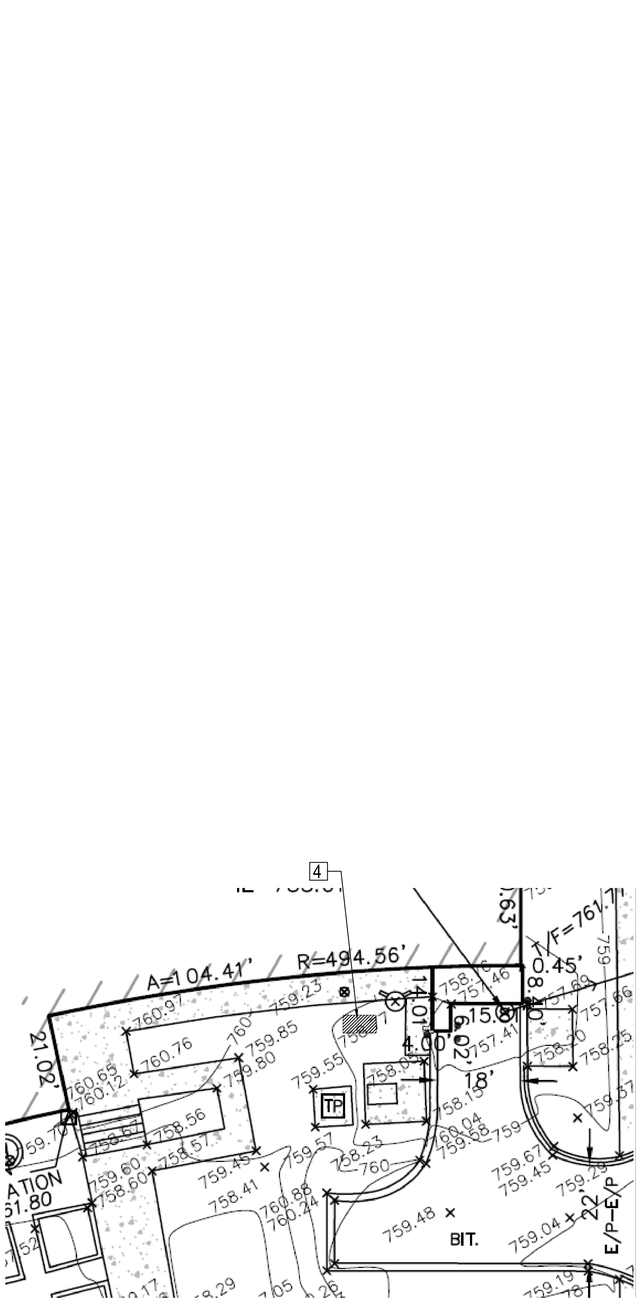
NEW EQUIPMENT

NEW DOOR

DOOR TO REMAIN

NEW PARTITION INFILL

PARTITION TO REMAIN

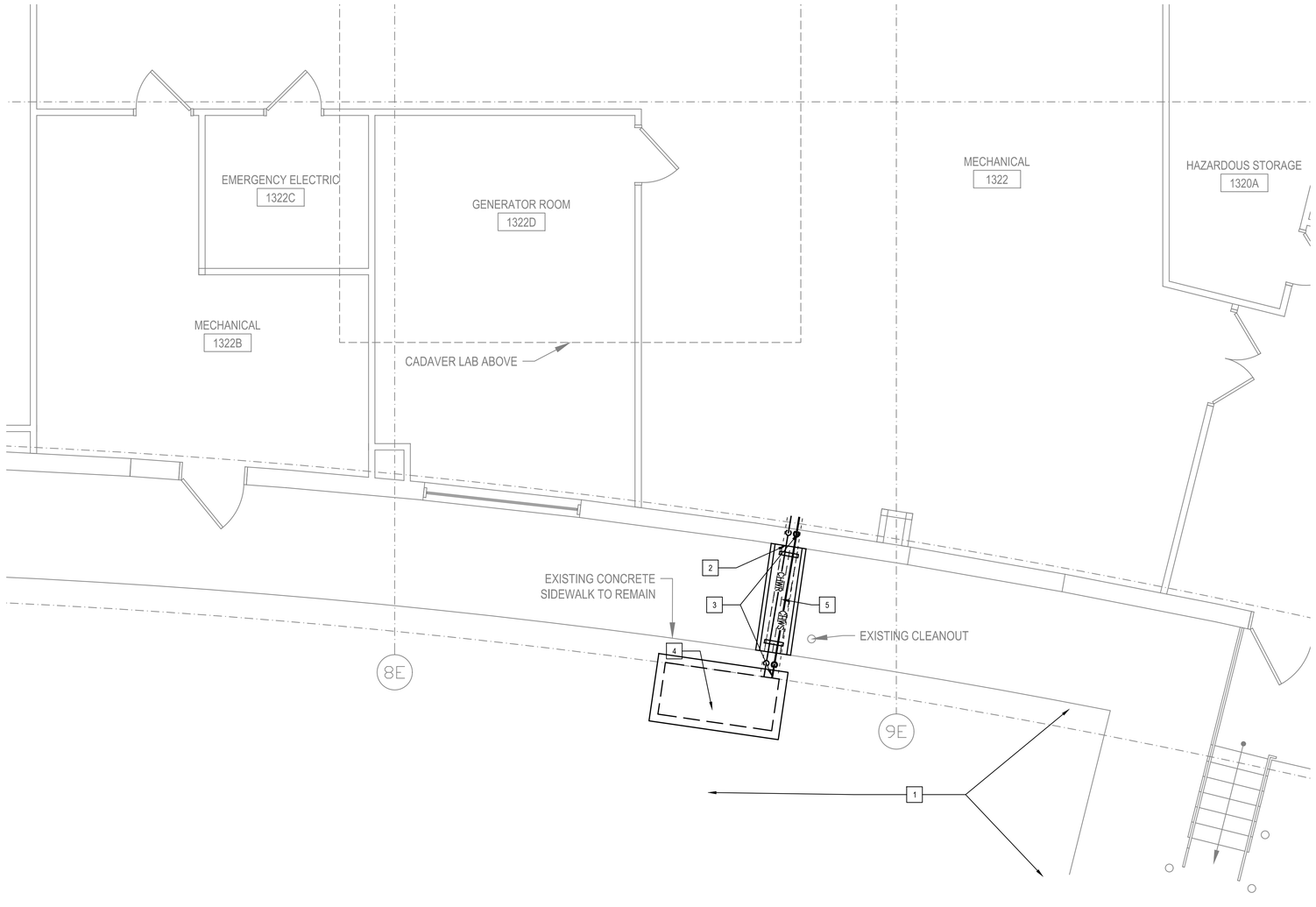


1 SITEPLAN

0 8' 16' 32'

SCALE: 1/16" = 1'-0"

NORTH



1 NEW WORK PLAN- 1st FLOOR

0 2' 4' 8'

SCALE: 1/4" = 1'

NORTH

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COLLEGE OF DUPAGE
CADAVER LAB
PHASE 2

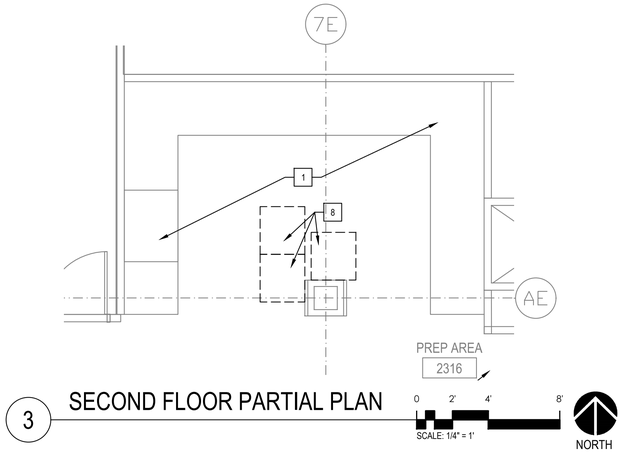
Drawing Title

NEW WORK PLAN -
1st FLOOR

BE Project No. 15044-15-03

Drawn By: PK

Drawing No. A100



3 SECOND FLOOR PARTIAL PLAN

0 2' 4' 8'

SCALE: 1/4" = 1'

NORTH

GENERAL NOTES

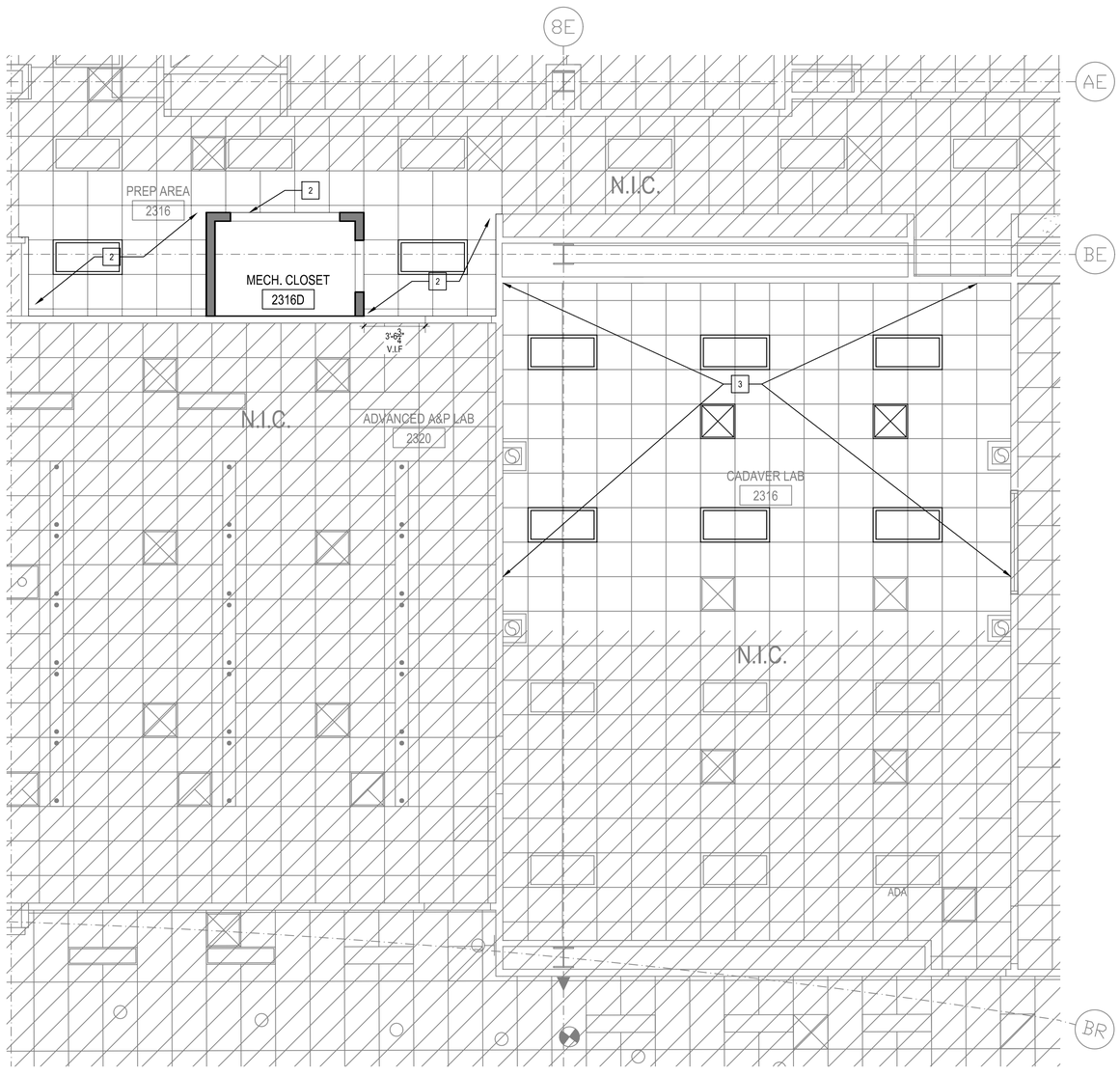
1. REFER TO SHEET G001 FOR ADDITIONAL WORK REQUIRED IN AREAS SHOWN.
2. CONTRACTOR SHALL VISIT THE SITE AND BECOME FAMILIAR WITH THE EXISTING CONDITIONS PRIOR TO COMMENCING THE WORK. EXISTING CONDITIONS SHOWN ARE FROM INFORMATION PROVIDED BY THE GOVERNMENT. VERIFY IN FIELD ALL EXISTING CONDITIONS, DIMENSIONS, ELEVATION HEIGHTS, CONSTRUCTION AND BUILDING SYSTEMS PRIOR TO PROCEEDING WITH THE WORK.
3. CONTRACTOR SHALL NOTIFY THE ARCHITECT OF ANY AND ALL DISCREPANCIES BETWEEN THE CONTRACT DOCUMENTS AND EXISTING CONDITIONS PRIOR TO PROCEEDING WITH THE WORK.
4. PATCH AND PREPARE EXISTING WALLS AS NECESSARY TO RECEIVE NEW FINISHES WHERE SCHEDULED.
5. ROOM LAYOUTS AND CONFIGURATIONS FOR AREAS OUTSIDE OF THE CURRENT WORK ARE SHOWN FOR REFERENCE ONLY. EXISTING CONSTRUCTION IS BASED UPON LIMITED SURVEYS BY THE ARCHITECT AND INFORMATION PROVIDED BY THE GOVERNMENT. FIELD VERIFICATION PRIOR TO COMMENCEMENT OF CONSTRUCTION IS REQUIRED.
6. APPLY NEW FINISHES TO EXISTING WALL AND CEILING MOUNTED COVER PLATES, ITEMS, ETC, LOCATED ON EXISTING SURFACES SCHEDULED TO BE REFINISHED. EXISTING ITEMS THAT ARE NOT REMOVABLE SHALL BE CAREFULLY TAPED, OR OTHERWISE COVERED DURING REFINISHING.

KEYNOTE LEGEND - PLAN

1. CABINETS, CASEWORK FIXTURES AND EQUIPMENTS TO REMAIN - PROTECT AS REQUIRED.
2. NEW CEILING TILES AND GRID AS SCHEDULED. REMOVE AND REINSTALL ALL CEILING MOUNTED FIXTURES AND DEVICES AS REQUIRED. SEE ELECTRICAL AND MECHANICAL DRAWINGS.
3. REMOVE AND REPLACE CEILING TILES AS REQUIRED FOR MEP. REMOVE AND REINSTALL ALL CEILING MOUNTED FIXTURES AND DEVICES AS REQUIRED. SEE MEP DRAWINGS.
4. 2-LAYER 5/8" GYPSUM BOARD FULL HEIGHT AND FULL WIDTH. LAMINATE TO EXISTING PARTITION. TAPE, FLOAT AND SAND TO MATCH NEW PARTITIONS.
5. MINIMUM CLEAR INSIDE DIMENSIONS. V.I.F WITH FINAL EQUIPMENT SELECTION AND DUCTS, SEE MECHANICAL DRAWINGS.
6. CAST IN PLACE CONCRETE HOUSE KEEPING PAD, REINFORCED WITH 4 x 4 W.W.F. MIN. SEE MECHANICAL DRAWINGS.
7. MECHANICAL AHU UNIT AND DUCTS, SEE MECHANICAL DRAWINGS.
8. 3 EXISTING REFRIGERATORS RELOCATED TO HERE BY OWNER. SEE ELECTRICAL.

DRAWING LEGEND

- NEW 2' x 4' LIGHT
- EXISTING 2' x 4' LIGHT
- EXISTING DIFFUSERS
- NEW CEILING GRID
- CEILING GRID TO REMAIN
- NEW DOOR
- DOOR TO REMAIN
- NEW EQUIPMENT
- PARTITION TO REMAIN
- NEW PARTITION INFILL

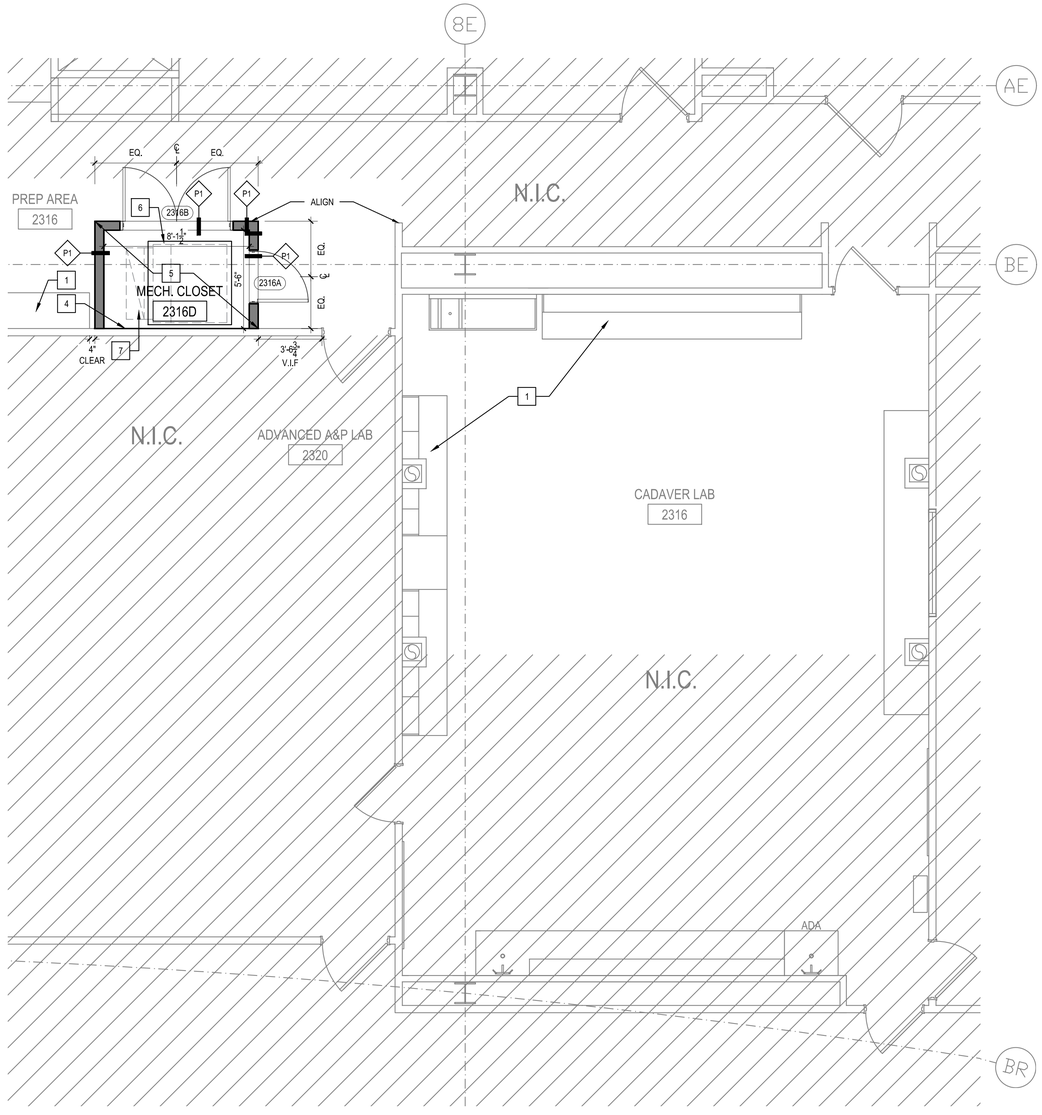


2 NEW WORK REFLECTED CEILING PLAN - 2nd FLOOR

0 2' 4' 8'

SCALE: 1/4" = 1'

NORTH



1 NEW WORK FLOOR PLAN- 2nd FLOOR

0 2' 4' 8'

SCALE: 1/4" = 1'

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Drawing Title

NEW WORK FLOOR PLAN AND RCP- 2nd FLOOR

BE Project No. 15044-15-03

Drawn By: PK

Drawing No. A101

GENERAL NOTES:

1. FIELD VERIFY EXACT LOCATION OF EXISTING PIPING.
2. PROVIDE HANGERS AND SUPPORTS FOR ALL PIPES FROM CONCRETE DECK ABOVE AS REQUIRED.
3. ACID WASTE PIPING SHALL BE BLUE (CLAMP-FREE) ELECTROFUSION POLYPROPYLENE PIPING. SANITARY VENT PIPING SHALL BE HUBLESS CAST IRON PIPING. MATCH EXISTING.

PLUMBING KEY NOTES:

1. ROUTE PIPING PARALLEL TO EXISTING PIPING IN ROOM 1322A. DON'T INSTALL NEW PIPING OVER EXISTING ELECTRICAL EQUIPMENT IN ROOM.
2. PROVIDE FIRESTOPPING AT ALL FLOOR AND WALL PENETRATIONS.
3. CONNECT ACID WASTE/ACID VENT PIPING TO EXISTING STUBS.

PLUMBING FIXTURE SCHEDULE

TAG NO.	DESCRIPTION	FIXTURE CONNECTIONS		
		HOT	COLD	SANITARY
FD	FLOOR DRAIN, JAY R SMITH MODEL NUMBER 2005. WITH HEEL PROOF STRAINER, TRAP, 5" BRASS ROUND COVER.	–	–	2"

1 PLUMBING 1st FLOOR NEW WORK PLAN

SCALE: 1/4" = 1'

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PLUMBING 1st FLOOR NEW WORK PLAN

BE Project No. 15044-15-03

Drawn By: JPB/NPT

Drawing No. P100

REMOVE EXISTING ACID WASTE (BLUE PIPE) PIPE AND PROVIDE NEW PIPE AT LOWER ELEVATION, ALLOWING M.C. TO INSTALL NEW DUCTWORK. FIELD VERIFY EXACT LOCATIONS. COORDINATE WITH M.C.

PROVIDE FITTINGS AND NEW CONNECTION TO EXISTING PIPE. MATCH EXISTING MATERIALS AND PIPE HANGERS.

RECONNECT TO EXISTING ACID WASTE (BLUE PIPE) PIPE AT LOWER ELEVATION.

2 EXISTING CONDITIONS ABOVE CEILING

TYPICAL ARM-OVER (SPRINKLER HEAD)
NO SCALE

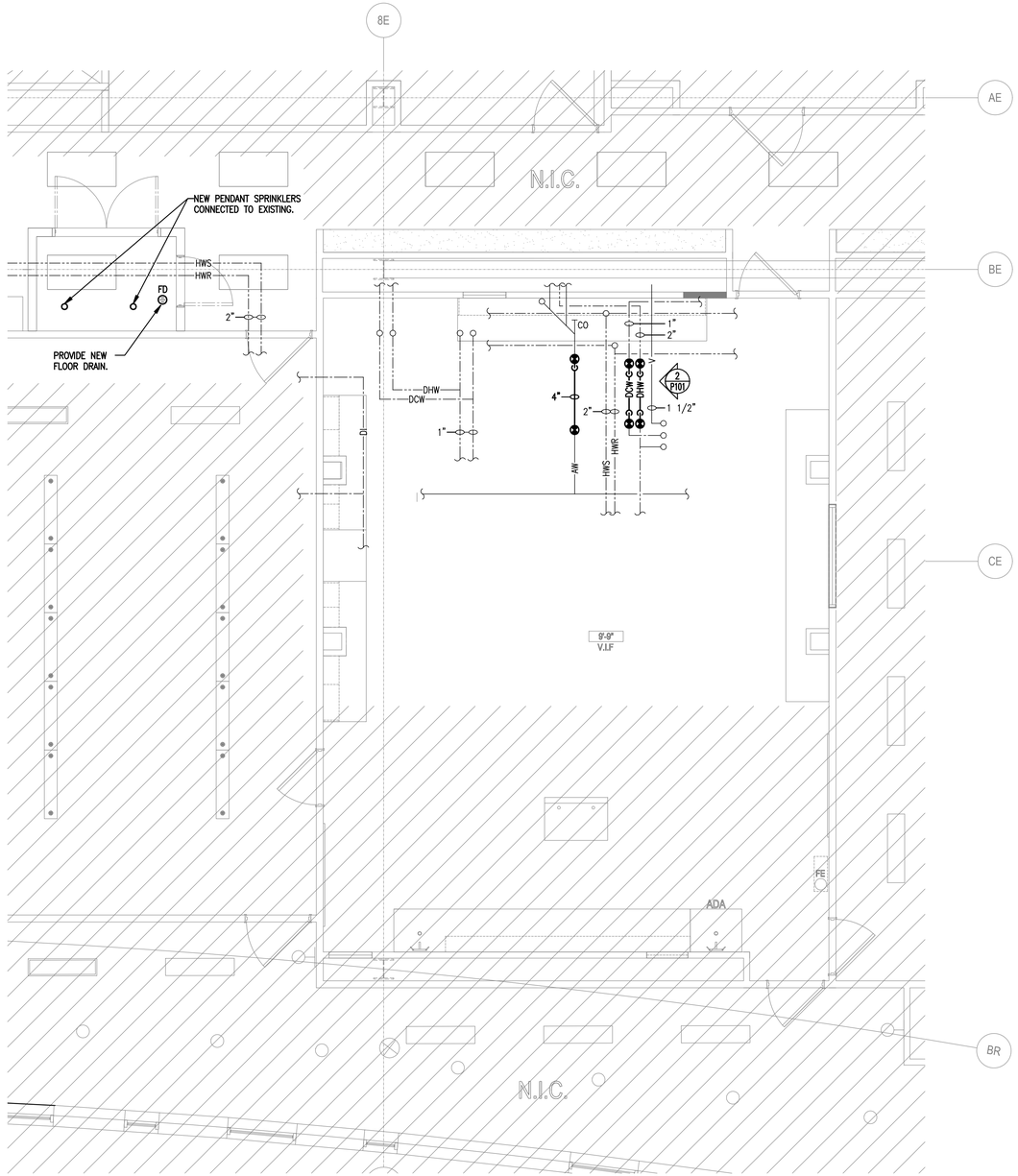
FIRE PROTECTION NOTES:

AREAS SHOWN: LIGHT HAZARD, 0.10 GPM OVER 1,500 SQ. FEET
LINE PIPING – SCHEDULE 40 STEEL PIPE, STANDARD CAST IRON FITTINGS
MAIN PIPING – SCHEDULE 10 STEEL PIPE, GROOVED FITTINGS, WELDED OUTLETS, HANGERS – 3/8" THREADED ROD, CLAMP TO STRUCTURE, UNISTRUT TRAPEZE AS REQUIRED, HYDROSTATICALLY TEST COMPLETED SYSTEM AT 200 PSI FOR 2 HOURS. ALARM WIRING AND CENTRAL SUPERVISION TO BE PROVIDED BY E.C. PROVIDE 115 VOLT DEVICES.

1. ALL AREAS ARE CLASSIFIED AS LIGHT HAZARD.
2. ALL SPRINKLER HEADS WILL REQUIRE WORK IN NEW CEILING AREAS. PROTECT FROM BREAKAGE DURING CONSTRUCTION.
3. COORDINATE WITH ARCHITECTURAL PLANS TO VERIFY NEW CEILING AREAS.
4. EXTEND BRANCH PIPING TO NEW SPRINKLER PIPING LOCATIONS. FIELD VERIFY LOCATIONS OF PIPING WITH EXISTING CONDITIONS.
5. THE CONTRACTOR IS RESPONSIBLE FOR PROVIDING COVERAGE THAT COMPLIES WITH NFPA 13. PROVIDE REVISED HYDRAULIC CALCULATIONS AND SHOP DRAWINGS. SHOP DRAWINGS SHALL DEMONSTRATE LOCATIONS PIPING WITH CLEAR DIFFERENTIATION BETWEEN NEW AND EXISTING PIPING. ALL CALCULATIONS BY LICESNSED FIRE PROTECTION ENGINEER OR NICET LEVEL III CERTIFIED DESIGNER.
6. NEW SUPPORTS SHALL BE INDEPENDENT OF ALL OTHER TRADES.
7. COORDINATE PIPE ROUTING, SPRINKLER LOCATION AND WORK SCHEDULE WITH OTHER TRADES.
8. TEST NEW PIPING WITH AIR PRIOR TO FILLING WITH WATER.

GENERAL NOTES:

1. COORDINATE WORK WITH MECHANICAL CONTRACTOR.
2. VERIFY PIPE SIZES IN FIELD PRIOR TO ORDERING MATERIALS.
3. PROVIDE INSULATION FOR NEW PIPING TO MATCH EXISTING.



1 PLUMBING NEW WORK FLOOR PLAN
SCALE: 1/4" = 1'
0 2' 4' 8'
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Drawing Title
PLUMBING AND FIRE PROTECTION 2nd FLOOR NEW WORK PLAN

BE Project No. 15044-15-03
Drawn By: JPB/NPT
Drawing No. P101

GENERAL NOTES:

1. MAINTAIN A MINIMUM OF 4' CLEARANCE AROUND ALL SIDES OF CHILLER.
2. COORDINATE WITH OWNER TO PROVIDE GLYCOL AND CHEMICAL TREATMENT CONSISTENT WITH EXISTING.

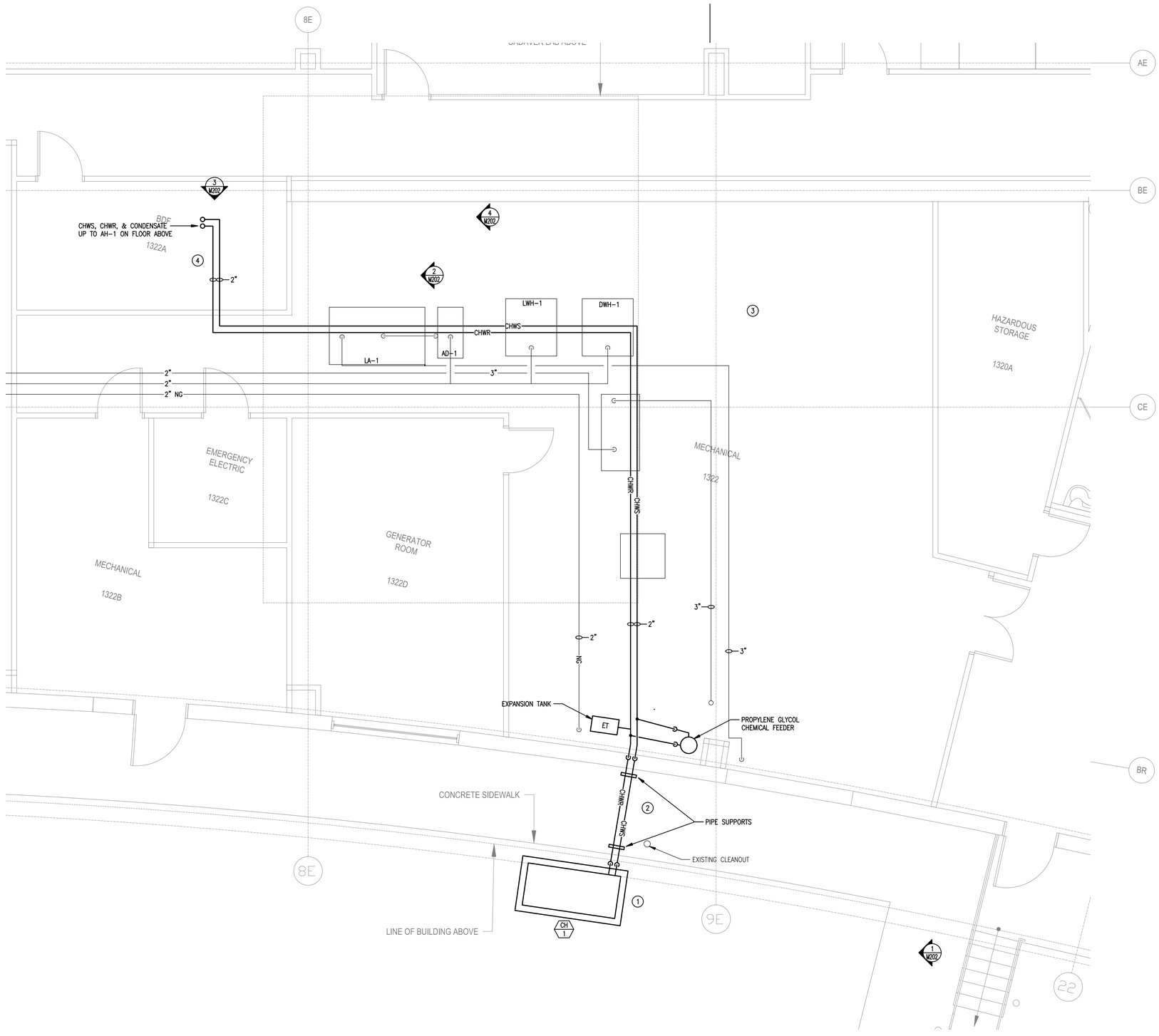
MECHANICAL KEY NOTES:

(1) PROVIDE CHILLER AND CONCRETE PAD OUTDOORS. VEGETATION SHALL BE CLEARED PRIOR TO POURING OF CONCRETE PAD. FIELD VERIFY EXACT LOCATION WITH OWNER. COORDINATE WITH G.C. COORDINATE EXACT LOCATION OF CHWS & CHWR CONNECTIONS.

(2) ROUTE CHWS & CHWR PIPING ALONG SIDEWALK. PENETRATE BUILDING EXTERIOR WALL AT A HEIGHT OF 18" AFF AND SEAL TO BE WATER TIGHT. ROUTE PIPE DOWN CLOSE TO THE EXTERIOR WALL. PROVIDE GROUND PIPE SUPPORTS AS REQUIRED. PROVIDE PIPE AND CONDUIT CURB TO PROTECT EXTERIOR PIPES. SEE DETAIL M300. COORDINATE WITH GENERAL AND ELECTRICAL CONTRACTORS.

(3) CHWS & CHWR PIPING SUSPENDED FROM CONCRETE CEILING. FIELD VERIFY CLEAR ROUTE FOR PIPING.

(4) ROUTE PIPING PARALLEL TO EXISTING PIPING IN ROOM 1322A. DON'T INSTALL NEW PIPING OVER EXISTING ELECTRICAL EQUIPMENT IN ROOM.



1 MECHANICAL 1st FLOOR NEW WORK PLAN

SCALE: 1/4" = 1' (0, 2', 4', 8')

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Drawing Title

MECHANICAL 1st FLOOR NEW WORK PLAN

BE Project No. 15044-15-03

Drawn By: JPB/NPT

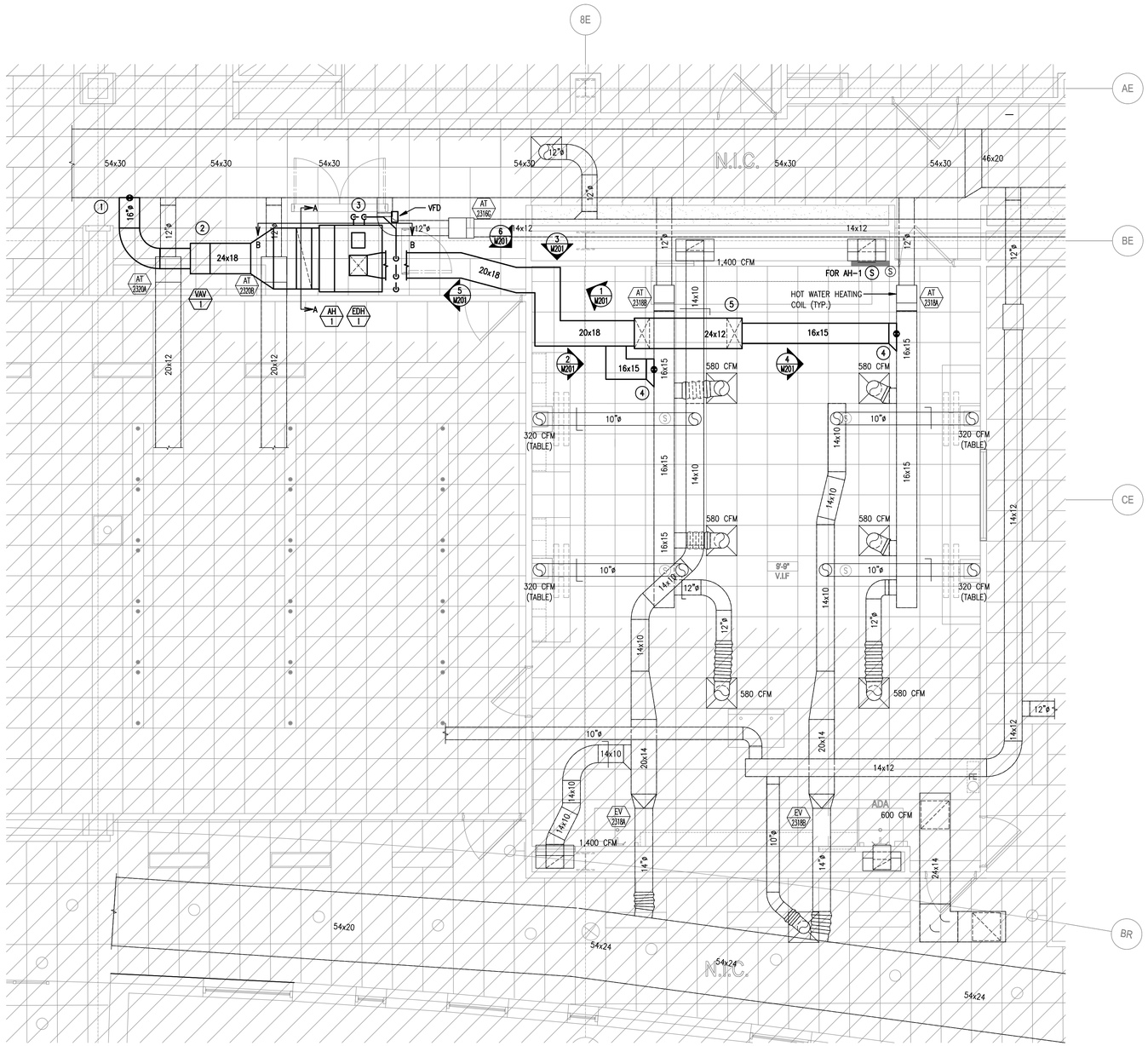
Drawing No. M100

GENERAL NOTES:

1. EXISTING CEILING GRID MAIN TO REMAIN DURING CONSTRUCTION. CONTRACTOR SHALL BE RESPONSIBLE FOR ANY DAMAGES TO GRID OCCURRED DURING CONSTRUCTION. COORDINATE WITH G.C.
2. FIELD VERIFY PLUMBING PIPING AND EQUIPMENT LOCATIONS TO AVOID CONFLICTS WITH PROPOSED DUCTWORK ROUTING.
3. PROVIDE TEST AND BALANCING FOR VAV-1, AH-1, & CH-1. A COPY OF THE TEST AND BALANCE REPORT SHALL BE SUBMITTED TO DUPAGE COUNTY PRIOR TO FINAL INSPECTION.
4. ALL NEW DUCTWORK SHALL BE INSULATED WITH 2" THICK DUCT WRAP. REINSULATE EXISTING DUCT AFTER CONNECTION.

MECHANICAL KEY NOTES:

1. CONNECT TO EXISTING HIGH PRESSURE SUPPLY DUCT.
2. PROVIDE VAV BOX SUSPENDED FROM CONCRETE DECK. PROVIDE CONTROL POWER.
3. PROVIDE AIR HANDLER UNIT AND VFD. FIELD VERIFY PIPE PENETRATIONS. COORDINATE ELECTRICAL REQUIREMENTS WITH E.C.
4. CONNECT TO EXISTING SUPPLY DUCTWORK.
5. PROVIDE TRANSITIONS AND FITTING AS REQUIRED TO ROUTE OVER EXISTING DUCTWORK. PROVIDE NEW HANGERS FOR ALL EXISTING PIPING AND DUCTWORK AS REQUIRED TO INSTALL NEW DUCT.



1 MECHANICAL NEW WORK FLOOR PLAN

SCALE: 1/4" = 1'

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MECHANICAL 2nd FLOOR NEW WORK PLAN

BE Project No. 15044-15-03

Drawn By: JPB/NPT

Drawing No. M101

VAV TERMINAL UNIT SCHEDULE

UNIT NO. (VAV)	VARIABLE VOLUME PRIMARY AIR CFM		AIR PRESSURE DROP INCHES			OVERALL TERM UNIT SIZE INCHES L X W X D	AIR INLET SIZE INCHES DIA.	AIR DISCH. SIZE INCHES DIA.	TITUS OR EQUAL (1)
	MAX.	MIN.	MAX. INLET PRESS.	MIN. INLET PRESS.	MAX. DISCH. PRESS.				
1	3600	0	–	0.05	–	15.5 x 24 x 18	16	24 x 18	DESV 16

(1) AIRFLOW SWITCH, 24 VOLT CONTROL TRANSFORMER, DUST TIGHT CONSTRUCTION.

ELECTRIC DUCT HEATER SCHEDULE (EDH)

UNIT TAG	MANUFACTURER AND MODEL NUMBER	KW	SERVICE	CFM	SIZE	NO. OF STEPS	WATTS PER SQ. IN.	VOLT/PH	REMARKS
1	INDEECO QUA	20	AH–1	3,480	20x18	4	8,000	480/3	–

(1) VERIFY VOLTAGE PRIOR TO ORDERING

(2) PROVIDE U/L LISTING, AIR FLOW SWITCH, OVER–CURRENT AND OVER–TEMPERATURE PROTECTION.

(3) PROVIDE REMOTE CONTROL PANEL AS PER LOCAL CODES, COORDINATE WITH ELECTRICAL TRADES PRIOR TO ORDERING.

(4) PROVIDE DUST TIGHT CONSTRUCTION.

AIR COOLED CHILLER SCHEDULE (C)

UNIT TAG	MANUFACTURER & MODEL #	CAPACITY TONS	ENT WATER TEMP	LVG WATER TEMP	GPM	EVAP PRESS DROP	ENT COND AIR	PROPYLENE GLYCOL	MOTOR DATA					REMARKS
									VOLT	HZ	PHASE	MCA	MOCP	
1	CARRIER 30RAP025	22.5	52	40	48.58	15.1	95	–	460	60	3	63.6	80	–

(1) AIR COOLED SCROLL CHILLER, EVAPORATOR HEATER, MICRO CHANNEL, ULTRA LOW SOUND, SINGLE PUMP 5 HP, DIGITAL COMPRESSOR, SECURITY GRILLES/HAIL GUARD, GFI CONVENIENCE OUTLET, DDC SINGLE POINT CONNECTION, HIGH EFFICIENCY VARIABLE CONDENSER FAN, WIND BAFFLE, CHILLED WATER STORAGE TANK, VIBRATION ISOLATION PACKAGE, NON–FUSED DISCONNECT.

AIR HANDLING UNIT SCHEDULE (AH)

UNIT NO.	QTY.	LOCATION	AREA SERVED	FAN SECTION								COOLING COIL SECTION									REFERENCE MFG.	REMARKS
				CFM	O.A.	TSP	BRAKE	RPM	MOTOR DATA			SQ. FT.	FV FPM	ROWS	S.P. H_2O	EAT F°		LAT F°		MBH	TYPE	
									HP	RPM	VOLTS/PHASE					DB	WB	DB	WB			
1	1	2ND FLOOR HALL	2318 CADAVER LAB	3480	3480	2.94	2.8	1533	3	1800	208/3	7.64	455.6	10	1.20	80	70	46	46	236.35	UP FLOW	CARRIER	39MN 08W

(1) AERO INDOOR AIR HANDLER, R–13 DOUBLE WALL SEALED PANEL, GALVANIZED EXTERIOR/INTERIOR PANELS, 6" TALL BASE RAIL, 2" PLEATED MERV 13 FILTER, 304 SS DRAIN PAN, COIL CONNECTION RIGHT SIDE, UPBLAST FRONT DISCHARGE FAN, MOTOR SHAFT GROUNDING, BELT DRIVE WITH EXTRA BELTS, VFD.

JOB: 0555.09
BUILDING: VA SAMPLE POINTS LIST

PAGE:

SYSTEM: VAV AIR HANDLER / SYSTEM COMPONENT:	POINT ID	ABBREVIATION	POINT LEGEND	SYSTEM OUTPUTS BINARY	SYSTEM OUTPUTS ANALOG	SYSTEM INPUTS BINARY	SYSTEM INPUTS ANALOG	SYSTEM SOFTWARE/CONTROL ALARM PROCESSING	SYSTEM SOFTWARE/CONTROL APPLICATION/FUNCTION	REMARKS
Return air Temperature	AI–1	RAT					●			
Cooiling Coil Temperature	AI–2	CCT					●			
Discharge Air Temperature	AI–3	DAT					●			
SUPPLY FAN STATUS	BI–1	SF–STS				●				
SUPPLY FAN VSMC ALARM	BI–2	SF–ALA				●				
SUPPLY FAN VSMC	AO–1	SF–SPD	●							FULL COMMUNICATION
VAV DAMPER	AO–2	VAVD		●						
SCR – ELECTRIC HEAT	AO–3	SCR		●						
COILING VALVE V–1	AO–4	CLG–V1		●						
SUPPLY FAN START/STOP	BO–1	SF–SST	●							

PROVIDE THE FOLLOWING POINTS FOR CHILLER:

ALARMS
NO EVAPORATOR FLOW, HIGH CONDENSER PRESSURE, GROUND FAULT PROTECTION, OUTSIDE AMBIENT TEMPERATURE, LOW EVAPORATOR PRESSURE, MOTOR PROTECTION SYSTEM, SENSOR FAILURES, EVAPORATOR FREEZE PROTECTION.

ANALONG INPUTS
RESET LEAVING, WATER TEMPERATURE, DIGITAL INPUTS – UNIT OFF SWITCH, REMOTE START/STOP, FLOW SWITCH, MOTOR PROTECTION.

(1) POINTS LIST FOR AIR HANDLING UNIT

NTS

SYMBOLS + ABBREVIATIONS

AD	ACCESS DOOR	GR	GRILLE
AH	AIR HANDLING SYSTEM	KW	KILOWATT
AT	AIR TERMINAL	LAT	LEAVING AIR TEMPERATURE
BOD	BOTTOM OF DUCT	MBH	THOUSANDS BRITISH THERMAL UNITS PER HOUR
BTU	BRITISH THERMAL UNIT		
CFM	CUBIC FEET PER MINUTE	MAN.	MANUAL
CH	WATER CHILLER	MAX.	MAXIMUM
CHWR	CHILLED WATER RETURN	MIN.	MINIMUM
CHWS	CHILLED WATER CUPPLY	NIC	NOT IN CONTRACT
CL	CENTER LINE	NTS	NOT TO SCALE
CLG	CEILING	OA	OUTSIDE AIR
COND	CONDENSATE	PRESS	PRESSURE
DIA	DIAMETER	REQD	REQUIRED
EAT	ENTERING AIR TEMPERATURE	RM	ROOM
ET	EXPANSION TANK	SP	STATIC PRESSURE
ETR	EXISTING TO REMAIN	SPEC	SPECIFICATION
EXH	EXHAUST	TSP	TOTAL STATIC PRESSURE
°F	DEGREES FAHRENHEIT	TT	DDC TEMPERATURE SENSOR
FL	FLOOR	TYP	TYPICAL
FLEX	FLEXIBLE	VAV	VARIABLE AIR VOLUME
FPM	FEET PER MINUTE	VD	VOLUME DAMPER
GPM	GALLONS PER MINUTE	VFD	VARIABLE FREQUENCY DRIVE

HVAC CONTROL SYMBOLS

- C — COLUMN LETTERS OR NUMBER
- 4 / M–5 — ELEVATION OR SECTION REMOTE LOCATION DETAIL NO DWG NO
- 4 — DETAIL SAME DRAWING
- DIRECTION OF AIR FLOW
- DUCT ELBOW TURNED DOWN
- DUCT ELBOW TURNED UP
- DUCT ELBOW WITH TURNING VANES (RADIUS ELBOW)
- DUCT ELBOW WITH TURNING VANES (SQUARE ELBOW)
- DN — DUCT INCLINED DOWN IN RESPECT TO AIR FLOW
- DUCT INCLINED UP IN RESPECT TO AIR FLOW
- 240 x 120 — DUCT–SIZE IN INCH. FIRST DIMENSION IS SIDE SHOWN.
- DUCT SIZE TRANSITION
- 240 x 120 / 240 x 120 — DUCT–SOUNDLINED–CLEAR INSIDE SIZE IN INCHES. FIRST DIMENSION IS SIDE SHOWN.
- 3 / M–5 — DETAIL TAG – DETAIL #/DRAWING #
- AT / 2 — EQUIPMENT TAG
- EXHAUST/RETURN DUCT SECTION
- MANUAL DAMPER WITH ACCESS DOOR
- SUPPLY DUCT
- VAV — VARIABLE AIR VOLUME UNIT NUMBER AS PER SCHEDULE
- T — ROOM THERMOSTAT (S–SENSOR)
- NEW CONNECTION

APPLICABLE BUILDING CODES:

ALL CONSTRUCTION SHALL COMPLY WITH DUPAGE COUNTY ADOPTED BUILDING CODES, ORDINANCES AND AMENDMENTS:

–2015 INTERNATIONAL BUILDING CODE
–2014 NATIONAL ELECTRIC CODE (NFPA 70)
–2015 INTERNATIONAL ENERGY CONSERVATION CODE
–2015 INTERNATIONAL MECHANICAL CODE
–1997 ILLINOIS ACCESSIBILITY CODE
–2014 ILLINOIS PLUMBING CODE
–CITY AMENDMENTS

GENERAL MECHANICAL NOTES

1. A COPY OF THE REQUIRED TEST AND BALANCE REPORT SHALL BE SUBMITTED TO DUPAGE COUNTY PRIOR TO THE FINAL INSPECTION.

SEQUENCE OF OPERATION FOR VARIABLE AIR VOLUME AIR HANDLING UNIT WITH MINIMUM OUTSIDE AIR

1. GENERAL

_1.1 WHEN THE SUPPLY AIR MAIN TEMPERATURE (EXISTING TT–4) REACHES 58°F (ADJUSTABLE) AS READ FROM THE CURRENT BAS SYSTEM INPUT, THE EXISTING VAV BOXES (AT–2318A,B) SHALL FULLY CLOSE AND EXISTING VAV BOXES (EV–2318A,B) SHALL FULLY OPEN. VAV BOX (VAV–1) SHALL OPEN AND THE AH UNIT SHALL START. THE AH VFD SHALL RAMP UP AT THE SAME SPEED AS VAV BOX DAMPER OPENS (AND EXISTING VAV BOXES SHALL CLOSE), UNTIL THE VAV BOX AND AH REACH 3,480 CFM. THEN CHILLER STARTS (SEE ITEM 5). ELECTRIC HEAT IS ENERGIZED.

_1.2 WHEN THE SUPPLY AIR MAIN TEMPERATURE (EXISTING TT–4) REACHES 53°F (ADJUSTABLE) AS READ FROM THE CURRENT BAS SYSTEM INPUT, THE EXISTING VAV BOXES (AT–2318A,B) SHALL OPEN. VAV BOX (VAV–1) SHALL CLOSE AND THE AH UNIT SHALL TURN OFF. THE AH VFD SHALL RAMP DOWN AT THE SAME SPEED AS VAV BOX DAMPER CLOSES (AND EXISTING VAV BOXES SHALL OPEN), UNTIL THE VAV BOX AND AH REACH 0 CFM. THEN CHILLER TURNS OFF (SEE ITEM 5). ELECTRIC HEAT IS DE–ENERGIZED.

2. TEMPERATURE CONTROL

_2.1 SUPPLY AIR TEMPERATURE, SENSED BY TT–1, SHALL BE MAINTAINED AT SPACE SETPOINT BY MODULATING SCR ELECTRIC HEAT.

_2.2 MODULATE V–1 TO MAINTAIN THE SUPPLY AIR TEMPERATURE, SENSED BY TT–6, AT 46°F (ADJUSTABLE).

3. AIR FLOW CONTROL

_3.1 THE SUPPLY AIR FLOW SHALL BE CONTROLLED BY THE DIGITAL CONTROL PANEL MODULATING THE SUPPLY FAN VARIABLE SPEED MOTOR CONTROLLER TO MAINTAIN BALANCED CFM.

4. TESTING

_4.1 WHEN TEST MODE IS ENGAGED, THE EXISTING VAV BOXES (AT–2318A,B) SHALL FULLY CLOSE AND EXISTING VAV BOXES (EV–2318A,B) SHALL FULLY OPEN. VAV BOX (VAV–1) SHALL OPEN AND THE AH UNIT SHALL START. THE AH VFD SHALL RAMP UP AT THE SAME SPEED AS VAV BOX DAMPER OPENS (AND EXISTING VAV BOXES SHALL CLOSE), UNTIL THE VAV BOX AND AH REACH 3,480 CFM. THEN CHILLER STARTS (SEE ITEM 5). ELECTRIC HEAT IS ENERGIZED. TEST MODE SHALL RUN FOR 30 MINUTES (ADJUSTABLE). THEN TEST MODE IS DEACTIVATED, THE EXISTING VAV BOXES (AT–2318A,B) SHALL OPEN. VAV BOX (VAV–1) SHALL CLOSE AND THE AH UNIT SHALL TURN OFF. THE AH VFD SHALL RAMP DOWN AT THE SAME SPEED AS VAV BOX DAMPER CLOSES (AND EXISTING VAV BOXES SHALL OPEN), UNTIL THE VAV BOX AND AH REACH 0 CFM. THEN CHILLER TURNS OFF (SEE ITEM 5). ELECTRIC HEAT IS DE–ENERGIZED.

5. AUTOMATIC SHUTDOWN/RESTART

_5.1 WHEN SMOKE IS DETECTED BY DUCT SMOKE DETECTOR, SD, THE SUPPLY AND RETURN FANS SHALL SHUT "OFF" AND AN ALARM SIGNAL SHALL BE TRANSMITTED TO THE FIRE ALARM SYSTEM. ALL SMOKE DAMPERS IN THE SUPPLY AND RETURN DUCTS SHALL CLOSE.

5. CHILLER

_5.1 CHILLER TO BE STARTED/STOPPED BY BAS. PUMP P–1 STARTS, FLOW IS PROVEN CHILLER IS ENERGIZED AND STAGES ON/OFF TO MAINTAIN CHWS TEMPERATURE. CHILLER TO OPERATE WITH AH–1.

NOTE:
EXISTING BAS SYSTEM IS A HONEYWELL PRODUCT. PLEASE CONTACT LOCAL HONEYWELL REPRESENTATIVE GIAN GIULIANI (847) 226–9534 Gian.Giuliani@Honeywell.com

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Glen Ellyn, IL 60137

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06/26/2017	ISSUE FOR PERMIT
07/20/2017	ISSUE FOR BID

COLLEGE OF DUPAGE
CADAVER LAB
PHASE 2

Drawing Title

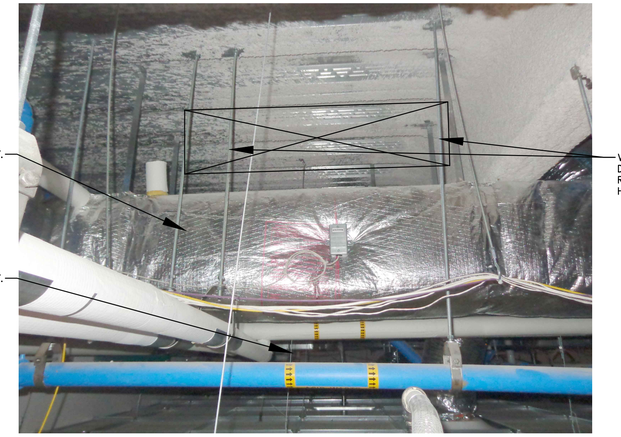
MECHANICAL SYMBOLS AND SCHEDULES

BE Project No. 15044-15-03

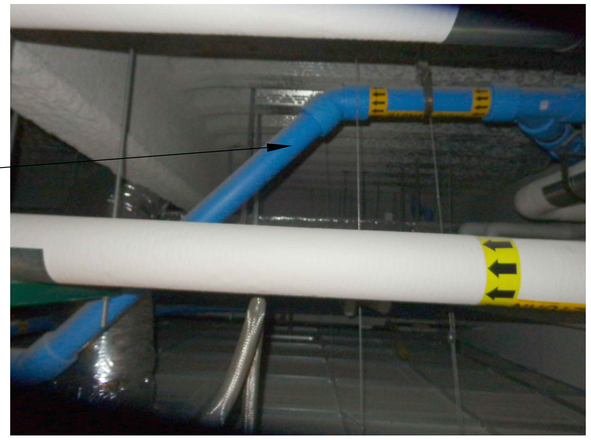
Drawn By: JPB/NPT

Drawing No. M200

1 DUCT PENETRATION _ CADAVER LAB



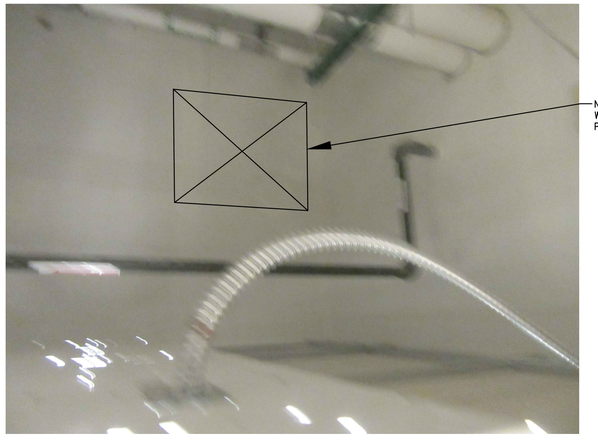
2 DUCT ROUTING - CADAVER LAB



3 DUCT ROUTING - CADAVER LAB

4 DUCT ROUTING - CADAVER LAB

5 DUCT ROUTING - HALLWAY



6 DUCT PENETRATION - HALLWAY

bailey edward

t 312.440.2300
f 312.440.2303
www.baileyedward.com

35 East Wacker Dr
Suite 2800
Chicago, IL
60601-2308

Owner
College of DuPage
425 Fawell Blvd.
Glen Ellyn, IL 60137

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Drawing Title

MECHANICAL NEW WORK PICTURES

BE Project No. 15044-15-03

Drawn By: JPB/NPT

Drawing No. M201

1 CHILLER LOCATION - LOADING DOCK

2 PIPE ROUTING - MECHANICAL ROOM

3 PIPE ROUTING - BDF ROOM

4 FLOOR DRAIN LOCATION - MECHANICAL ROOM

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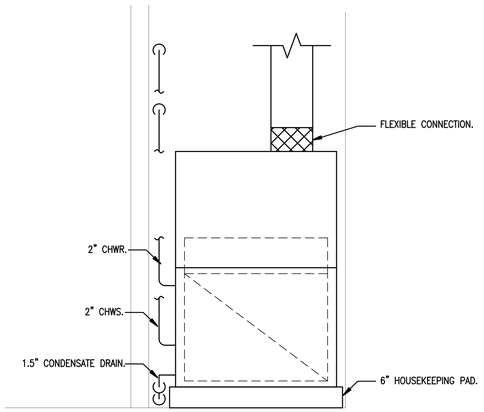
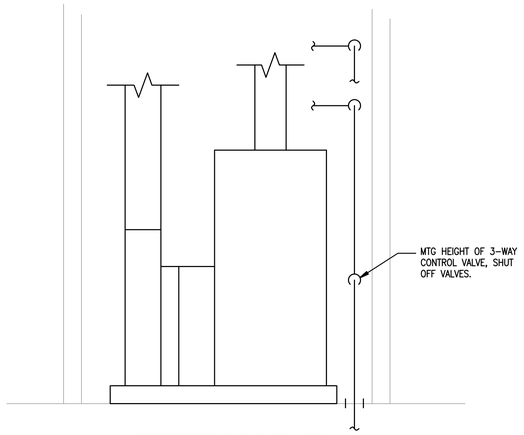
BE Project No. 15044-15-03

Drawn By: JPB/NPT

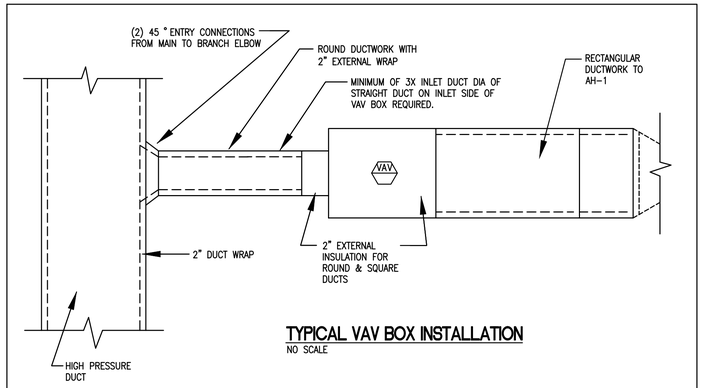
Drawing No. M202



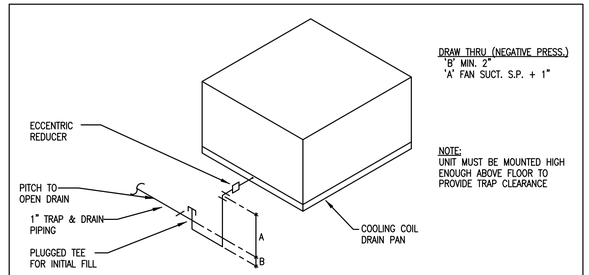
SECTION A-A
1/2"=1'-0"



SECTION B-B
1/2"=1'-0"

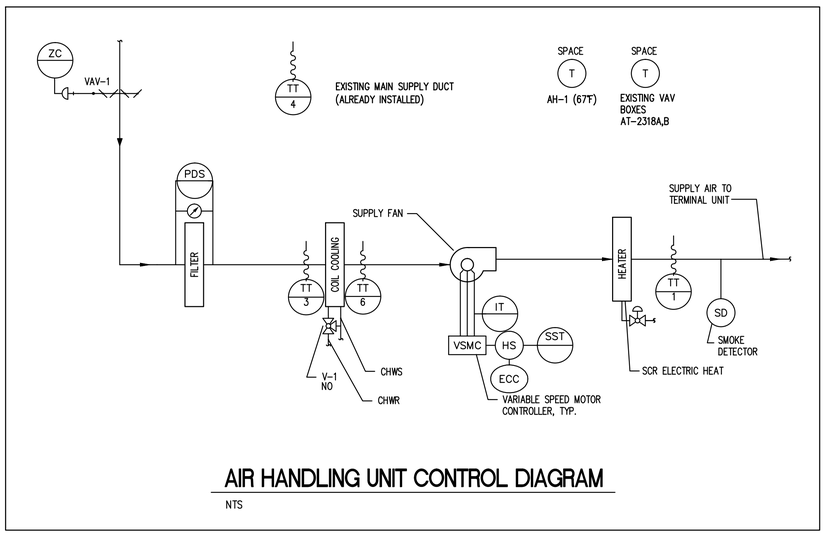


TYPICAL VAV BOX INSTALLATION
NO SCALE

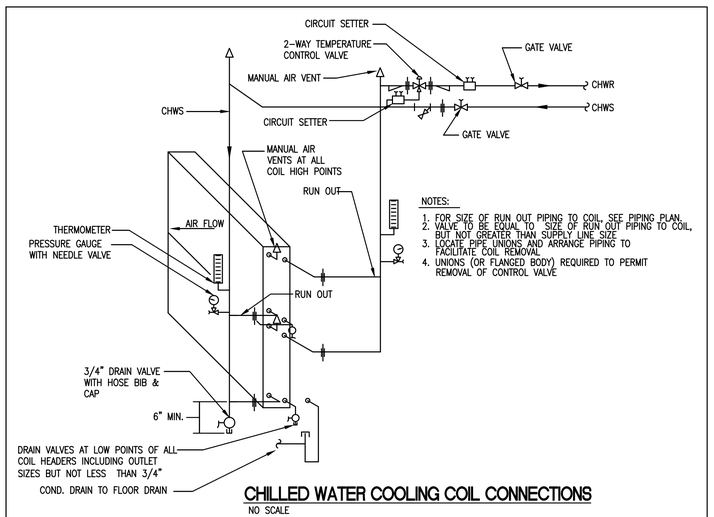


COOLING COIL DRAIN PAN PIPING DIAGRAM
NO SCALE

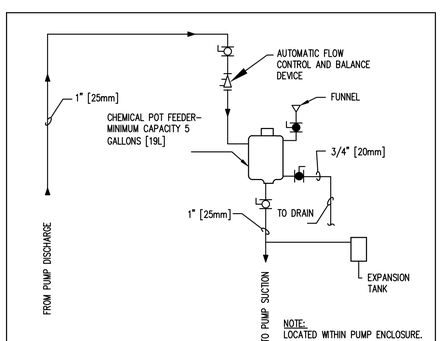
DUCT CONNECTIONS



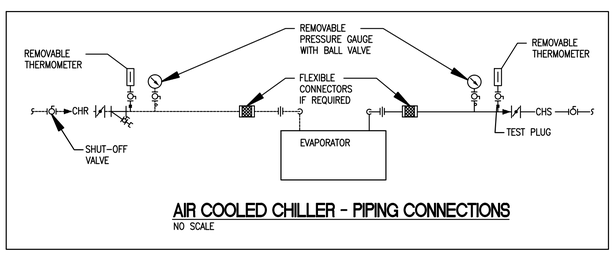
AIR HANDLING UNIT CONTROL DIAGRAM
NTS



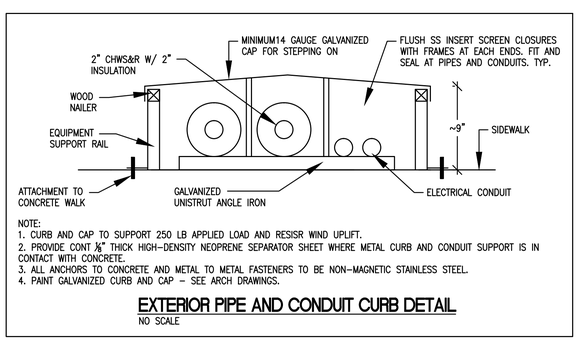
CHILLED WATER COOLING COIL CONNECTIONS
NO SCALE



WATER TREATMENT - CLOSED SYSTEMS
NO SCALE

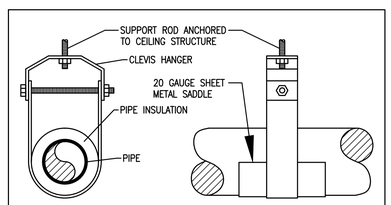


AIR COOLED CHILLER - PIPING CONNECTIONS
NO SCALE



NOTE:
1. CURB AND CAP TO SUPPORT 250 LB APPLIED LOAD AND RESISR WIND UPLIFT.
2. PROVIDE CONT ⅛" THICK HIGH-DENSITY NEOPRENE SEPARATOR SHEET WHERE METAL CURB AND CONDUIT SUPPORT IS IN CONTACT WITH CONCRETE.
3. ALL ANCHORS TO CONCRETE AND METAL TO METAL FASTENERS TO BE NON-MAGNETIC STAINLESS STEEL.
4. PAINT GALVANIZED CURB AND CAP - SEE ARCH DRAWINGS.

EXTERIOR PIPE AND CONDUIT CURB DETAIL
NO SCALE



TYPICAL PIPE HANGER DETAIL
NO SCALE

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f 312.440.2303
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MECHANICAL DETAILS AND DIAGRAMS

BE Project No.
15044-15-03

Drawn By:
JPB/NPT

Drawing No.
M300

GENERAL SYMBOLS AND ABBREVIATIONS

CONDUIT

- CONDUIT STUBBED UP
- CONDUIT STUBBED DOWN
- FEEDER CONDUIT – TAG INDICATES PANEL FEEDER NUMBER REFER TO FEEDER SCHEDULE

RECEPTACLES

- SINGLE 20A RECEPTACLE, MOUNTED AT 15" AFF U.N.O.
- SINGLE 20A RECEPTACLE, MOUNTED 6" ABOVE COUNTER
- DUPLEX 20A RECEPTACLE, MOUNTED AT 15" AFF U.N.O.
- DUPLEX 20A RECEPTACLE, MOUNTED 6" ABOVE COUNTER
- DUPLEX 20A GFI RECEPTACLE, MOUNTED 15" AFF U.N.O.
- DUPLEX 20A GFI RECEPTACLE, MOUNTED 6" ABOVE COUNTER
- QUADPLEX 20A RECEPTACLE, MOUNTED 15" AFF U.N.O.
- QUADPLEX 20A GFI RECEPTACLE, MOUNTED 15" AFF U.N.O.
- QUADPLEX 20A RECEPTACLE, MOUNTED 6" ABOVE COUNTER
- QUADPLEX 20A GFI RECEPTACLE, MOUNTED 6" ABOVE COUNTER
- SPECIAL USE RECEPTACLE, SIZED AS INDICATED OR AS REQUIRED
- FLUSH MOUNTED FLOOR BOX, WITH DEVICES AS INDICATED
- DUPLEX 20A RECEPTACLE, FLUSH MOUNTED IN CEILING
- DUPLEX 20A SWITCHED RECEPTACLE, MOUNTED AT 15" AFF U.N.O.
- DUPLEX 20A SWITCHED RECEPTACLE, W/ DUPLEX USB PORTS, HUBBELL #USB15X2W MOUNTED AT 15" AFF U.N.O.
- RETRACTABLE CORD REEL W/ DUPLEX 20A RECEPTACLE, CEILING–MOUNTED

POWER DISTRIBUTION

- PULLBOX, SIZED AS REQUIRED
- WALL MOUNTED JUNCTION BOX, SIZED AS REQUIRED (4"x4" MIN.)
- JUNCTION BOX, SIZED AS REQUIRED
- FLEXIBLE METAL CONDUIT CONNECTION (WHIP)
- MOTOR CONNECTION, 1ø OR 3ø AS INDICATED
- T – TRANSFORMER, SIZE AND RATING AS INDICATED
- PANEL BOARD, SIZED AS INDICATED
- C – CONTACTOR WITH ENCLOSURE, RATING AS INDICATED OR SCHEDULED
- CB – CIRCUIT BREAKER WITH ENCLOSURE, RATING AS INDICATED OR SCHEDULED
- CP – CONTROL PANEL
- COMBINATION STARTER/DISCONNECT EQUIPMENT–FURNISHED
- MOTOR STARTER, SIZED AS REQUIRED
- M – METER
- T – LOW VOLTAGE TEMPERATURE SENSOR (BY OTHERS), 4x4 BOX JUNCTION BOX WITH 3/4" CONDUIT STUBBED INTO ACCESSIBLE CEILING SPACE. COORDINATE LOCATIONS AND BOX SIZE WITH MECHANICAL CONTRACTOR.
- C – LOW VOLTAGE CO2/TEMP SENSOR (BY OTHERS), 4x4 BOX JUNCTION BOX WITH 3/4" CONDUIT STUBBED INTO ACCESSIBLE CEILING SPACE. COORDINATE LOCATIONS AND BOX SIZE WITH MECHANICAL CONTRACTOR.
- H – LOW VOLTAGE HUMIDITY SENSOR (BY OTHERS), 4x4 BOX JUNCTION BOX WITH 3/4" CONDUIT STUBBED INTO ACCESSIBLE CEILING SPACE. COORDINATE LOCATIONS AND BOX SIZE WITH MECHANICAL CONTRACTOR.
- HD – HAND/HAIR DRYER, COORDINATE MOUNTING HEIGHT IN FIELD.

SWITCHES

- $ – TOGGLE SWITCH, MOUNTED AT 44" AFF, U.N.O.
- $K – KEY OPERATED TOGGLE SWITCH, MOUNTED AT 44" AFF, U.N.O.
- $T – TOGGLE SWITCH WITH LOCAL TIMER
- $D – TOGGLE SWITCH, DIMMABLE, MOUNTED AT 44" AFF, U.N.O.
- $P – TOGGLE SWITCH, WITH PILOT LIGHT, MOUNTED AT 44" AFF, U.N.O.
- $OS1 – TOGGLE SWITCH WITH INTEGRAL INFRARED OCCUPANCY SENSOR, MOUNTED AT 44" AFF, U.N.O. HUBBELL #LHIR SERIES
- $OS2 – TOGGLE SWITCH WITH INTEGRAL DUAL–TECHNOLOGY OCCUPANCY SENSOR, MOUNTED AT 44" AFF, U.N.O. HUBBELL #LHDT SERIES
- $OS3 – TOGGLE SWITCH WITH INTEGRAL ULTRASONIC OCCUPANCY SENSOR, MOUNTED AT 44" AFF, U.N.O. HUBBELL #LHUS SERIES
- $3W – 3–WAY TOGGLE SWITCH, MOUNTED AT 44" AFF, U.N.O.
- $4W – 4–WAY TOGGLE SWITCH, MOUNTED AT 44" AFF, U.N.O.
- OS1 – 360° CEILING MOUNTED INFRARED OCCUPANCY SENSOR HUBBELL #OMNI–IR SERIES WITH UV–PP POWER PACK
- OS2 – 360° CEILING MOUNTED DUAL–TECHNOLOGY OCCUPANCY SENSOR HUBBELL #OMNI–DT SERIES WITH UV–PP POWER PACK
- OS3 – 360° CEILING MOUNTED ULTRASONIC OCCUPANCY SENSOR HUBBELL #OMNI–US SERIES WITH UV–PP POWER PACK
- 3–POLE NON–FUSED DISCONNECT SWITCH, SIZED AS INDICATED OR AS REQUIRED
- F – 3–POLE FUSED DISCONNECT SWITCH, SIZED AS INDICATED OR AS REQUIRED
- PANIC BUTTON
- DOORBELL BUTTON ALARM

LOW VOLTAGE

- VOICE/DATA OUTLET, MOUNTED AT 15" AFF U.N.O. PROVIDE 4x4 JUNCTION BOX WITH 1"C STUBBED INTO ACCESSIBLE CEILING SPACE.
- VOICE/DATA OUTLET, MOUNTED 6" ABOVE COUNTER U.N.O. PROVIDE 4x4 JUNCTION BOX WITH 1"C STUBBED INTO ACCESSIBLE CEILING SPACE.
- VOICE OUTLET, MOUNTED AT 48" AFF U.N.O. PROVIDE 4x4 JUNCTION BOX WITH 1"C STUBBED INTO ACCESSIBLE CEILING SPACE. PROVIDE WALL PLATE COMPATIBLE WITH OWNER FURNISHED PHONE.
- DATA OUTLET, MOUNTED AT 15" AFF U.N.O. PROVIDE 4x4 JUNCTION BOX WITH 1"C STUBBED INTO ACCESSIBLE CEILING SPACE.
- F – DATA OUTLET, MOUNTED WITHIN FURNITURE
- CAMERA WITH DATA CONNECTION. PROVIDE FINAL CONNECTION TO CAMERA PER MANUFACTURER RECOMMENDATIONS. PROVIDE GREEN DATA JACK ON OTHER END, PLUGGED DIRECTLY INTO SWITCH.
- DATA OUTLET, CEILING MOUNTED. PROVIDE SINGLE GANG JUNCTION BOX WITHIN CEILING TILE.
- WAP – WIRELESS ACCESS POINT, MOUNTED ABOVE CEILING.
- TV – CABLE TELEVISION (CATV) OUTLET, LOCATED AT 15" AFF U.N.O. PROVIDE 4x4 JUNCTION BOX WITH 3/4"C STUBBED INTO ACCESSIBLE CEILING SPACE.
- WALL MOUNTED MICROPHONE JACK, MOUNTED AT 15" AFF, U.N.O.
- RS – RESCUE ASSISTANCE CALL STATION
- RSP – RESCUE ASSISTANCE SYSTEM HEADEND
- TTB – TELEPHONE TERMINAL BOARD. PROVIDE 5/8" PLYWOOD BACKBOARD, 4'–0" x 8'–0".
- PP – PUSH PLATE
- IDF – INTERMEDIATE DISTRIBUTION FRAME (CABINET)
- IC – INTERCOM STATION
- THREE BUTTON ROLL–UP DOOR CONTROLLER
- PJ – CEILING MOUNTED PROJECTOR

FIRE ALARM

- FCP – FIRE ALARM CONTROL PANEL
- FAA – FIRE ALARM ANNUNCIATOR PANEL
- PS – DUAL–ACTION MANUAL PULL STATION, MOUNTED AT 44" AFF
- SD – CEILING MOUNTED PHOTO–ELECTRIC SMOKE DETECTOR
- HD – CEILING MOUNTED HEAT DETECTOR
- HD FT – CEILING MOUNTED HEAT DETECTOR, FIXED TEMPERATURE
- DD – DUCT MOUNTED SMOKE DETECTOR, INSTALLED PER NFPA REQUIREMENTS
- R – FAN SHUTDOWN RELAY
- AV – AUDIO–VISUAL DEVICE, MOUNTED AT 80" AFF, CANDELA RATING AS REQUIRED
- A – AUDIO DEVICE, MOUNTED AT 80" AFF
- V – VISUAL DEVICE, MOUNTED AT 80" AFF, CANDELA RATING AS REQUIRED
- DOOR HOLD–OPEN DEVICE, MOUNTED AS REQUIRED
- DC – DOOR CLOSER
- KB – LOCKABLE KEY (KNOX) BOX, PER LOCAL FIRE AUTHORITY REQUIREMENTS
- RA – REMOTE ANNUNCIATOR
- FS – FLOW SWITCH
- TS – TAMPER SWITCH

SECURITY

- SCP – SECURITY SYSTEM CONTROL PANEL
- DVR – DIGITAL VIDEO RECORDER, SIZED AS SPECIFIED
- TV – VIDEO MONITOR, 19" U.N.O.
- CR – CARD READER, MOUNTED AT 44" AFF, U.N.O.
- KP – KEY PAD, MOUNTED AT 44" AFF, U.N.O.
- KB – KNOX BOX
- GB – GLASS BREAK DETECTOR
- DOOR CONTACT
- CCTV CAMERA, SEE MATRIX ON SHEET E200
- PIR MOTION DETECTOR, MOUNTED AS REQUIRED
- ES – ELECTRIC STRIKE, FURNISHED BY DOOR PROVIDER, WIRED BY E.C.

MISCELLANEOUS

- ---------- INDICATES COMPONENT TO BE REMOVED
- ——— INDICATES EXISTING TO REMAIN
- ——— INDICATES NEW
- XRR – DENOTES EXISTING TO BE REMOVED AND RELOCATED
- XN – DENOTES EXISTING COMPONENT IN ITS NEW LOCATION
- X – DENOTES EXISTING COMPONENT TO REMAIN
- P – FLEXIBLE POWER CONNECTION TO FURNITURE. SEE SHEET E501, DETAIL #12.
- D – FLEXIBLE DATA CONNECTION TO FURNITURE. SEE SHEET E501, DETAIL #11.

AFF	ABOVE FINISHED FLOOR
AMP OR A	AMPERE
ARCH	ARCHITECTURAL
ATS	AUTOMATIC TRANSFER SWITCH
A/V	AUDIO/VISUAL
AUX	AUXILIARY
BLDG	BUILDING
C	CLOCK OR CONDUIT
CB	CIRCUIT BREAKER
CCT	CIRCUIT
CCTV	CLOSED CIRCUIT TELEVISION
CLG	CEILING
C/T	CURRENT TRANSFORMER
D	DIMMER
dB	DECIBEL
DIA	DIAMETER
DIM	DIMENSION
DISC	DISCONNECT
DIST	DISTRIBUTION
DN	DOWN
DW	DISHWASHER
DWG	DRAWING
EC	ELECTRICAL CONTRACTOR
EL	ELEVATION OR ELEVATOR
ELEC	ELECTRICAL
ELEV	ELEVATOR
EM OR EMERG	EMERGENCY
EQ OR EQUIP	EQUIPMENT
EWC	ELECTRIC WATER COOLER
EWH	ELECTRIC WATER HEATER
EXIST	EXISTING
EXP	EXPOSED
FA	FIRE ALARM
FC	FOOT CANDLE
FDR	FEEDER
FIXT	FIXTURE
FL	FLOOR
FLA	FULL LOAD AMPERE
FLEX	FLEXIBLE
FLUOR	FLUORESCENT
FT	FOOT, FEET
GFI OR GFCI	GROUND FAULT CIRCUIT INTERRUPTER
GRD	GROUND, GROUNDING
HID	HIGH INTENSITY DISCHARGE (LAMP)
HORIZ	HORIZONTAL
HP	HORSEPOWER
HTR	HEATER
HV	HIGH VOLTAGE
HVAC	HEATING, VENTILATING AND AIR COND.
HZ	HERTZ (CYCLES PER SECOND)
IG	ISOLATED GROUND
IN	INCH, INCHES
INCAND	INCANDESCENT
JB	JUNCTION BOX
KV	KILOVOLT
KVA	KILOVOLT AMPERE
KW	KILOWATT
LTG	LIGHTING
MAX	MAXIMUM
MC	MECHANICAL CONTRACTOR
MCC	MOTOR CONTROL CENTER
MECH	MECHANICAL, MECHANISM
MFR	MANUFACTURER
MH	MANHOLE OR MOUNTING HEIGHT
MIN	MINIMUM
MISC	MISCELLANEOUS
MTD	MOUNTED
MTG	MOUNTING
NEUT	NEUTRAL
NIC	NOT IN CONTRACT
NL	NIGHT LIGHT
NTS	NOT TO SCALE
OC	OVER CURRENT OR ON CENTER (SPACING)
PIR	PASSIVE INFRA RED
P	POLE
PA	PUBLIC ADDRESS SYSTEM
PB	PULL BOX OR PUSH BUTTON
PH OR ø	PHASE
PL	PILOT LIGHT
PNL	PANEL
PVC	POLYVINYL CHLORIDE
RECEP	RECEPTACLE
REF	REFERENCE OR REFRIGERATOR
REQ'D	REQUIRED
REV	REVISE/REVISION
RM	ROOM
SCHED	SCHEDULE
SPEC	SPECIFICATION
SQ. FT.	SQUARE FEET
STD	STANDARD
SWBD	SWITCHBOARD
TEMP	TEMPERATURE
T	THERMAL OVERLOAD OR LOCAL TIMER
XFMR	TRANSFORMER
TTB	TELEPHONE TERMINAL BOARD
TV	TELEVISION
TYP	TYPICAL
V	VOLT
W	WATT OR WIRE
W/	WITH
WP	WEATHER PROOF
X	EXISTING TO REMAIN
XR	EXISTING TO BE REMOVED
XRI	EXISTING TO BE REMOVED AND RE–INSTALLED
XN	EXISTING COMPONENT IN ITS NEW LOCATION
XP	EXPLOSION PROOF
XRR	EXISTING TO BE REMOVED AND RELOCATED

APPLICABLE BUILDING CODES:

ALL CONSTRUCTION SHALL COMPLY WITH DUPAGE COUNTY ADOPTED BUILDING CODES, ORDINANCES AND AMENDMENTS:

–2015 INTERNATIONAL BUILDING CODE
–2014 NATIONAL ELECTRIC CODE (NFPA 70)
–2015 INTERNATIONAL ENERGY CONSERVATION CODE
–2015 INTERNATIONAL MECHANICAL CODE
–1997 ILLINOIS ACCESSIBILITY CODE
–2014 ILLINOIS PLUMBING CODE
–CITY AMENDMENTS

GENERAL NOTES:

1. CONTRACTOR SHALL PAY FOR & OBTAIN ALL REQUIRED LICENSES, INSURANCES, PERMITS & SATISFY NECESSARY ORDINANCES TO UNDERTAKE & EXECUTE THE WORK UNDER THIS CONTRACT.
2. FAMILIARIZE YOURSELF WITH THE EXISTING SITE CONDITIONS, CONDITIONS OF CONTRACT, THE SCOPE OF WORK & THE DESIGN INTENT PRIOR TO SUBMITTING YOUR BID. REQUESTS FOR EXTRA PAYMENTS WILL NOT BE APPROVED AFTER CONTRACT AWARD.
3. ALL WORK SHALL BE PERFORMED IN COMPLIANCE WITH REQUIREMENTS OF THE LATEST LOCAL CODE AUTHORITY & OTHER CODES, STANDARDS & REGULATIONS REFERENCED BY SUCH AUTHORITY. IN CASE OF CONFLICT BETWEEN THE CODES, THE REQUIREMENT OF THE LOCAL AUTHORITY SHALL GOVERN.
4. COORDINATE ELECTRICAL INSTALLATION WITH WORK BY OTHER TRADES PRIOR TO PERFORMING WORK. PERFORM ALL WORK IN COOPERATION WITH LANDLORD, G.C. & OTHER TRADES.
5. ALL MATERIAL/EQUIPMENT SHALL BE NEW, U.L. LISTED, WITHOUT DEFECT OR DAMAGE AND SHALL BE A STANDARD PRODUCT OF A MANUFACTURER. WIRING DEVICES SHALL BE SPECIFICATION GRADE.
6. ELECTRICAL DWGS. ARE SCHEMATIC IN NATURE. THEY DO NOT INTEND TO SHOW EVERY DETAIL, LOCATION, SIZE, ROUTE ETC. FURNISH ALL MATERIAL, EQUIPMENT, INCIDENTALS & SERVICES TO PROVIDE A SATISFACTORY, COMPLETE & OPERATIONAL SYSTEM.
7. PROVIDE TEMPORARY ELECTRICAL SERVICE PER G.C. TO PROVIDE LIGHTING & POWER FOR USE BY ALL TRADES DURING CONSTRUCTION.
8. MINIMUM CONDUIT SIZE SHALL BE 3/4" UNLESS NOTED OTHERWISE. PROVIDE COMPRESSION FITTINGS. SET SCREW FITTINGS ARE NOT PERMITTED.
9. COORDINATE INSTALLATION OF ALL EQUIPMENT WITH ARCHITECTURAL, MECHANICAL, PLUMBING, AND FIRE PROTECTION CONTRACTOR.
10. IT IS CONTRACTOR'S RESPONSIBILITY TO REVIEW ALL DRAWINGS IN THIS PROJECT PRIOR TO BIDDING.

GENERAL DEMOLITION NOTES:

1. EXISTING ELECTRICAL SYSTEMS SHOWN ON THE DRAWINGS BASED ON VISUAL INSPECTION AND EXISTING DRAWINGS. BUT THEY MAY NOT REFLECT THE EXTERNAL CONDITION IN EVERY CASE. THE CONTRACTOR SHALL VISIT THE SITE PRIOR TO SUBMITTING A BID AND VERIFY EXISTING CONDITIONS.
2. THE BUILDING WHERE THE WORK TO BE DONE IS IN USE. SCHEDULE ANY DISCONNECTION & RECONNECTIONS WITH THE CONTRACTING OFFICER, AT LEAST TWO (2) WEEKS NOTICE IS REQUIRED. ARRANGE WORK SO AS NOT TO INTERRUPT ANY ELECTRICAL POWER, TELEPHONE, FIRE, COMMUNICATION, AND OTHER SYSTEMS DURING NORMAL WORKING HOURS.
   A. WHERE CORE DRILLING AND CUTTING OF FLOOR OR WALLS IS REQUIRED, USE METAL DETECTORS OR OTHER APPROVED DEVICES TO DETERMINE AND AVOID INTERFERENCE WITH EXISTING CONCEALED CONDUITS & PIPES.
   B. USE GREAT DILIGENCE AND CARE IN DISCONNECTING VARIOUS SYSTEMS. RECONNECT SYSTEMS THAT SERVE ADJACENT AREAS IS SUCH SYSTEMS HAVE BEEN DISRUPTED DURING DEMOLITION WORK. EXTEND CONDUIT & WIRING AS REQUIRED TO MAINTAIN OPERATION OF REMOVING EQUIPMENT OR DEVICES.
   C. COORDINATE ALL DEMOLITION WORK WITH OTHER TRADES AS REQUIRED.
3. ELECTRICAL ITEMS REMOVED AND NOT RELOCATED SUCH AS LIGHTING FIXTURES, SWITCHES, RECEPTACLES, BREAKERS, WIRE, ET. REMAIN THE PROPERTY OF THE OWNER AND SHALL BE STORED OR DISPOSED OF AS DIRECTED BY OWNER.
4. ALL CONDUITS WHERE ELECTRICAL ITEMS ARE BEING REMOVED SHALL HAVE ALL WIRING REMOVED BACK TO THE SOURCE OR FEEDER JUNCTION BOX SERVING THE DEVISE AND STUBS SHALL BE PLUGGED FLUSH WITH FLOOR, CEILING SLABS, OR WALLS. ALL EXPOSED CONDUIT AND FITTINGS, INCLUDING ABOVE DROP CEILINGS, THAT IS NOT USED OR REUSED SHALL BE REMOVED UNLESS OTHERWISE NOTED.
5. WHERE EXISTING ELECTRICAL ITEMS THAT ARE OUTSIDE THE CONTRACT LIMITS OF CONSTRUCTION ARE TO REMAIN BUT ARE AFFECTED BY THE EXECUTION OF ELECTRICAL WORK SUCH AS RECONDITIONING OF WALL AND CEILINGS SHALL BE REMOVED, CLEANED, AND REINSTALLED INLINE WITH NEW WALLS OR CEILINGS.
6. LAMPS THAT CONTAIN MERCURY AND BALLASTS MANUFACTURED PRIOR TO 1980 THAT CONTAINS PCBs SHALL BE DISPOSED OF BY FEDERAL OR STATED E.P.A. APPROVED METHOD AND IN ACCORDANCE WITH SPECIFICATIONS.
7. EXISTING PANEL BOARDS SHOWN ON THE DRAWINGS ARE TO BE MODIFIED AND NEW OVER CURRENT DEVICES AND CONNECTIONS ADDED. ENSURE THAT SHORT CIRCUIT INTERRUPTING CAPACITY OF NEW OVERCURRENT DEVICES SHALL MATCH OR EXCEED EXISTING.

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t 312.440.2300
f 312.440.2303
www.baileyedward.com

35 East Wacker Dr
Suite 2800
Chicago, IL
60601-2308

Owner
College of DuPage
425 Fawell Blvd.
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Issue Date	Title
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07/20/2017	ISSUE FOR BID

COLLEGE OF DUPAGE
CADAVER LAB
PHASE 2

Drawing Title

NOTES, SYMBOL LISTS, AND ABBREVIATIONS

BE Project No. 15044-15-03

Drawn By: JPB/NPT

Drawing No. E000

DEMOLITION NOTES:

D-1 DISCONNECT AND REMOVE EXISTING RECESSED 2X4 LIGHTING FIXTURE IN THE AREA AFFECTED BY DEMOLITION DUE TO CONSTRUCTION OF NEW HVAC CLOSET. SECURE BRANCH CIRCUIT WIRING TO BE EXTENDED TO NEW CLOSET LIGHTING FIXTURE(S).

ELECTRICAL KEY NOTES:

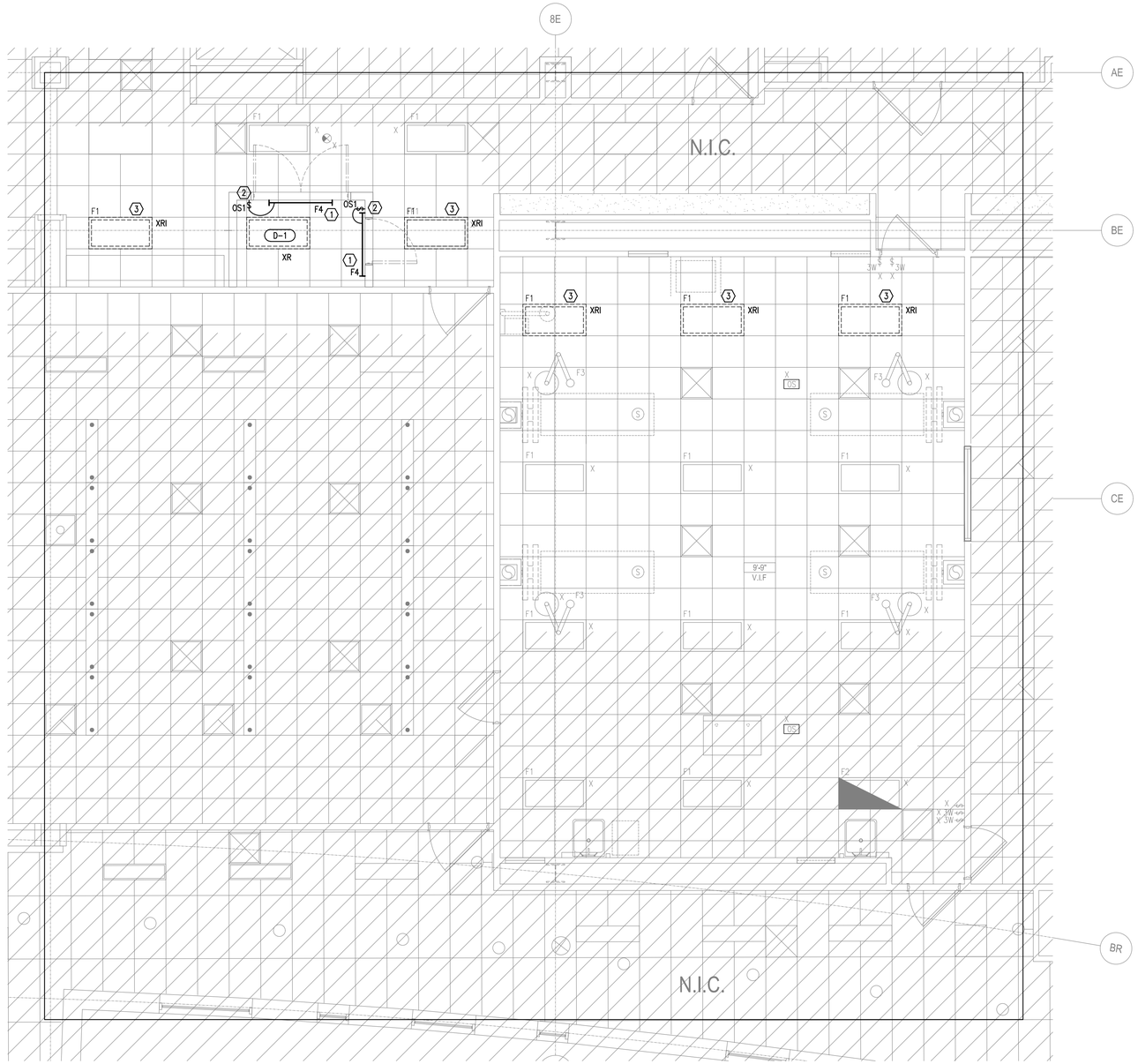
1. PROVIDE NEW LIGHTING FIXTURE IN THE CLOSET AS SHOWN. EXTEND EXISTING LIGHTING BRANCH CIRCUIT SERVING THE AREA TO NEW LIGHTING FIXTURE. CONNECT NEW LIGHTING FIXTURE TO NEW WALL-MOUNTED OCCUPANCY SENSOR SWITCH FOR CONTROL AS SHOWN ON PLAN.
2. PROVIDE NEW WALL-MOUNTED OCCUPANCY SENSOR SWITCH TO CONTROL CLOSET LIGHTING AS SHOWN. FIELD COORDINATE SUITABLE LOCATION.
3. REMOVE AND REINSTALL LIGHTING FIXTURE(S) AS REQUIRED TO INSTALL NEW MECHANICAL DUCTWORK ABOVE CEILING.

LIGHTING FIXTURE SCHEDULE

TYPE	LAMP QTY.	LAMP TYPE	MOUNTING	VOLTAGE	WATTS	MANUFACTURER AND MODEL	DESCRIPTION
F4	N/A	LED	WALL	277	31	PHILIPS DAY-BRITE CFI CUBELITE LED SERIES	WALL SURFACE MOUNTED LINEAR LED FIXTURE WITH DIE-FORMED HEAVY GAUGE COLD ROLLED STEEL CHASSIS, CLEAR PROSMATIC LENS, 2800 LUMENS

NOTE:

VERIFY VOLTAGE IN THE FIELD PRIOR TO ANY PURCHASE.



1 LIGHTING 2nd FLOOR NEW WORK PLAN

SCALE: 1/4" = 1'

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t 312.440.2300
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CADAVER LAB
PHASE 2

Drawing Title

LIGHTING 2nd FLOOR NEW WORK AND DEMOLITION PLAN

BE Project No. 15044-15-03

Drawn By: JPB/NPT

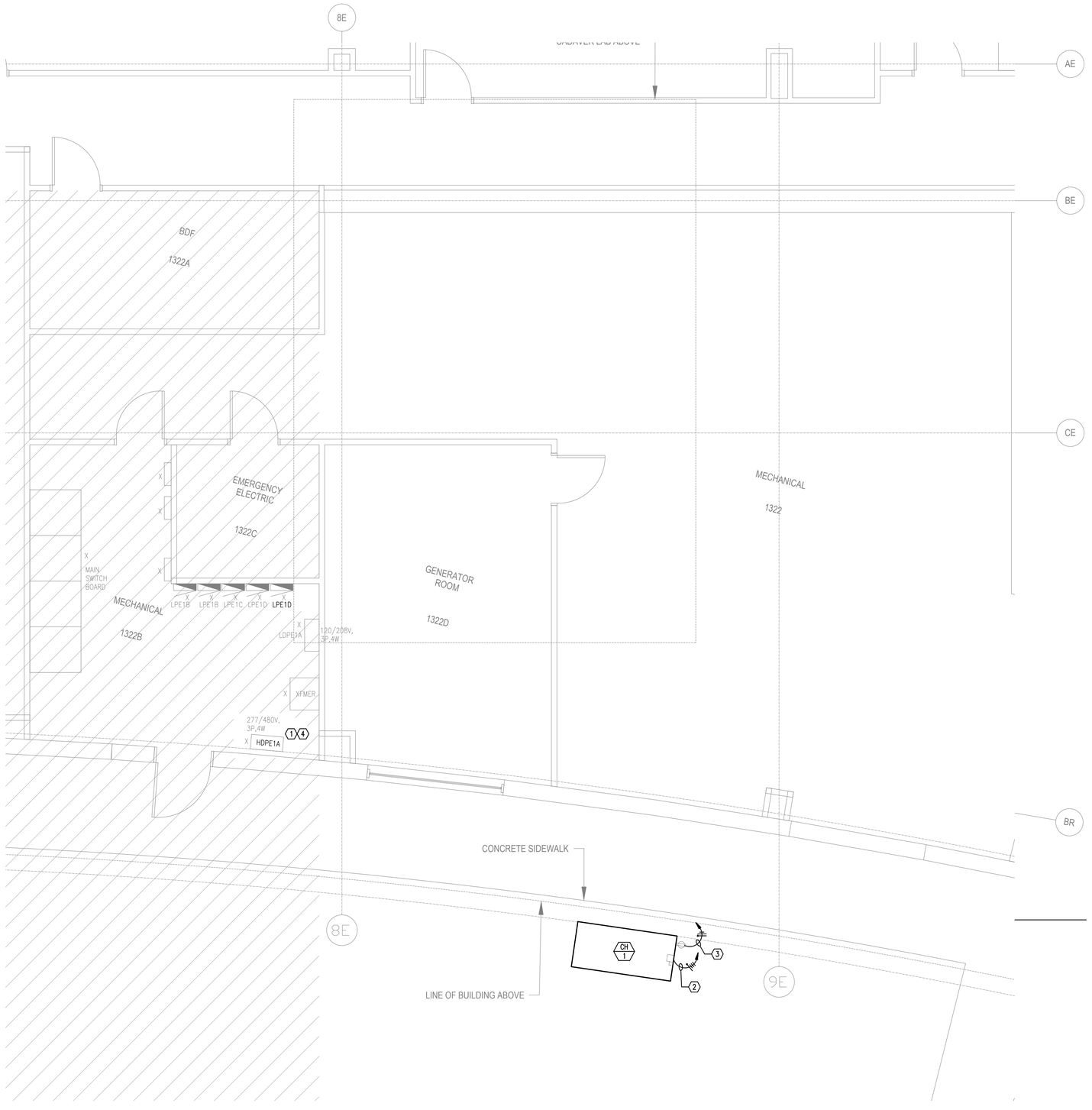
Drawing No. E101

GENERAL ELECTRICAL NOTES:

1. ALL CONDUCTORS MUST BE 90-DEGREE COPPER UNLESS NOTED OTHERWISE.
2. VERIFY EQUIPMENT REQUIREMENTS WITH SHOP DRAWINGS, PROVIDE CONDUIT, WIRING AND OTHER DEVICES AS REQUIRED.
3. ALL LIGHTING FIXTURES ARE EXISTING TO REMAIN, NO LIGHTING WORK TO BE DONE.

ELECTRICAL KEY NOTES:

1. PROVIDE ONE (1) NEW GE TYPE FC 80A/3P CIRCUIT BREAKER IN ONE OF THE TWO SPACES IN PANEL "HDPE1A" TO SERVE THE NEW CHILLER EQUIPMENT. THE NEW CIRCUIT BREAKER SHALL HAVE AN INTERRUPTING CAPACITY RATING EQUAL TO OR GREATER THAN THE EXISTING ONES IN THE SAME PANEL.
2. COORDINATE WITH HVAC CONTRACTOR AND VERIFY EXACT LOCATION AND MOUNTING HEIGHT OF EQUIPMENT-FURNISHED NON-FUSED DISCONNECT. PROVIDE POWER TO HVAC EQUIPMENT BY ROUTING 3 #4 AWG+1 #8 (GRD)-1"C FROM EQUIPMENT DISCONNECT TO EXISTING DISTRIBUTION PANEL "HDPE1A" IN THE MAIN ELECTRIC ROOM (ROOM 1322B) ON THE FIRST FLOOR. CONNECT TO NEW 80A/3P CIRCUIT BREAKER STIPULATED IN NOTE #1 ABOVE. CONDUIT ROUTING TO FOLLOW CHWS&R PIPING-SEE M-SHEETS AND A-SHEETS.
3. COORDINATE WITH HVAC CONTRACTOR AND VERIFY EXACT LOCATION AND MOUNTING HEIGHT OF EQUIPMENT-FURNISHED 120V, GFCI RECEPTACLE. PROVIDE POWER TO RECEPTACLE BY ROUTING 2 #12+1 #12 (GRD)-3/4"C FROM GFCI RECEPTACLE TO EXISTING PANEL "LPE1D" SECTION 2 IN THE MAIN ELECTRIC ROOM (ROOM 1322B) ON THE FIRST FLOOR. CONNECT TO EXISTING SPARE CIRCUIT BREAKER 44. CONDUIT ROUTING TO FOLLOW CHWS&R PIPING-SEE M-SHEETS AND A-SHEETS.
4. PROVIDE ONE (1) NEW GE TYPE FC 30A/3P CIRCUIT BREAKER IN ONE OF THE TWO SPACES IN PANEL "HDPE1A" TO SERVE THE NEW ELECTRIC DUCT HEATER (EDH-1) ON THE SECOND FLOOR HVAC CLOSET. THE NEW CIRCUIT BREAKER SHALL HAVE AN INTERRUPTING CAPACITY RATING EQUAL TO OR GREATER THAN THE EXISTING ONES IN THE SAME PANEL. REFER TO SHEET E201 FOR LOCATION OF EDH-1.



1 POWER AND AUXILIARY 1st FLOOR NEW WORK PLAN

SCALE: 1/4" = 1' (0, 2', 4', 8')

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www.baileyedward.com

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Suite 2800
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CADAVER LAB
PHASE 2

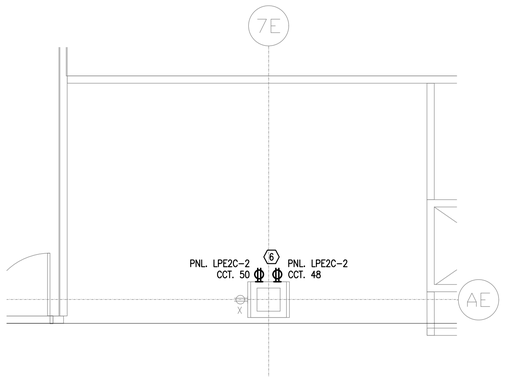
Drawing Title

POWER AND AUXILIARY 1st FLOOR NEW WORK PLAN

BE Project No. 15044-15-03

Drawn By: JPB/NPT

Drawing No. E200



2 SECOND FLOOR PARTIAL PLAN

SCALE: 1/4" = 1'

NORTH

GENERAL NOTES:

1. VERIFY WITH ARCHITECTURAL DRAWINGS AND ELEVATIONS EXACT LOCATION AND MOUNTING HEIGHT OF ELECTRICAL DEVICES. FIELD COORDINATE EXACT CONNECTION TYPE.

ELECTRICAL KEY NOTES:

1. PROVIDE NEW ONE (1) 30A/3P CIRCUIT BREAKER IN EXISTING PANEL "LPE2C-2" CCTS 66-68-70 TO POWER NEW AIR HANDLING UNIT AH-1.
2. COORDINATE WITH HVAC CONTRACTOR AND VERIFY THE EXACT LOCATION AND MOUNTING HEIGHT OF EQUIPMENT-FURNISHED VFD FOR NEW AIR HANDLING UNIT (AH-1). PROVIDE POWER TO EQUIPMENT BY ROUTING 3 #12 AWG+1 #10 (GRD)-3/4"C FROM VFD'S INTEGRAL DISCONNECT TO EXISTING PANEL "LPE2C-2" (LOCATED ON THE SAME FLOOR) AND CONNECT TO NEW 30A/3P CIRCUIT BREAKER STIPULATED IN NOTE #1 ABOVE.
3. FIELD COORDINATE WITH DIVISION 23 EXACT LOCATION OF DUCT-MOUNTED SMOKE DETECTOR AND REMOTE ANNUNCIATOR. INTERFACE DUCT-MOUNTED SMOKE DETECTOR WITH EXISTING FIRE ALARM SYSTEM. E.C. TO FURNISH AND WIRE, M.C. TO INSTALL.
4. PROVIDE NEW ONE (1) 70A/3P CIRCUIT BREAKER IN EXISTING PANEL "LPE2C-2" CCTS 72-74-76 TO POWER NEW ELECTRIC DUCT HEATER EDH-1.
5. PROVIDE NEW 30A/3P NON-FUSED DISCONNECT FOR NEW ELECTRIC DUCT HEATER (EDH-1), COORDINATE WITH HVAC CONTRACTOR AND VERIFY THE SUITABLE LOCATION AND MOUNTING HEIGHT OF DISCONNECT. PROVIDE POWER TO EQUIPMENT BY ROUTING 3 #10 AWG+1 #10 (GRD)-3/4"C FROM DISCONNECT TO EXISTING DISTRIBUTION PANEL "HDPE1A" (LOCATED ON THE FIRST FLOOR MAIN ELECTRIC ROOM 1322B) AND CONNECT TO NEW 30A/3P CIRCUIT BREAKER STIPULATED IN NOTE #4 ON SHEET E200. REFER TO SHEET E200 FOR LOCATION OF DISTRIBUTION PANEL.
6. PROVIDE TWO NEW DUPLEX RECEPTACLES AS SHOWN ON PLAN AND ROUTE 4 #12 AWG+1 #12 (GRD)-3/4"C FROM LOCATION OF THESE TWO NEW DUPLEX RECEPTACLES TO EXISTING PANEL "LPE2C-2" (LOCATED ON THE SAME FLOOR) AND CONNECT EACH DUPLEX RECEPTACLE TO SPARE CIRCUIT BREAKERS #48 AND #50 RESPECTIVELY. PROVIDE CONDUIT AND WIRING AS REQUIRED.

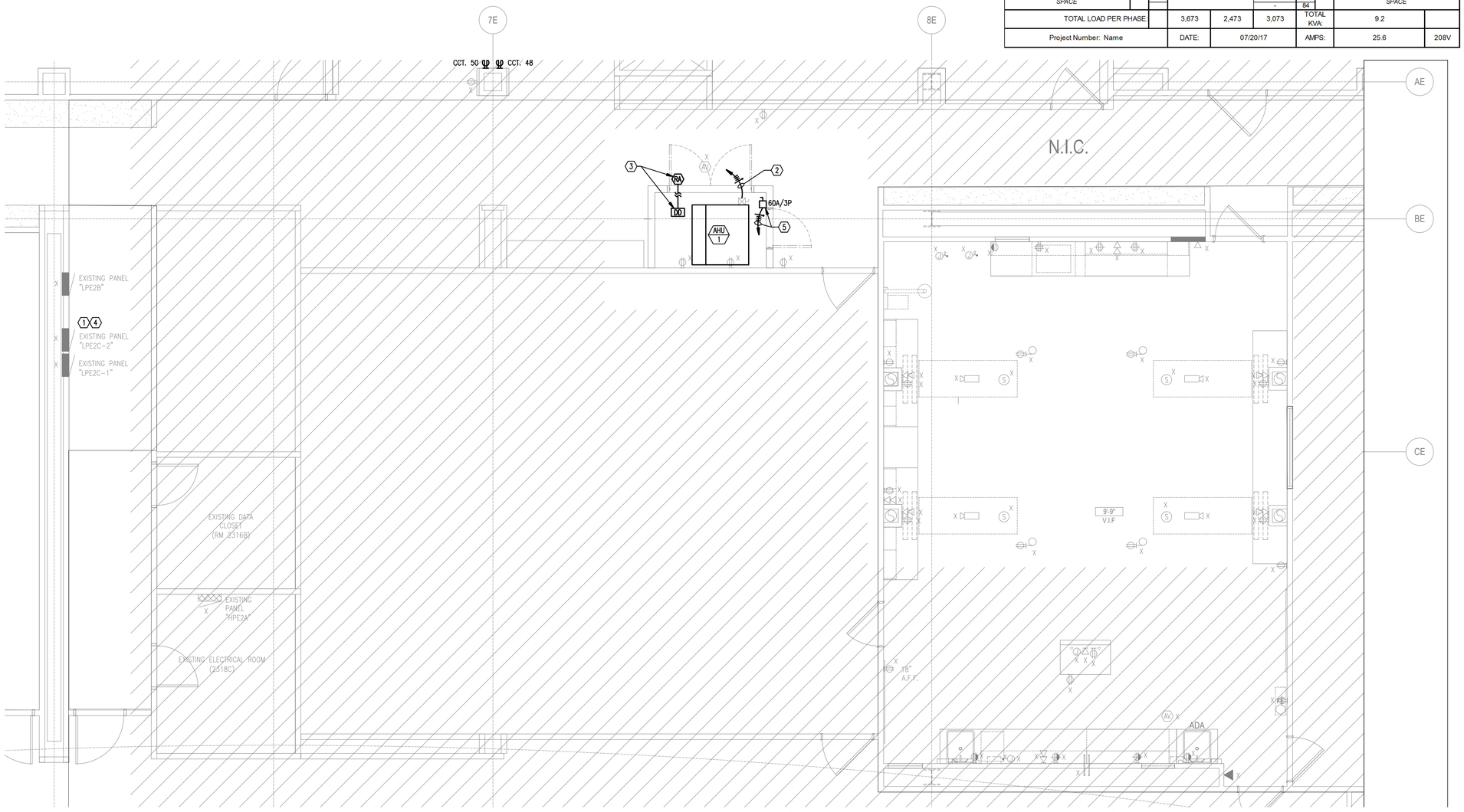
PANELBOARD SCHEDULE

LPE2C-2 — LOCATION: CORRIDOR ALONG GRID 6E

VOLTAGE: 120/208V-3 PHASE 4 WIRE — MAIN (A): 225 WITH GROUND BUS — MCB — MLO: X, X — MOUNT: RECESSED — TYPE: NEMA-1

USE/AND OR AREA SERVED	C/B	CIR. NO.	A	B	C	CIR. NO.	C/B	USE/AND OR AREA SERVED
RECEPTACLES 3316B	20/1	43	-			44	20/1	*Z E*
			-					
RECEPTACLES 3316B	20/1	45		-		46	20/1	*TRAP PRIMER*
				-				
RECEPTACLES 3316B	20/1	47			-	48	20/1	**REFRIGERATOR**
					1000			
RECEPTACLES 3316B	20/1	49	-			50	20/1	**REFRIGERATOR**
			1000					
RECEPTACLES - CADAVER LAB 2318	20/1	51		400		52	20/1	*SPARE*
				-				
RECEPTACLES - CADAVER LAB 2318	20/1	53			400	54	20/1	*SPARE*
					-			
DISHWASHER - CADAVER LAB 2318	20/1	55	1000			56	20/1	*SPARE*
			-					
RECEPTACLES, TV - CADAVER LAB 2318	20/1	57		800		58	20/1	*SPARE*
				-				
RECEPTACLES - CADAVER LAB 2318, RETRACTABLE - CEILING MOUNTED	20/1	59			400	60	20/1	*SPARE*
					-			
RECEPTACLES - CADAVER LAB 2318, RETRACTABLE - CEILING MOUNTED	20/1	61	400			62	20/1	*SPARE*
			-					
SPARE	20/1	63		-		64	20/1	*SPARE*
				-				
SPACE		65			-	66	30	**AHU-1 (3HP)**
					1273			
SPACE		67	-			68	3	
			1273					
SPACE		69		-		70		
				1273				
SPACE		71			-	72		*SPACE*
					-			
SPACE		73	-			74		*SPACE*
			-					
SPACE		75		-		76		*SPACE*
				-				
SPACE		77			-	78		*SPACE*
					-			
SPACE		79	-			80		*SPACE*
			-					
SPACE		81		-		82		*SPACE*
				-				
SPACE		83			-	84		*SPACE*
					-			
TOTAL LOAD PER PHASE:			3,673	2,473	3,073	TOTAL KVA:		9.2
Project Number: Name			DATE:	07/20/17		AMPS:		25.6

208V



1 POWER AND AUXILIARY 2nd FLOOR NEW WORK PLAN

SCALE: 1/4" = 1'

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t 312.440.2300
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www.baileyedward.com

35 East Wacker Dr
Suite 2800
Chicago, IL
60601-2308

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CADAVER LAB
PHASE 2

Drawing Title

POWER AND AUXILIARY 2nd FLOOR NEW WORK PLAN

BE Project No. 15044-15-03

Drawn By: JPB/NPT

Drawing No. E201

EXHIBIT C - Project Manual - HSC Cadaver Lab Renovation, Phase II Supplemental Cooling

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SPECIFICATIONS

College of DuPage
HSC Cadaver Lab Renovation
Phase II Supplemental Cooling

Project No. 15044-15-03

ISSUED FOR BID

July 20, 2017

College of DuPage
Health and Science Center
425 Fawell Blvd.
Glen Ellyn, IL 60137

BY:

Bailey Edward Design
35 E Wacker Drive, Suite 2800
Chicago, IL 60601-2314
t 312.440.2300
f 312.440.2303

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DRAWING INDEX:

SPECIFIERS:

General: Michael Petti, Bailey Edward (312) 789-4009, mpetti@baileyedward.com
Mechanical: Matt Montalbano, Bailey Edward
Electrical: Neil Nigos, Bailey Edward

END OF TABLE OF CONTENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Project information.
2. Work covered by Contract Documents.
3. Work by Owner.
4. Owner-furnished products.
5. Contractor-furnished, Owner-installed products.
6. Access to site.
7. Work restrictions.
8. Specification and drawing conventions.
9. Miscellaneous provisions.

1.3 PROJECT INFORMATION

A. Project Identification: College of DuPage Cadaver Lab Renovation Phase II Supplemental Cooling.
1. Project Location: HSC Building, 425 Fawell Boulevard, Glen Ellyn, IL 60137.

B. Owner: College of DuPage 425 Fawell Boulevard, Glen Ellyn, Illinois 60137.

1. Owner's Representative: David Lesniak.

C. Architect: Bailey Edward 35 East Wacker Drive, Chicago Illinois, 60601.

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

1. A/V Design.

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

a. None

1.4 WORK COVERED BY CONTRACT DOCUMENTS

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

1. The project includes the renovation of the existing 1128 square foot Cadaver Lab in the Health and Science Center building (HSC). The scope includes, but is not limited to: partial demolition,

partitions, interior finishes, casework, furnishings, and plumbing, mechanical ventilation, controls, electrical power, data, fire alarm, also A/V systems and controls. The scope also includes installation of Owner provided equipment.

B. Type of Contract:

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

1.5 WORK UNDER SEPARATE CONTRACTS

A. General: Cooperate fully with separate contractors so work on those contracts may be carried out smoothly, without interfering with or delaying work under this Contract or other contracts. Coordinate the Work of this Contract with work performed under separate contracts.

1.6 OWNER-FURNISHED PRODUCTS

A. Owner will furnish products indicated. The Work includes receiving, unloading, handling, storing, protecting, and installing Owner-furnished products.

B. Owner-Furnished Products:
1. Cadaver Tables
2. Metal Casework
3. Miscellaneous Equipment
4. As indicated in the Drawings and Specifications and equipment schedule in the drawings.

1.7 ACCESS TO SITE

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

B. Use of Site: Limit use of Project site to areas within the Contract limits indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.

1. Limits: Confine construction operations to the single room renovation.

2. Driveways, Walkways and Entrances: Keep driveways and entrances serving site clear and available to emergency vehicles at all times. Do not use these areas for parking or storage of materials.

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

1.8 WORK RESTRICTIONS

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

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

B. Noise, Vibration, and Odors: Coordinate operations that may result in high levels of noise and vibration, odors, or other disruption to acceptable hours for the C.O.D.

C. Nonsmoking Building: Smoking is not permitted within the building or within 100 feet of entrances, operable windows, or outdoor-air intakes.

D. Controlled Substances: Use of tobacco products and other controlled substances on Project site is not permitted.

1.9 SPECIFICATION AND DRAWING CONVENTIONS

A. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:

1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.

2. Specification requirements are to be performed by Contractor unless specifically stated otherwise.

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

C. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in the Specifications. One or more of the following are used on Drawings to identify materials and products:

1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.

2. Abbreviations: Materials and products are identified by abbreviations as scheduled on Drawings.

3. Keynoting: Materials and products are identified by reference keynotes referencing Specification Section numbers found in this Project Manual.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 10 00

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

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

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

C. Related Requirements:
1. Section 017700 "Closeout Procedures" for coordinating closeout of the Contract.

1.3 DEFINITIONS

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

1.4 INFORMATIONAL SUBMITTALS

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

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

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

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

1.5 COORDINATION DRAWINGS

A. Coordination Drawings: Prepare coordination drawings according to requirements in individual Sections, and additionally where installation is not completely shown on Shop Drawings, where limited space availability necessitates coordination, or if coordination is required to facilitate integration of products and materials fabricated or installed by more than one entity.

1. Content: Project-specific information, drawn accurately to a scale large enough to indicate and resolve conflicts. Do not base coordination drawings on standard printed data. Include the following information, as applicable:

a. Use applicable Drawings as a basis for preparation of coordination drawings. Prepare sections, elevations, and details as needed to describe relationship of various systems and components.
b. Coordinate the addition of trade-specific information to the coordination drawings by multiple contractors in a sequence that best provides for coordination of the information and resolution of conflicts between installed components before submitting for review.
c. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
d. Indicate space requirements for routine maintenance and for anticipated replacement of components during the life of the installation.
e. Show location and size of access doors required for access to concealed dampers, valves, and other controls.
f. Indicate required installation sequences.
g. Indicate dimensions shown on the Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to Architect indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.

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

1. Floor Plans and Reflected Ceiling Plans: Show architectural and structural elements, and mechanical, plumbing, fire-protection, fire-alarm, and electrical Work. Show locations of visible ceiling-mounted devices relative to acoustical ceiling grid. Supplement plan drawings with section drawings where required to adequately represent the Work.

2. Plenum Space: Indicate subframing for support of ceiling and wall systems, mechanical and electrical equipment, and related Work. Locate components within ceiling plenum to accommodate layout of light fixtures indicated on Drawings. Indicate areas of conflict between light fixtures and other components.

3. Mechanical Rooms: Provide coordination drawings for mechanical rooms showing plans and elevations of mechanical, plumbing, fire-protection, fire-alarm, and electrical equipment.

4. Structural Penetrations: Indicate penetrations and openings required for all disciplines.

5. Slab Edge and Embedded Items: Indicate slab edge locations and sizes and locations of embedded items for metal fabrications, sleeves, anchor bolts, bearing plates, angles, door floor closers, slab depressions for floor finishes, curbs and housekeeping pads, and similar items.

6. Mechanical Work: Show the following:

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

c. Fire-rated enclosures around ductwork.

7. Electrical Work: Show the following:

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

8. Fire-Protection System: Show the following:

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

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

10. Coordination Drawing Prints: Prepare coordination drawing prints according to requirements in Section 013300 "Submittal Procedures."

C. Coordination Digital Data Files: Prepare coordination digital data files according to the following requirements:

1. File Preparation Format: Same digital data software program, version, and operating system as original Drawings.

2. File Preparation Format: DWG, Version AutoCAD 2013 , operating in Microsoft Windows operating system.

3. File Submittal Format: Submit or post coordination drawing files using Portable Data File (PDF) format.

4. Architect will furnish Contractor one set of digital data files of Drawings for use in preparing coordination digital data files.

a. Architect makes no representations as to the accuracy or completeness of digital data files as they relate to Drawings.
b. Digital Data Software Program: Drawings are available in AutoCAD 2013.
c. Contractor shall execute a data licensing agreement in the form of AIA Document C106.

1.6 REQUESTS FOR INFORMATION (RFIs)

A. General: Immediately on discovery of the need for additional information or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified.

1. Architect will return RFIs submitted to Architect by other entities controlled by Contractor with no response.
2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.

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

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

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

C. RFI Forms:

1. Attachments shall be electronic files in Adobe Acrobat PDF format.

D. Architect's and Construction Manager's Action: Architect and Construction Manager will review each RFI, determine action required, and respond. Allow seven working days for Architect's response for each RFI. RFIs received by Construction Manager after 1:00 p.m. will be considered as received the following working day.

1. The following Contractor-generated RFIs will be returned without action:

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

2. Architect's action may include a request for additional information, in which case Architect's time for response will date from time of receipt of additional information.

3. Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Section 012600 "Contract Modification Procedures."

    a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect and Construction Manager in writing within 10 days of receipt of the RFI response.

1.7 PROJECT MEETINGS

A. General: General Contractor will schedule and conduct meetings and conferences at Project site unless otherwise indicated.

1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times.
2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
3. Minutes: Entity responsible for conducting meeting will record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner, Construction Manager, and Architect, within 5 days of the meeting.

B. Preconstruction Conference: General Contractor will schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner and Architect.

1. Conduct the conference to review responsibilities and personnel assignments.
2. Attendees: Authorized representatives of Owner, Owner's Commissioning Authority, , Construction Manager, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
3. Agenda: Discuss items of significance that could affect progress, including the following:
    a. Tentative construction schedule.
    b. Phasing.
    c. Critical work sequencing and long-lead items.
    d. Designation of key personnel and their duties.
    e. Lines of communications.
    f. Procedures for processing field decisions and Change Orders.
    g. Procedures for RFIs.
    h. Procedures for testing and inspecting.
    i. Procedures for processing Applications for Payment.
    j. Distribution of the Contract Documents.
    k. Submittal procedures.
    l. Preparation of record documents.
    m. Use of the premises and existing building.
    n. Work restrictions.
    o. Working hours.
    p. Owner's occupancy requirements.
    q. Responsibility for temporary facilities and controls.
    r. Procedures for moisture and mold control.
    s. Procedures for disruptions and shutdowns.
    t. Construction waste management and recycling.
    u. Parking availability.
    v. Office, work, and storage areas.
    w. Equipment deliveries and priorities.
    x. First aid.
    y. Security.
    z. Progress cleaning.
4. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes.

C. Preinstallation Conferences: Conduct a preinstallation conference at Project site before each construction activity that requires coordination with other construction.

1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect, Construction Manager, and Owner's Commissioning Authority of scheduled meeting dates.

2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:

   a. Contract Documents.
   b. Options.
   c. Related RFIs.
   d. Related Change Orders.
   e. Purchases.
   f. Deliveries.
   g. Submittals.
   h. Review of mockups.
   i. Possible conflicts.
   j. Compatibility requirements.
   k. Time schedules.
   l. Weather limitations.
   m. Manufacturer's written instructions.
   n. Warranty requirements.
   o. Compatibility of materials.
   p. Acceptability of substrates.
   q. Temporary facilities and controls.
   r. Space and access limitations.
   s. Regulations of authorities having jurisdiction.
   t. Testing and inspecting requirements.
   u. Installation procedures.
   v. Coordination with other work.
   w. Required performance results.
   x. Protection of adjacent work.
   y. Protection of construction and personnel.

3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.

4. Reporting: Distribute minutes of the meeting to each party present and to other parties requiring information.

5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.

6. Work proceeding in advance of a pre-installation meeting, or without resolution of the minuted issues, may be subject to removal and reinstallation at no charge to the Owner.

D. Project Closeout Conference: General Contractor will schedule and conduct a project closeout conference, at a time convenient to Owner and Architect, but no later than 30 days prior to the scheduled date of Substantial Completion.

1. Conduct the conference to review requirements and responsibilities related to Project closeout.

2. Attendees: Authorized representatives of Owner, Owner's Commissioning Authority, Construction Manager, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the meeting. Participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.

3. Agenda: Discuss items of significance that could affect or delay Project closeout, including the following:

    a. Preparation of record documents.
    b. Procedures required prior to inspection for Substantial Completion and for final inspection for acceptance.
    c. Submittal of written warranties.
    d. Requirements for preparing operations and maintenance data.
    e. Requirements for delivery of material samples, attic stock, and spare parts.
    f. Requirements for demonstration and training.
    g. Preparation of Contractor's punch list.
    h. Procedures for processing Applications for Payment at Substantial Completion and for final payment.
    i. Submittal procedures.
    j. Coordination of separate contracts.
    k. Owner's partial occupancy requirements.
    l. Installation of Owner's furniture, fixtures, and equipment.
    m. Responsibility for removing temporary facilities and controls.

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

E. Progress Meetings: General Contractor will conduct progress meetings at weekly intervals.

1. Coordinate dates of meetings with preparation of payment requests.

2. Attendees: In addition to representatives of Owner and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.

3. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.

    a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.

        1) Review schedule for next period.

    b. Review present and future needs of each entity present, including the following:

        1) Interface requirements.
        2) Sequence of operations.
        3) Status of submittals.
        4) Deliveries.
        5) Off-site fabrication.
        6) Access.

7) Site utilization.
8) Temporary facilities and controls.
9) Progress cleaning.
10) Quality and work standards.
11) Status of correction of deficient items.
12) Field observations.
13) Status of RFIs.
14) Status of proposal requests.
15) Pending changes.
16) Status of Change Orders.
17) Pending claims and disputes.
18) Documentation of information for payment requests.

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

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

F. Coordination Meetings: General Contractor will conduct Project coordination meetings at weekly intervals. Project coordination meetings are in addition to specific meetings held for other purposes, such as progress meetings and preinstallation conferences.

1. Attendees: In addition to representatives of Owner, Construction Manager, and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meetings shall be familiar with Project and authorized to conclude matters relating to the Work.

2. Agenda: Review and correct or approve minutes of the previous coordination meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.

   a. Combined Contractor's Construction Schedule: Review progress since the last coordination meeting. Determine whether each contract is on time, ahead of schedule, or behind schedule, in relation to combined Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.

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

   c. Review present and future needs of each contractor present, including the following:

      1) Interface requirements.
      2) Sequence of operations.
      3) Status of submittals.
      4) Deliveries.
      5) Off-site fabrication.
      6) Access.
      7) Site utilization.
      8) Temporary facilities and controls.

9) Work hours.
10) Hazards and risks.
11) Progress cleaning.
12) Quality and work standards.
13) Change Orders.

3. Reporting: Record meeting results and distribute copies to everyone in attendance and to others affected by decisions or actions resulting from each meeting.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 31 00

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

B. Related Requirements:
   1. Section 01 78 23 "Operation and Maintenance Data" for submitting operation and maintenance manuals.
   2. Section 01 78 39 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.

1.3 DEFINITIONS

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

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

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

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

1.4 ACTION SUBMITTALS

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

1. Coordinate submittal schedule with list of subcontracts, the schedule of values, and Contractor's construction schedule.
2. Initial Submittal: Submit concurrently with startup construction schedule. Include submittals required during the first 60 days of construction. List those submittals required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.
3. Final Submittal: Submit concurrently with the first complete submittal of Contractor's construction schedule.

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

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

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

1.5 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

A. Architect's Digital Data Files: Electronic digital data files of the Contract Drawings will be provided by Architect for Contractor's use in preparing submittals.

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

    a. Architect makes no representations as to the accuracy or completeness of digital data drawing files as they relate to the Contract Drawings.
    b. Digital Drawing Software Program: The Contract Drawings are available in AutoCAD Rev 2013.
    c. Contractor shall execute a data licensing agreement in the form of Agreement form acceptable to Owner and Architect.
    d. The following digital data files will by furnished for each appropriate discipline:

        1) Floor plans.
        2) Reflected ceiling plans.
        3) Other Drawings as specifically requested.

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

1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.

2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
3. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.
4. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.

    a. Architect and Construction Manager reserve the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

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

1. Initial Review: Allow 10 business days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Construction Manager will advise Contractor when a submittal being processed must be delayed for coordination.
2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
3. Resubmittal Review: Allow 10 business days for review of each resubmittal.
4. Sequential Review: Where sequential review of submittals by Architect's consultants, Owner, or other parties is indicated, allow 15 business days for initial review of each submittal.

5. Concurrent Consultant Review: Where the Contract Documents indicate that submittals may be transmitted simultaneously to Architect and to Architect's consultants, allow 10 business days for review of each submittal. Submittal will be returned to Construction Manager, through Architect, before being returned to Contractor.

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

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

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

3. Provide means for insertion to permanently record Contractor's review and approval markings and action taken by Architect and Construction Manager.
4. Transmittal Form for Electronic Submittals: Use electronic form acceptable to Owner, containing the following information:

    a. Project name.
    b. Date.
    c. Name and address of Architect.
    d. Name of Construction Manager.
    e. Name of Contractor.
    f. Name of firm or entity that prepared submittal.

g. Names of subcontractor, manufacturer, and supplier.
h. Category and type of submittal.
i. Submittal purpose and description.
j. Specification Section number and title.
k. Specification paragraph number or drawing designation and generic name for each of multiple items.
l. Drawing number and detail references, as appropriate.
m. Location(s) where product is to be installed, as appropriate.
n. Related physical samples submitted directly.
o. Indication of full or partial submittal.
p. Transmittal number, numbered consecutively (paper submittals must be included in numbering system).
q. Submittal and transmittal distribution record.
r. Other necessary identification.
s. Remarks.

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

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

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

1. Electronic submittals are preferred.
2. Indicate name of firm or entity that prepared each submittal on label or title block.
3. Provide a space approximately 6 by 8 inches on label or beside title block to record Contractor's review and approval markings and action taken by Architect and Construction Manager.
4. Include the following information for processing and recording action taken:

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

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

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

5. Copies:

a. Submit four copies of submittal to Construction Manager for concurrent review.

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

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

F. Options: Identify options requiring selection by Architect.

G. Deviations and Additional Information: On an attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Architect and Construction Manager on previous submittals, and deviations from requirements in the Contract Documents, including minor variations and limitations. Include same identification information as related submittal.

H. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.

1. Note date and content of previous submittal.
2. Note date and content of revision in label or title block and clearly indicate extent of revision.
3. Resubmit submittals until they are marked with approval notation from Architect's and Construction Manager's action stamp.

I. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.

J. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with approval notation from Architect's and Construction Manager's action stamp.

PART 2 - PRODUCTS

2.1 SUBMITTAL PROCEDURES

A. General Submittal Procedure Requirements: Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.

1. Post electronic submittals as PDF electronic files directly to General Contractor's system.

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

2. Submit electronic submittals via email as PDF electronic files.

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

3. Action Submittals: Submit four paper copies of each submittal unless otherwise indicated. Architect, through General Contractor, will return two copies to General Contractor, with one for Contractor.

4. Informational Submittals: Submit three paper copies of each submittal unless otherwise indicated. Architect and General Contractor will not return copies.

5. Certificates and Certifications Submittals: Provide a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.

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

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

1. If information must be specially prepared for submittal because standard published data are not suitable for use, submit as Shop Drawings, not as Product Data.
2. Mark each copy of each submittal to show which products and options are applicable.
3. Include the following information, as applicable:

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

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

    a. Wiring diagrams showing factory-installed wiring.
    b. Printed performance curves.
    c. Operational range diagrams.

d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.

5. Submit Product Data before or concurrent with Samples.

6. Submit Product Data in the following format:

a. PDF electronic file.

C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.

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

a. Identification of products.
b. Schedules.
c. Compliance with specified standards.
d. Notation of coordination requirements.
e. Notation of dimensions established by field measurement.
f. Relationship and attachment to adjoining construction clearly indicated.
g. Seal and signature of professional engineer if specified.

2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches, but no larger than 24 by 36 inches.

3. Submit Shop Drawings in the following format:

a. PDF electronic file.
b. Four opaque (bond) copies of each submittal. Architect, through Construction Manager, will return two copies, one of which goes to Contractor.

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

1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.

2. Identification: Attach label on unexposed side of Samples that includes the following:

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

3. For projects where electronic submittals are required, provide corresponding electronic submittal of Sample transmittal, digital image file illustrating Sample characteristics, and identification information for record.

4. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.

a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.

b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.

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

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

6. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.

   a. Number of Samples: Submit five sets of Samples. Architect and General Contractor will retain two (one for office and one to keep on site) Sample sets; one set will be returned.

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

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

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

   a. PDF electronic file.

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

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

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

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

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

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

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

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

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

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

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

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

1. Name of evaluation organization.
2. Date of evaluation.
3. Time period when report is in effect.
4. Product and manufacturers' names.
5. Description of product.
6. Test procedures and results.
7. Limitations of use.

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

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

T. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.

U. Design Data: Prepare and submit written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.

2.2 DELEGATED-DESIGN SERVICES

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

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

B. Delegated-Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit digitally signed PDF electronic file of certificate, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.

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

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

A. Action and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect and General Contractor.

B. Project Closeout and Maintenance Material Submittals: See requirements in Section 017700 "Closeout Procedures."

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

3.2 ARCHITECT'S AND CONSTRUCTION MANAGER'S ACTION

A. Action Submittals: Architect and Construction Manager will review each submittal, make marks to indicate corrections or revisions required, and return it. Architect and General Contractor will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action.

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

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

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

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

END OF SECTION 01 33 00

SUBMITTAL LOG

PROJECT: 10544-15-03 College of DuPage HSC Cadaver Lab Renovation Phase II Supplemental Cooling
OWNER: College of DuPage

PROJECT NO:
CONTRACTOR:

DATE REC'D.	SPECIFICATION SECTION NO.	SUBMITTAL ITEM		NO. RECEIVED	OTHER REVIEWER					ACTION				DATE RETURNED	COPIES TO			
					DATE SENT	RECIPIENT	NO. COPIES	DUE DATE	DATE REC'D.	APPROVED	APPROVED AS NOTED	REVISE & RESUBMIT	NOT APP'D.		CONTRACTOR	OWNER	FIELD	FILE
	033053	**MISC CAST-IN-PLACE CONCRETE**																
		Product Data																
		Design Mixtures																
	061000	**ROUGH CARPENTRY**																
		Product Data																
	078413	**PENETRATION FIRESTOPPING**																
		Product Data																
		Product Schedule																
	079200	**JOINT SEALANTS**																
		Product Data																
		Joint Sealant Schedule																
		Qualification Statements																
	083473.13	**METAL SOUND CONTROL DOOR ASSEMBLIES**																
		Product Data																
		Maintenance Data																
		Product Certification																
		Sample Warranty																
		Product Test Report																
		Qualification Data																
		Warranty																
	087100	**DOOR HARDWARE**																
		Product Data																
		Shop Drawings																
		Samples																
		Door Hardware Schedule																
		Keying Schedule																
	092216	**NON-STRUCTURAL METAL FRAMING**																
		Product Data																
	092900	**GYPSUM BOARD**																
		Product Data																
	095113	**ACOUSTICAL CEILINGS**																
		Product Data																
		Samples																
	096513	**RESILIENT BASE AND ACCESSORIES**																
		Product Data																

SUBMITTAL LOG

PROJECT: 10544-15-03 College of DuPage HSC Cadaver Lab Renovation Phase II Supplemental Cooling
OWNER: College of DuPage

PROJECT NO:
CONTRACTOR:

DATE REC'D.	SPECIFICATION SECTION NO.	SUBMITTAL ITEM		NO. RECEIVED	OTHER REVIEWER					ACTION				DATE RETURNED	COPIES TO			
					DATE SENT	RECIPIENT	NO. COPIES	DUE DATE	DATE REC'D.	APPROVED	APPROVED AS NOTED	REVISE & RESUBMIT	NOT APP'D.		CONTRACTOR	OWNER	FIELD	FILE
		Samples																
		Material Test Reports																
	099123	**INTERIOR PAINTING**																
		Product Data																
		Samples																
	221319	**SANITARY WASTE PIPING SPECIALTIES**																
		Product Data																
		Operation & Maintenance Data																
	230553	**IDENTIIFCATION FO HVAC PIPING AND EQUIPMENT**																
		Product Data Samples																
		Equipment Label Schedule																
		Value Schedules																
	230593	**TESTING, ADJUSTING AND BALANCEING FOR HVAC**																
		Certified TAB Reports																
	230713	**DUCT INSULATION**																
		Product Data																
		Material Test Reports																
		Field Quality Control Reports																
	230719	**HVAC PIPING INSULATION**																
		Product Data																
		Shop Drawings																
		Field Quality Control Reports																
	230900	**INSTRUMENTATION AND CONTORL FOR HVAC**																
		Product Data																
		Shop Drawings																
		Samples																
	232113	**HYDRONIC PIPING**																
		Product Data																
		Coordination Drawings																
		Qualification Data																
		Welding Certifications																
		Field Quality Control Reports																
		Water Analysis																

SUBMITTAL LOG

PROJECT: 10544-15-03 College of DuPage HSC Cadaver Lab Renovation Phase II Supplemental Cooling
OWNER: College of DuPage

PROJECT NO:
CONTRACTOR:

DATE REC'D.	SPECIFICATION SECTION NO.	SUBMITTAL ITEM		NO. RECEIVED	OTHER REVIEWER					ACTION				DATE RETURNED	COPIES TO			
					DATE SENT	RECIPIENT	NO. COPIES	DUE DATE	DATE REC'D.	APPROVED	APPROVED AS NOTED	REVISE & RESUBMIT	NOT APP'D.		CONTRACTOR	OWNER	FIELD	FILE
	232116	**HYDRONIC PIPING SPECIALTIES**																
		Product Data																
		Operation and Maintenance Data																
	233113	**METAL DUCTS**																
		Product Data																
		Shop Drawings																
		Delegated-Design Submittal																
		Welding Certificates																
	233300	**AIR DUCT ACCESSORIES**																
		Product Data																
		Operation and Maintenance Data																
	233113	**METAL DUCTS**																
		Product Data																
		Shop Drawings																
		Delegated Design Submittal																
		Welding Certificates																
	233300	**AIR DUCT ACCESSORIES**																
		Product Data																
		Operation and Maintenance Data																
	233600	**AIR TERMINAL UNITS**																
		Product Data																
		Shop Drawings																
		Delegated Design Submittal																
		Coordination Drawings																
		Field Quality Control Reports																
		Operation and Maintenance Data																
	236426.21	**AIR COOLED, ROTARY SCREW WATER CHILLERS**																
		Product Data																
		Shop Drawings																
		Source Quality Control Reports																
		Field Test Reports																
		Sample Warranty																
		Operation and Maintenance Data																

	237313	**MODULAR INDOOR CENTRAL STAION AIR HANDLING UINTS**																
		Product Data																
		Delegated Design Submittal																
		Qualification Data																
		Source Quality Control Reports																
		Operation and Maintenance Data																
	260519	**LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES**																
		Product Data																
		Qualification Statements																
		Field Quality-Control Reports																
	260526	**GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS**																
		Product Data																
	260529	**HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS**																
		Product Data																
		Coordination Drawings																
		Seismic Qualification Certificates																
		Welding Certificates																
	260533	**RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS**																
		Product Data																
		Seismic Qualification Data																
		Coordination Drawings																
		Qualification Statements																
	260544	**SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING**																
		Product Data																
	260553	**IDENTIFICATION FOR ELECRICAL SYSTEMS**																
		Product Data																
		Delegated-Design Submittal																
	262816	**ENCLOSED SWITCHES AND CIRCUIT BREAKERS**																
		Product Data																
		Operation & Maintenance Data																
		Warranty																

PART 1 - GENERAL

1.1 WORK INCLUDED:

A. Furnish all labor, materials, equipment and services necessary or incidental to the completion of all work of this section and herein specified, including:

1. Schedule elements of remodeling and renovation work to expedite completion.
2. In addition to demolition, cut, move or remove existing construction to provide access or to allow remodeling and new work to proceed. Include:
    a. Repair or remove hazardous or unsanitary conditions.
    b. Remove abandoned piping, conduit and wiring.
    c. Remove 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.
    d. Clean surfaces. Remove surface finishes to install new work and finishes.
3. Patch, repair and refinish existing items to remain, to the specified condition for each material, with a neat transition to adjacent new construction.
4. Note or record existing project conditions before beginning work to minimize later disputes.

1.2 RELATED REQUIREMENTS

A. Specified elsewhere:

1. 01 74 19 - Construction Waste Management and Disposal
2. 01 77 00 - Closeout Procedures

1.3 SEQUENCE AND SCHEDULES

A. Submit separate detailed sub-schedule for alterations work, coordinated with Construction Schedule. Show:

1. Each stage of work; occupancy dates of areas.
2. Date of Substantial Completion for each area of alteration work.
3. Crafts and subcontractors employed in each stage.

1.4 ALTERATIONS, CUTTING AND PROTECTION

A. 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.

B. Protect existing and new work from weather and temperature extremes.

1. Maintain existing interior work above (*60) degrees F.
2. Provide weather protection, waterproofing, heat and humidity control to prevent damage to remaining existing work and to new work.

C. Provide temporary enclosures to separate work areas from existing building and from areas occupied by Using Agency, and to provide weather protection.

PART 2 - PRODUCTS

2.1 SALVAGED MATERIALS

A. Salvage sufficient quantities of cut or removed materials to replace damaged work, when material is not readily obtainable on current market.

1. Use particular care in removal and salvage of:

a. Doors/Frames
b. Equipment Mounts
c. Any items indicated to be salvaged on Drawings and Specifications.

2. Store salvaged items in a dry, secure place on site.

3. Designated items not specified for use in repair work remain College of DuPage's property.

4. Do not use salvaged or used material in new construction except with prior written authorization from Architect/Engineer.

2.2 MATERIALS FOR PATCHING, EXTENDING AND MATCHING

B. Ensure that work is complete:

1. Provide same materials or types of construction as that in existing structure, to patch, extend or match existing work.

PART 3 - EXECUTION

3.1 REMOVE EXISTING CONSTRUCTION

A. Temporary Removals:

1. Remove existing pencil sharpeners, signage, etc
2. Store all items indicated to be removed.
3. Recondition items damaged by removal.
4. Recondition items as designated.
5. Reinstall in locations indicated.

B. Remove and relocate: doors and hardware designated for reuse.

1. Remove and dispose of: Dispose of items noted to be demolished.

3.2 PERFORMANCE.

A. Patch and extend existing work using skilled craftsmen capable of matching existing quality of workmanship. For patched or extended work, provide quality equal to that specified for new work.

3.3 ADJUSTMENTS

A. Where partitions are removed, patch floors, walls and ceilings with finish materials to match existing as closely as possible.

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 of (*two inches) or more occurs, request instructions from Architect/Engineer.

B. Trim and refinish existing doors to clear new floors.

3.4 DAMAGED SURFACES

A. Patch and replace all portions of existing finished surfaces found to be damaged, lifted, discolored or showing other imperfections, with matching material.

1. Provide adequate support 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 logical break as determined by Architect.

3.5 TRANSITION FROM EXISTING TO NEW WORK

A. When new work abuts or finishes flush with existing work, make a smooth transition. Patched work shall match existing adjacent work in texture and appearance as closely as possible.

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.

3.6 CLEANING

A. Perform construction cleaning as specified.

1. Clean User occupied areas daily.
2. Clean all spillage, overspray or heavy dust collections in User occupied areas immediately.

B. At completion of work of each craft, clean area and make surfaces ready for work of successive crafts.

C. At completion of alterations work in each area, provide final cleaning and return space to a condition suitable for use of User.

END OF SECTION 01 35 16

PART 1 - GENERAL

1.1 WORK INCLUDES

A. Contractor: Supervise and perform construction procedures to promote adequate indoor air quality during and after construction.

1.2 RELATED WORK

1.3 DESCRIPTIONS

A. Dust and Airborne Particulates: Prevent deposition of dust and other particulates in HVAC ducts and equipment.
1. Contractor shall bear the cost of cleaning required due to failure to protect ducts and equipment from construction dust.

B. Airborne Contaminants:
1. Avoid construction practices that could result in contamination of installed products leading to indoor air pollution.

1.4 SUBMITTALS

A. Submit Indoor Air Quality Management Plan: Describe in detail measures to be taken to promote adequate indoor air quality upon completion; use SMACNA IAQ Guideline for Occupied Buildings Under Construction.
1. Submit IAQ Plan at pre-construction meeting.
2. Identify potential sources of odor and dust.
3. Identify construction activities likely to produce odor or dust.
4. Identify areas of project potentially affected, especially occupied areas.
5. Evaluate potential problems by severity and describe methods of control.
6. Describe construction ventilation to be provided, including type and duration of ventilation, use of permanent HVAC systems, types of filters and schedule for replacement of filters.
7. Describe cleaning and dust control procedures.
8. Describe coordination with commissioning procedure.

B. Interior Finishes Installation Schedule: Identify each interior finish that either generates odors, moisture, or vapors or is susceptible to absorption of odors and vapors, and indicate air handling zone, sequence of application, and curing times.

D. Provide a Letter Template, signed by the General Contractor declaring that a Construction IAQ Management Plan has been developed and implemented, and listing each air filter used during construction and at the end of construction. Include the MERV value, manufacturer name and model number.

E. Provide 18 photographs – six photographs taken on three different occasions during construction – along with identification of the SMACNA approach featured by each photograph, in order to show consistent adherence to the credit requirements.
1. As an alternative of providing photographs, declare the five Design Approaches of SMACNA IAQ Guideline for Occupied Buildings under Construction, Chapter 3, which were used during building construction. Include a brief description of some of the important design approaches employed.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Provide materials required by the Indoor Air Quality (IAQ) Management Plan for the construction and pre-occupancy phases.

PART 3 - EXECUTION

3.1 IMPLEMENTATION

A. Develop and implement an Indoor Air Quality (IAQ) Management Plan for the construction and pre-occupancy phases of the building as follows:
   1. During construction, meet or exceed the recommended Design Approaches of the Sheet Metal and Air Conditioning National Contractors Association (SMACNA) IAQ Guideline for Occupied Buildings under Construction, Chapter 3.
   2. Protect stored on-site or installed absorptive materials from moisture damage.
   3. If air handlers must be used during construction, filtration media with a Minimum Efficiency Reporting Value (MERV) of 8 must be used at each return air grill.
   4. Replace all filtration media immediately prior to occupancy. Provide filtration media having a Minimum Efficiency Reporting Value as scheduled.

B. Prevent the absorption of moisture and humidity by absorptive materials by:
   1. Sequencing the delivery of such materials so that they are not present in the building until wet work is completed and dry.
   2. Delivery and storage of such materials in fully sealed moisture-impermeable packaging.
   3. Provide sufficient ventilation for drying within reasonable time frame.

C. When working in a portion of an occupied building, prevent movement of air from construction area to occupied area.

E. HVAC equipment and supply air ductwork may not be used for ventilation during construction without meeting the following criteria as specified in the IAQ.
   1. Operate HVAC system on 100 percent outside air, with 1.5 air changes per hour, minimum.
   2. Ensure that air filters are correctly installed prior to starting use; replace filters when they loss efficiency.
   3. Do not use return air ductwork for ventilation.
   4. Seal return air inlets or otherwise positively isolate return air system to prevent recirculation of air; provide alternate return air pathways to the maximum extent possible.

F. Do not store construction materials or waste in mechanical or electrical rooms.

G. Prior to permanent use of return air ductwork without intake filters, clean up and remove dust debris generated by construction activities using a HEPA vacuum cleaning system.

H. Do not perform dusty or dirty work after starting use of return air ducts without intake filters.

I. Use other relevant recommendations of SMACNA IAQ Guideline for Occupied Buildings Under Construction for avoiding unnecessary contamination due to construction procedures.

END OF SECTION 01 73 40

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for the following:

1. Salvaging nonhazardous demolition and construction waste.
2. Recycling nonhazardous demolition and construction waste.
3. Disposing of nonhazardous demolition and construction waste.

B. Related Requirements:
1. Section 02 41 19 "Selective Demolition" for disposition of waste resulting from partial demolition of buildings, structures, and site improvements.

1.3 DEFINITIONS

A. Construction Waste: Building and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.

B. Demolition Waste: Building and site improvement materials resulting from demolition or selective demolition operations.

C. Disposal: Removal off-site of demolition and construction waste and subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction.

D. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.

E. Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another facility.

F. Salvage and Reuse: Recovery of demolition or construction waste and subsequent incorporation into the Work.

1.4 PERFORMANCE REQUIREMENTS

A. General: Achieve end-of-Project rates for salvage/recycling of 75 percent by weight of total non-hazardous solid waste generated by the Work. Practice efficient waste management in the use of materials in the course of the Work. Use all reasonable means to divert construction and demolition waste from landfills and incinerators. Facilitate recycling and salvage of materials, including the following:

1. Demolition Waste:
   a. Gypsum board.

b. Acoustical tile and panels.
c. Plumbing fixtures.
d. Piping.
e. Supports and hangers.
f. Lighting fixtures.
g. Lamps.
h. Ballasts.

2. Construction Waste:

a. Wood sheet materials.
b. Metals.
c. Gypsum board.
d. Piping.
e. Electrical conduit.
f. Packaging: Regardless of salvage/recycle goal indicated in "General" Paragraph above, salvage or recycle 100 percent of the following uncontaminated packaging materials:

1) Paper.
2) Cardboard.
3) Boxes.
4) Plastic sheet and film.
5) Polystyrene packaging.
6) Wood crates.
7) Plastic pails.

1.5 ACTION SUBMITTALS

A. Waste Management Plan: Submit plan within 30 days from Notice to Proceed.

1.6 INFORMATIONAL SUBMITTALS

A. Waste Reduction Progress Reports: Concurrent with each Application for Payment, submit report. Use Form CWM-7 for construction waste and Form CWM-8 for demolition waste Include the following information:

1. Material category.
2. Generation point of waste.
3. Total quantity of waste in tons
4. Quantity of waste salvaged, both estimated and actual in tons.
5. Quantity of waste recycled, both estimated and actual in tons.
6. Total quantity of waste recovered (salvaged plus recycled) in tons.
7. Total quantity of waste recovered (salvaged plus recycled) as a percentage of total waste.

B. Waste Reduction Calculations: Before request for Substantial Completion, submit calculated end-of-Project rates for salvage, recycling, and disposal as a percentage of total waste generated by the Work.

C. Records of Donations: Indicate receipt and acceptance of salvageable waste donated to individuals and organizations. Indicate whether organization is tax exempt.

D. Records of Sales: Indicate receipt and acceptance of salvageable waste sold to individuals and organizations. Indicate whether organization is tax exempt.

E. Recycling and Processing Facility Records: Indicate receipt and acceptance of recyclable waste by recycling and processing facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.

F. Landfill and Incinerator Disposal Records: Indicate receipt and acceptance of waste by landfills and incinerator facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.

G. Qualification Data: For waste management coordinator and refrigerant recovery technician.

H. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.

1.7 QUALITY ASSURANCE

A. Waste Management Coordinator Qualifications: Experienced firm, with a record of successful waste management coordination of projects with similar requirements. Refrigerant Recovery Technician Qualifications: Certified by EPA-approved certification program.

B. Regulatory Requirements: Comply with hauling and disposal regulations of authorities having jurisdiction.

C. Waste Management Conference: Conduct conference at Project site to comply with requirements in Section 013100 "Project Management and Coordination." Review methods and procedures related to waste management including, but not limited to, the following:

1. Review and discuss waste management plan including responsibilities of waste management coordinator.
2. Review requirements for documenting quantities of each type of waste and its disposition.
3. Review and finalize procedures for materials separation and verify availability of containers and bins needed to avoid delays.
4. Review procedures for periodic waste collection and transportation to recycling and disposal facilities.
5. Review waste management requirements for each trade.

1.8 WASTE MANAGEMENT PLAN

A. General: Develop a waste management plan according to ASTM E 1609 and requirements in this Section. Plan shall consist of waste identification, waste reduction work plan, and cost/revenue analysis. Distinguish between demolition and construction waste. Indicate quantities by weight or volume, but use same units of measure throughout waste management plan.

B. Waste Identification: Indicate anticipated types and quantities of demolition, site-clearing and construction waste generated by the Work. Use Form CWM-1 for construction waste and Form CWM-2 for demolition waste. Include estimated quantities and assumptions for estimates.

C. Waste Reduction Work Plan: List each type of waste and whether it will be salvaged, recycled, or disposed of in landfill or incinerator. Use Form CWM-3 for construction waste and Form CWM-4 for demolition waste. Include points of waste generation, total quantity of each type of waste, quantity for each means of recovery, and handling and transportation procedures.

1. Salvaged Materials for Reuse: For materials that will be salvaged and reused in this Project, describe methods for preparing salvaged materials before incorporation into the Work.
2. Salvaged Materials for Sale: For materials that will be sold to individuals and organizations, include list of their names, addresses, and telephone numbers.
3. Salvaged Materials for Donation: For materials that will be donated to individuals and organizations, include list of their names, addresses, and telephone numbers.
4. Recycled Materials: Include list of local receivers and processors and type of recycled materials each will accept. Include names, addresses, and telephone numbers.
5. Disposed Materials: Indicate how and where materials will be disposed of. Include name, address, and telephone number of each landfill and incinerator facility.
6. Handling and Transportation Procedures: Include method that will be used for separating recyclable waste including sizes of containers, container labeling, and designated location where materials separation will be performed.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 PLAN IMPLEMENTATION

A. General: Implement approved waste management plan. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract.

1. Comply with operation, termination, and removal requirements in specifications.

B. Waste Management Coordinator: Engage a waste management coordinator to be responsible for implementing, monitoring, and reporting status of waste management work plan.

C. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work.

1. Distribute waste management plan to everyone concerned within three days of submittal return.
2. Distribute waste management plan to entities when they first begin work on-site. Review plan procedures and locations established for salvage, recycling, and disposal.

D. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

1. Designate and label specific areas on Project site necessary for separating materials that are to be salvaged, recycled, reused, donated, and sold.
2. Comply with specifications for controlling dust and dirt, environmental protection, and noise control.

3.2 SALVAGING DEMOLITION WASTE

A. Salvaged Items for Reuse in the Work: Salvage items for reuse and handle as follows:

1. Clean salvaged items.
2. Pack or crate items after cleaning. Identify contents of containers with label indicating elements, date of removal, quantity, and location where removed.
3. Store items in a secure area until installation.
4. Protect items from damage during transport and storage.
5. Install salvaged items to comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make items functional for use indicated.

B. Salvaged Items for Owner's Use: Salvage items for Owner's use and handle as follows:

1. Clean salvaged items.
2. Pack or crate items after cleaning. Identify contents of containers with label indicating elements, date of removal, quantity, and location where removed.
3. Store items in a secure area until delivery to Owner.
4. Transport items to Owner's storage area on-site and off-site as designated by Owner.
5. Protect items from damage during transport and storage.

C. Doors and Hardware: Brace open end of door frames. Except for removing door closers, leave door hardware attached to doors.

D. Equipment: Drain tanks, piping, and fixtures. Seal openings with caps or plugs. Protect equipment from exposure to weather.

E. Plumbing Fixtures: Separate by type and size.

F. Lighting Fixtures: Separate lamps by type and protect from breakage.

G. Electrical Devices: Separate switches, receptacles, switchgear, transformers, meters, panelboards, circuit breakers, and other devices by type.

3.3 RECYCLING DEMOLITION AND CONSTRUCTION WASTE, GENERAL

A. General: Recycle paper and beverage containers used by on-site workers.

B. Recycling Incentives: Revenues, savings, rebates, tax credits, and other incentives received for recycling waste materials shall accrue to Contractor.

C. Preparation of Waste: Prepare and maintain recyclable waste materials according to recycling or reuse facility requirements. Maintain materials free of dirt, adhesives, solvents, petroleum contamination, and other substances deleterious to the recycling process.

D. Procedures: Separate recyclable waste from other waste materials, trash, and debris. Separate recyclable waste by type at Project site to the maximum extent practical according to approved construction waste management plan.

1. Provide appropriately marked containers or bins for controlling recyclable waste until removed from Project site. Include list of acceptable and unacceptable materials at each container and bin.

    a. Inspect containers and bins for contamination and remove contaminated materials if found.

2. Stockpile processed materials on-site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
3. Stockpile materials away from construction area. Do not store within drip line of remaining trees.
4. Store components off the ground and protect from the weather.
5. Remove recyclable waste from Owner's property and transport to recycling receiver or processor.

3.4 RECYCLING DEMOLITION WASTE

A. Concrete: Remove reinforcement and other metals from concrete and sort with other metals.

B. Wood Materials: Sort and stack members according to size, type, and length. Separate lumber, engineered wood products, panel products, and treated wood materials.

C. Metals: Separate metals by type.

1. Structural Steel: Stack members according to size, type of member, and length.
2. Remove and dispose of bolts, nuts, washers, and other rough hardware.

D. Gypsum Board: Stack large clean pieces on wood pallets or in container and store in a dry location. Remove edge trim and sort with other metals. Remove and dispose of fasteners.

E. Acoustical Ceiling Panels and Tile: Stack large clean pieces on wood pallets and store in a dry location.

F. Metal Suspension System: Separate metal members including trim, and other metals from acoustical panels and tile and sort with other metals.

G. Carpet Roll large pieces tightly after removing debris, trash, adhesive, and tack strips.

1. Store clean, dry carpet in a closed container or trailer provided by Carpet Reclamation Agency or carpet recycler.

H. Carpet Tile: Remove debris, trash, and adhesive.

1. Stack tile on pallet and store clean, dry carpet in a closed container or trailer provided by Carpet Reclamation Agency or carpet recycler.

I. Piping: Reduce piping to straight lengths and store by type and size. Separate supports, hangers, valves, sprinklers, and other components by type and size.

J. Conduit: Reduce conduit to straight lengths and store by type and size.

3.5 RECYCLING CONSTRUCTION WASTE

A. Packaging:

1. Cardboard and Boxes: Break down packaging into flat sheets. Bundle and store in a dry location.
2. Polystyrene Packaging: Separate and bag materials.
3. Pallets: As much as possible, require deliveries using pallets to remove pallets from Project site. For pallets that remain on-site, break down pallets into component wood pieces and comply with requirements for recycling wood.
4. Crates: Break down crates into component wood pieces and comply with requirements for recycling wood.

B. Wood Materials:

1. Clean Cut-Offs of Lumber: Grind or chip into small pieces.
2. Clean Sawdust: Bag sawdust that does not contain painted or treated wood.

C. Gypsum Board: Stack large clean pieces on wood pallets or in container and store in a dry location.

3.6 DISPOSAL OF WASTE

A. General: Except for items or materials to be salvaged, recycled, or otherwise reused, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.

1. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

B. Burning: Do not burn waste materials.

C. Disposal: Remove waste materials from Owner's property and legally dispose of them.

END OF SECTION 01 74 19

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:

1. Substantial Completion procedures.
2. Final completion procedures.
3. Warranties.
4. Final cleaning.
5. Repair of the Work.

B. Related Requirements:

1. Section 017823 "Operation and Maintenance Data" for operation and maintenance manual requirements.
2. Section 017839 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.

1.3 ACTION SUBMITTALS

A. Product Data: For cleaning agents.

B. Contractor's List of Incomplete Items: Initial submittal at Substantial Completion.

C. Certified List of Incomplete Items: Final submittal at Final Completion.

1.4 CLOSEOUT SUBMITTALS

A. Certificates of Release: From authorities having jurisdiction.

B. Certificate of Insurance: For continuing coverage.

C. Field Report: For pest control inspection.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Schedule of Maintenance Material Items: For maintenance material submittal items specified in other Sections.

1.6 SUBSTANTIAL COMPLETION PROCEDURES

A. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's punch list), indicating the value of each item on the list and reasons why the Work is incomplete.

B. Submittals Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.

1. Certificates of Release: Obtain and submit releases from authorities having jurisdiction permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
2. Submit closeout submittals specified in other Division 01 Sections, including project record documents, operation and maintenance manuals, final completion construction photographic documentation, damage or settlement surveys, property surveys, and similar final record information.
3. Submit closeout submittals specified in individual Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
4. Submit maintenance material submittals specified in individual Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by Construction Manager. Label with manufacturer's name and model number where applicable.

    a. Schedule of Maintenance Material Items: Prepare and submit schedule of maintenance material submittal items, including name and quantity of each item and name and number of related Specification Section. Obtain Construction Manager's signature for receipt of submittals.

5. Submit test/adjust/balance records.
6. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.

C. Procedures Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.

1. Advise Owner of pending insurance changeover requirements.
2. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
3. Complete startup and testing of systems and equipment.
4. Perform preventive maintenance on equipment used prior to Substantial Completion.
5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training video recordings specified in Section 017900 "Demonstration and Training."
6. Advise Owner of changeover in heat and other utilities.
7. Participate with Owner in conducting inspection and walkthrough with local emergency responders.

8. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
9. Complete final cleaning requirements, including touchup painting.
10. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.

D. Inspection: Submit a written request for inspection to determine Substantial Completion a minimum of 10 days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, Architect and General Contractor will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.

1. Re-inspection: Request re-inspection when the Work identified in previous inspections as incomplete is completed or corrected.
2. Results of completed inspection will form the basis of requirements for final completion.

1.7 FINAL COMPLETION PROCEDURES

A. Submittals Prior to Final Completion: Before requesting final inspection for determining final completion, complete the following:

1. Submit a final Application for Payment according to Section 012900 "Payment Procedures."
2. Certified List of Incomplete Items: Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. Certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
3. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.
4. Submit pest-control final inspection report.

B. Inspection: Submit a written request for final inspection to determine acceptance a minimum of 10 days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, Architect and General Contractor will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.

1. Re-inspection: Request re-inspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.8 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.

1. Organize list of spaces in sequential order, starting with exterior areas first and proceeding from lowest floor to highest floor.
2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.

3. Include the following information at the top of each page:

    a. Project name.
    b. Date.
    c. Name of Architect and Construction Manager.
    d. Name of Contractor.
    e. Page number.

4. Submit list of incomplete items in the following format:

    a. MS Excel electronic file. Architect, through Construction Manager, will return annotated file.
    b. PDF electronic file. Architect**,** through Construction Manager, will return annotated file.
    c. Three paper copies. Architect, through Construction Manager**,** will return one copy.

1.9 SUBMITTAL OF PROJECT WARRANTIES

A. Time of Submittal: Submit written warranties on request of Architect for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated, or when delay in submittal of warranties might limit Owner's rights under warranty.

B. Partial Occupancy: Submit properly executed warranties within 15 days of completion of designated portions of the Work that are completed and occupied or used by Owner during construction period by separate agreement with Contractor.

C. Organize warranty documents into an orderly sequence based on the table of contents of Project Manual.

1. Bind warranties and bonds in heavy-duty, three-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch paper.
2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.
4. Warranty Electronic File: Scan warranties and bonds and assemble complete warranty and bond submittal package into a single indexed electronic PDF file with links enabling navigation to each item. Provide bookmarked table of contents at beginning of document.

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

PART 2 - PRODUCTS

2.1 MATERIALS

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

1. Use cleaning products that comply with Green Seal's GS-37, or if GS-37 is not applicable, use products that comply with the California Code of Regulations maximum allowable VOC levels.

PART 3 - EXECUTION

3.1 FINAL CLEANING

A. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.

B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.

1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a designated portion of Project:

a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
d. Remove tools, construction equipment, machinery, and surplus material from Project site.
e. Remove snow and ice to provide safe access to building.
f. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
g. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
h. Sweep concrete floors broom clean in unoccupied spaces.
i. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean according to manufacturer's recommendations if visible soil or stains remain.
j. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Polish mirrors and glass, taking care not to scratch surfaces.
k. Remove labels that are not permanent.
l. Wipe surfaces of mechanical and electrical equipment, elevator equipment, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
m. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
n. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
o. Clean ducts, blowers, and coils if units were operated without filters during construction or that display contamination with particulate matter on inspection.

1) Clean HVAC system in compliance with NADCA Standard 1992-01. Provide written report on completion of cleaning.

p. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency.
q. Leave Project clean and ready for occupancy.

C. Pest Control: Comply with pest control requirements in Section 015000 "Temporary Facilities and Controls." Prepare written report.

D. Construction Waste Disposal: Comply with waste disposal requirements in Section 017419 "Construction Waste Management and Disposal."

3.2 REPAIR OF THE WORK

A. Complete repair and restoration operations before requesting inspection for determination of Substantial Completion.

B. Repair or remove and replace defective construction. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment. Where damaged or worn items cannot be repaired or restored, provide replacements. Remove and replace operating components that cannot be repaired. Restore damaged construction and permanent facilities used during construction to specified condition.

1. Remove and replace chipped, scratched, and broken glass, reflective surfaces, and other damaged transparent materials.
2. Touch up and otherwise repair and restore marred or exposed finishes and surfaces. Replace finishes and surfaces that that already show evidence of repair or restoration.

    a. Do not paint over "UL" and other required labels and identification, including mechanical and electrical nameplates. Remove paint applied to required labels and identification.

3. Replace parts subject to operating conditions during construction that may impede operation or reduce longevity.
4. Replace burned-out bulbs, bulbs noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.

END OF SECTION 01 77 00

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:

1. Operation and maintenance documentation directory.
2. Emergency manuals.
3. Operation manuals for systems, subsystems, and equipment.
4. Product maintenance manuals.
5. Systems and equipment maintenance manuals.

B. Related Requirements:
1. Section 013300 "Submittal Procedures" for submitting copies of submittals for operation and maintenance manuals.

1.3 DEFINITIONS

A. System: An organized collection of parts, equipment, or subsystems united by regular interaction.

B. Subsystem: A portion of a system with characteristics similar to a system.

1.4 CLOSEOUT SUBMITTALS

A. Manual Content: Operations and maintenance manual content is specified in individual Specification Sections to be reviewed at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.

1. Architect and Commissioning Authority will comment on whether content of operations and maintenance submittals are acceptable.
2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.

B. Format: Submit operations and maintenance manuals in the following format:

1. PDF electronic file. Assemble each manual into a composite electronically indexed file. Submit on digital media acceptable to Architect.

a. Name each indexed document file in composite electronic index with applicable item name. Include a complete electronically linked operation and maintenance directory.

b. Enable inserted reviewer comments on draft submittals.

2. Three paper copies. Include a complete operation and maintenance directory. Enclose title pages and directories in clear plastic sleeves. Architect, through General Contractor, will return two copies.

C. Initial Manual Submittal: Submit draft copy of each manual at least 30 days before commencing demonstration and training. Architect and Commissioning Authority will comment on whether general scope and content of manual are acceptable.

D. Final Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 15 days before commencing demonstration and training. Architect and Commissioning Authority will return copy with comments.

1. Correct or revise each manual to comply with Architect's and Commissioning Authority's comments. Submit copies of each corrected manual within 15 days of receipt of Architect's and Commissioning Authority's comments and prior to commencing demonstration and training.

PART 2 - PRODUCTS

2.1 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY

A. Directory: Prepare a single, comprehensive directory of emergency, operation, and maintenance data and materials, listing items and their location to facilitate ready access to desired information. Include a section in the directory for each of the following:

1. List of documents.
2. List of systems.
3. List of equipment.
4. Table of contents.

B. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.

C. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.

D. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.

E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

2.2 REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS

A. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:

1. Title page.
2. Table of contents.
3. Manual contents.

B. Title Page: Include the following information:

1. Subject matter included in manual.
2. Name and address of Project.
3. Name and address of Owner.
4. Date of submittal.
5. Name and contact information for Contractor.
6. Name and contact information for General Contractor.
7. Name and contact information for Architect.
8. Name and contact information for Commissioning Authority.
9. Names and contact information for major consultants to the Architect that designed the systems contained in the manuals.
10. Cross-reference to related systems in other operation and maintenance manuals.

C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.

1. If operation or maintenance documentation requires more than one volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.

D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.

E. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.

1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
2. File Names and Bookmarks: Enable bookmarking of individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel on opening file.

F. Manuals, Paper Copy: Submit manuals in the form of hard copy, bound and labeled volumes.

1. Binders: Heavy-duty, three-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.

a. If two or more binders are necessary to accommodate data of a system, organize data in each binder into groupings by subsystem and related components. Cross-reference other binders if necessary to provide essential information for proper operation or maintenance of equipment or system.

b. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter of content, and indicate Specification Section number on bottom of spine. Indicate volume number for multiple-volume sets.

2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section of the manual. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.
3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software storage media for computerized electronic equipment.
4. Supplementary Text: Prepared on 8-1/2-by-11-inch white bond paper.
5. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.

a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

2.3 EMERGENCY MANUALS

A. Content: Organize manual into a separate section for each of the following:

1. Type of emergency.
2. Emergency instructions.
3. Emergency procedures.

B. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:

1. Fire.
2. Flood.
3. Gas leak.
4. Water leak.
5. Power failure.
6. Water outage.
7. System, subsystem, or equipment failure.
8. Chemical release or spill.

C. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of Owner's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.

D. Emergency Procedures: Include the following, as applicable:

1. Instructions on stopping.
2. Shutdown instructions for each type of emergency.
3. Operating instructions for conditions outside normal operating limits.
4. Required sequences for electric or electronic systems.

5. Special operating instructions and procedures.

2.4 OPERATION MANUALS

A. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:

1. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.
2. Performance and design criteria if Contractor has delegated design responsibility.
3. Operating standards.
4. Operating procedures.
5. Operating logs.
6. Wiring diagrams.
7. Control diagrams.
8. Piped system diagrams.
9. Precautions against improper use.
10. License requirements including inspection and renewal dates.

B. Descriptions: Include the following:

1. Product name and model number. Use designations for products indicated on Contract Documents.
2. Manufacturer's name.
3. Equipment identification with serial number of each component.
4. Equipment function.
5. Operating characteristics.
6. Limiting conditions.
7. Performance curves.
8. Engineering data and tests.
9. Complete nomenclature and number of replacement parts.

C. Operating Procedures: Include the following, as applicable:

1. Startup procedures.
2. Equipment or system break-in procedures.
3. Routine and normal operating instructions.
4. Regulation and control procedures.
5. Instructions on stopping.
6. Normal shutdown instructions.
7. Seasonal and weekend operating instructions.
8. Required sequences for electric or electronic systems.
9. Special operating instructions and procedures.

D. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.

E. Piped Systems: Diagram piping as installed, and identify color-coding where required for identification.

2.5 PRODUCT MAINTENANCE MANUALS

A. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.

B. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.

C. Product Information: Include the following, as applicable:

1. Product name and model number.
2. Manufacturer's name.
3. Color, pattern, and texture.
4. Material and chemical composition.
5. Reordering information for specially manufactured products.

D. Maintenance Procedures: Include manufacturer's written recommendations and the following:

1. Inspection procedures.
2. Types of cleaning agents to be used and methods of cleaning.
3. List of cleaning agents and methods of cleaning detrimental to product.
4. Schedule for routine cleaning and maintenance.
5. Repair instructions.

E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.

F. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

1. Include procedures to follow and required notifications for warranty claims.

2.6 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

A. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, as described below.

B. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.

C. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:

1. Standard maintenance instructions and bulletins.
2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
3. Identification and nomenclature of parts and components.
4. List of items recommended to be stocked as spare parts.

D. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:

1. Test and inspection instructions.
2. Troubleshooting guide.
3. Precautions against improper maintenance.
4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
5. Aligning, adjusting, and checking instructions.
6. Demonstration and training video recording, if available.

E. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.

1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.

F. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.

G. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.

H. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

1. Include procedures to follow and required notifications for warranty claims.

PART 3 - EXECUTION

3.1 MANUAL PREPARATION

A. Operation and Maintenance Documentation Directory: Prepare a separate manual that provides an organized reference to emergency, operation, and maintenance manuals.

B. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.

C. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.

D. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.

1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.

E. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.

1. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.

F. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in record Drawings to ensure correct illustration of completed installation.

1. Do not use original project record documents as part of operation and maintenance manuals.
2. Comply with requirements of newly prepared record Drawings in Section 017839 "Project Record Documents."

G. Comply with Section 017700 "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

END OF SECTION 01 78 23

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for project record documents, including the following:

1. Record Drawings.
2. Record Specifications.
3. Record Product Data.
4. Miscellaneous record submittals.

B. Related Requirements:

1. Section 017700 "Closeout Procedures" for general closeout procedures.
2. Section 017823 "Operation and Maintenance Data" for operation and maintenance manual requirements.

1.3 CLOSEOUT SUBMITTALS

A. Record Drawings: Comply with the following:

1. Number of Copies: Submit one set(s) of marked-up record prints.
2. Number of Copies: Submit copies of record Drawings as follows:
    a. Initial Submittal:
        1) Submit PDF electronic files of scanned record prints and one of file prints.
        2) Architect will indicate whether general scope of changes, additional information recorded, and quality of drafting are acceptable.
    b. Final Submittal:
        1) Submit PDF electronic files of scanned record prints and three set(s) of prints.
        2) Print each drawing, whether or not changes and additional information were recorded.

B. Record Specifications: Submit one paper copy and annotated PDF electronic files of Project's Specifications, including addenda and contract modifications.

C. Record Product Data: Submit one paper copy and annotated PDF electronic files and directories of each submittal.

1. Where record Product Data are required as part of operation and maintenance manuals, submit duplicate marked-up Product Data as a component of manual.

D. Miscellaneous Record Submittals: See other Specification Sections for miscellaneous record-keeping requirements and submittals in connection with various construction activities. Submit one paper copy and annotated PDF electronic files and directories of each submittal.

E. Reports: Submit written report weekly indicating items incorporated into project record documents concurrent with progress of the Work, including revisions, concealed conditions, field changes, product selections, and other notations incorporated.

PART 2 - PRODUCTS

2.1 RECORD DRAWINGS

A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings, incorporating new and revised drawings as modifications are issued.

1. Preparation: Mark record prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.

    a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
    b. Accurately record information in an acceptable drawing technique.
    c. Record data as soon as possible after obtaining it.
    d. Record and check the markup before enclosing concealed installations.
    e. Cross-reference record prints to corresponding archive photographic documentation.

2. Content: Types of items requiring marking include, but are not limited to, the following:

    a. Dimensional changes to Drawings.
    b. Revisions to details shown on Drawings.
    c. Depths of foundations below first floor.
    d. Locations and depths of underground utilities.
    e. Revisions to routing of piping and conduits.
    f. Revisions to electrical circuitry.
    g. Actual equipment locations.
    h. Duct size and routing.
    i. Locations of concealed internal utilities.
    j. Changes made by Change Order or Change Directive.
    k. Changes made following Architect's written orders.
    l. Details not on the original Contract Drawings.
    m. Field records for variable and concealed conditions.
    n. Record information on the Work that is shown only schematically.

3. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.
4. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
5. Mark important additional information that was either shown schematically or omitted from original Drawings.
6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

B. Newly Prepared Record Drawings: Prepare new Drawings instead of preparing record Drawings where Architect determines that neither the original Contract Drawings nor Shop Drawings are suitable to show actual installation.

1. New Drawings may be required when a Change Order is issued as a result of accepting an alternate, substitution, or other modification.
2. Consult Architect and General Contractor for proper scale and scope of detailing and notations required to record the actual physical installation and its relation to other construction. Integrate newly prepared record Drawings into record Drawing sets; comply with procedures for formatting, organizing, copying, binding, and submitting.

C. Format: Identify and date each record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.

1. Record Prints: Organize record prints and newly prepared record Drawings into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
2. Format: Annotated PDF electronic file with comment function enabled.
3. Record Digital Data Files: Organize digital data information into separate electronic files that correspond to each sheet of the Contract Drawings. Name each file with the sheet identification. Include identification in each digital data file.
4. Identification: As follows:

    a. Project name.
    b. Date.
    c. Designation "PROJECT RECORD DRAWINGS."
    d. Name of Architect and General Contractor.
    e. Name of Contractor.

2.2 RECORD SPECIFICATIONS

A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
4. For each principal product, indicate whether record Product Data has been submitted in operation and maintenance manuals instead of submitted as record Product Data.
5. Note related Change Orders, record Product Data, and record Drawings where applicable.

B. Format: Submit record Specifications as scanned PDF electronic file(s) of marked-up paper copy of Specifications.

2.3 RECORD PRODUCT DATA

A. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
3. Note related Change Orders, record Specifications, and record Drawings where applicable.

B. Format: Submit record Product Data as scanned PDF electronic file(s) of marked-up paper copy of Product Data.

1. Include record Product Data directory organized by Specification Section number and title, electronically linked to each item of record Product Data.

2.4 MISCELLANEOUS RECORD SUBMITTALS

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

B. Format: Submit miscellaneous record submittals as scanned PDF electronic file(s) of marked-up miscellaneous record submittals.

1. Include miscellaneous record submittals directory organized by Specification Section number and title, electronically linked to each item of miscellaneous record submittals.

PART 3 - EXECUTION

3.1 RECORDING AND MAINTENANCE

A. Recording: Maintain one copy of each submittal during the construction period for project record document purposes. Post changes and revisions to project record documents as they occur; do not wait until end of Project.

B. Maintenance of Record Documents and Samples: Store record documents and Samples in the field office apart from the Contract Documents used for construction. Do not use project record documents for construction purposes. Maintain record documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to project record documents for Architect's and Construction Manager's reference during normal working hours.

END OF SECTION 01 78 39

PART 1 - GENERAL

1.1 WORK INCLUDES

A. Base Bid: General Contractor shall furnish all labor, materials, equipment and services necessary or incidental to the completion of all work of this section as shown on the drawings and herein specified, including:

1. Selective demolition as noted on D-series sheets.
2. Coordination of demolition of work of other trades.

1.2 PROTECTION

A. Protect adjacent materials and surfaces to remain.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Dust control barriers.

PART 3 - EXECUTION

3.1 DEMOLITION

A. Proper coordination for the shut-off of utility services and control measures for dust and noise must occur prior to commencement of any demolition work. In confined areas of selective demolition, install and maintain dust and noise control barriers to keep dirt, dust, and noise from being transmitted to adjacent areas. Remove these protection measures after demolition operations are complete. Where placed adjacent to new finishes in contract, protect new finishes, and repair any damage to like-new condition.

B. Maintain and protect existing building services which transit the area affected by selective demolition.

C. Completely remove all equipment noted on the drawings for removal including all associated devices, controls, conduit, wiring, etc. Remove all exposed conduit and wiring back to the panel from which it is served. Provide flush, clean termination where conduit extends into existing wall or floor construction. Mark all disassociated breakers "spare". Unless otherwise noted, the General Contractor shall fill and patch all wall, floor, and ceiling openings resulting from this demolition work with materials and finishes identical to adjacent materials and finished.

D. Unless otherwise noted, remove all wiring devices, fixtures, controls, circuitry (conduit and wiring), etc., made obsolete by the demolition within or around the building.

E. The respective Contractor shall relocate all existing piping, circuitry (conduit and wiring), ductwork, etc., which impedes the installation of new materials and equipment of their own trade, unless otherwise noted.

F. Demolish, remove, demount, and disconnect the following:

1. Inactive and obsolete piping, fitting and specialties, equipment, ductwork, controls, fixtures, and insulation.
2. Piping and ducts embedded in floors, wall, and ceiling may remain if such materials do not interfere with new installation. Remove materials above accessible ceilings. Drain and cap piping and ducts allowed to remain.

3.2 DISPOSAL OF EQUIPMENT AND MATERIALS

A. The Contractor shall remove all generated trash, recyclables and debris from site, and dispose of in an environmentally friendly manner. The Contractor may not place this trash and debris in building-related dumpsters. The Contractor will comply with all requirements as outlined in 01 41 00 Regulatory Requirements.

3.3 DEFINITIONS

A. Remove: Detach items from existing construction and legally dispose of them off-site, unless indicated to be removed and salvaged or removed and reinstalled.

B. Remove and Salvage: Detach items from existing construction and deliver them to Using Agency ready for reuse.

C. Remove and Reinstall: Detach items from existing construction, prepare them for reuse, and reinstall them where indicated.

D. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

3.4 REMOVED AND SALVAGED ITEMS:

A. Clean salvaged items.

B. Pack or crate items after cleaning. Identify contents of containers.

C. Store items in a secure area until delivery to Using Agency.

D. Transport items to storage area designated by Using Agency.

E. Protect items from damage during transport and storage.

3.5 REMOVED AND REINSTALLED ITEMS:

A. Clean and repair items to functional condition adequate for intended reuse. Paint equipment to match new equipment.

B. Pack or crate items after cleaning and repairing. Identify contents of containers.

C. Protect items from damage during transport and storage.

D. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.

3.6 EXISTING ITEMS TO REMAIN:

A. Protect construction indicated to remain against damage and soiling during selective demolition.

B. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.

END OF SECTION 02 41 19

PART 1 - GENERAL

1.1 WORK INCLUDES

A. Base Bid:

1. General Contractor shall provide ALL labor, materials, equipment, and services necessary or incidental to the completion of all work of this section as shown herein specified or otherwise required.

2. All cast-in-place standard weight concrete and steel reinforcement for construction of new mechanical equipment parts.

1.2 RELATED DOCUMENTS

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

1.3 SUMMARY

A. Section includes cast-in-place concrete, including reinforcement, concrete materials, mixture design, placement procedures, and finishes.

B. Related Requirements:

1. Division 23 - Mechanical.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Design Mixtures: For each concrete mixture.

1.5 QUALITY ASSURANCE

A. Ready-Mix-Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.

PART 2 - PRODUCTS

2.1 CONCRETE, GENERAL

A. Comply with the following sections of ACI 301 (ACI 301M) unless modified by requirements in the Contract Documents:

1. "General Requirements."
2. "Formwork and Formwork Accessories."
3. "Reinforcement and Reinforcement Supports."
4. "Concrete Mixtures."
5. "Handling, Placing, and Constructing."

B. Comply with ACI 117 (ACI 117M).

2.2 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed.

B. Plain-Steel Wire: ASTM A 1064/A 1064M, as drawn.

2.3 CONCRETE MATERIALS

A. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.

B. Cementitious Materials:

1. Portland Cement: ASTM C 150/C 150M.
2. Fly Ash: ASTM C 618, Class C or F.
3. Slag Cement: ASTM C 989/C 989M, Grade 100 or 120.
4. Blended Hydraulic Cement: ASTM C 595/C 595M.

C. Normal-Weight Aggregate: ASTM C 33/C 33M, 1 inch nominal maximum aggregate size.

D. Air-Entraining Admixture: ASTM C 260/C 260M.

E. Water: ASTM C 94/C 94M.

2.4 CURING MATERIALS

A. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

B. Water: Potable.

C. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B.

2.5 CONCRETE MIXTURES

A. Comply with ACI 301 (ACI 301M).

B. Normal-Weight Concrete:

1. Minimum Compressive Strength: 3500 psi (24.1 MPa) at 28 days.
2. Maximum W/C Ratio: 0.50.
3. Cementitious Materials: Use fly ash, pozzolan, slag cement, and silica fume as needed to reduce the total amount of portland cement, which would otherwise be used, by not less than 40 percent.
4. Slump Limit: 5 inches (125 mm) for concrete with verified slump of 2 to 4 inches (50 to 100 mm) before adding high-range water-reducing admixture or plasticizing admixture, plus or minus 1 inch (25 mm).
5. Air Content: Maintain within range permitted by ACI 301 (ACI 301M). Do not allow air content of trowel-finished floor slabs to exceed 3 percent.

2.6 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M, and furnish batch ticket information.

1. When air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 FORMWORK INSTALLATION

A. Design, construct, erect, brace, and maintain formwork according to ACI 301 (ACI 301M).

3.2 STEEL REINFORCEMENT INSTALLATION

A. Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.

3.3 CONCRETE PLACEMENT

A. Comply with ACI 301 (ACI 301M) for placing concrete.

B. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301 (ACI 301M).

C. Do not add water to concrete during delivery, at Project site, or during placement.

D. Equipment Bases:

1. Coordinate sizes and locations of concrete bases with actual equipment provided.

2. Construct concrete bases 6 inches ((150 mm)) high unless otherwise indicated; and extend base not less than 6 inches (150 mm) in each direction beyond the maximum dimensions of supported equipment unless otherwise indicated or unless required for space constraints. See Drawings.
3. Minimum Compressive Strength: 3500 psi (24.1 MPa) at 28 days.
4. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 24-inch (450-mm) centers around the full perimeter of concrete base.
5. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base, and anchor them into structural concrete substrate.

3.4 FINISHING FORMED SURFACES

A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections exceeding 1/2 inch (13 mm).

1. Apply to concrete surfaces not exposed to public view.

B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defective areas. Remove fins and other projections exceeding 1/8 inch (3 mm).

1. Apply to concrete surfaces exposed to public view.

C. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.5 FINISHING UNFORMED SURFACES

A. General: Comply with ACI 302.1R for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Screed surfaces with a straightedge and strike off. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane before excess moisture or bleedwater appears on surface.

1. Do not further disturb surfaces before starting finishing operations.

C. Scratch Finish: Apply scratch finish to surfaces indicated and surfaces to receive concrete floor topping or mortar setting beds for ceramic or quarry tile, portland cement terrazzo, and other bonded cementitious floor finishes unless otherwise indicated.

D. Float Finish: Apply float finish to surfaces indicated, to surfaces to receive trowel finish, and to floor and slab surfaces to be covered with fluid-applied or sheet waterproofing, fluid-applied or direct-to-deck-applied membrane roofing, or sand-bed terrazzo.

E. Trowel Finish: Apply a hard trowel finish to surfaces indicated and to floor and slab surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin film-finish coating system.

3.6 CONCRETE PROTECTING AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and with ACI 301 (ACI 301M) for hot-weather protection during curing.

B. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h (1 kg/sq. m x h) before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

C. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.

D. Curing Methods: Cure formed and unformed concrete for at least seven days by one or a combination of the following methods:

1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:

    a. Water.
    b. Continuous water-fog spray.
    c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch (300-mm) lap over adjacent absorptive covers.

2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches (300 mm), and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period, using cover material and waterproof tape.
3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.
4. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

3.7 FIELD QUALITY CONTROL

A. Testing Agency: The Contractor will engage a qualified testing agency to perform tests and inspections at the expense of the Contractor.

B. Tests: Perform according to ACI 301 (ACI 301M).
1. Testing Frequency: Obtain at least one composite sample for each 100 cu. yd. (76 cu. m) or fraction thereof of each concrete mixture placed each day.

END OF SECTION 03 30 53

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Base Bid: General Contractor shall furnish all labor, materials, equipment and services necessary or incidental to the completion of all work of this section and herein specified, including:

1. Wood blocking and nailers
2. Wood furring
3. Back boards

1.2 DEFINITIONS

A. Exposed Framing: Framing not concealed by other construction.

B. Dimension Lumber: Lumber of 2 inches nominal or greater but less than 5 inches nominal in least dimension.

C. Lumber grading agencies, and the abbreviations used to reference them, include the following:

1. NeLMA: Northeastern Lumber Manufacturers' Association.
2. NLGA: National Lumber Grades Authority.
3. RIS: Redwood Inspection Service.
4. SPIB: The Southern Pine Inspection Bureau.
5. WCLIB: West Coast Lumber Inspection Bureau.
6. WWPA: Western Wood Products Association.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

B. Submittals:

1. For adhesives, documentation including printed statement of VOC content.
2. For composite wood products, documentation indicating that product contains no urea formaldehyde.
3. For adhesives, documentation indicating that products comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

1.4 DELIVERY, STORAGE, AND HANDLING

A. Stack lumber flat with spacers beneath and between each bundle to provide air circulation. Protect lumber from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.

1. Factory mark each piece of lumber with grade stamp of grading agency.
2. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry lumber.
3. Provide dressed lumber, S4S, unless otherwise indicated.

B. Maximum Moisture Content of Lumber: 15 percent for 2-inch nominal thickness or less, 19 percent for more than 2-inch nominal thickness.

2.2 MISCELLANEOUS LUMBER

A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:

1. Blocking.
2. Nailers.

B. For items of dimension lumber size, provide Standard, Stud, or No. 3 grade lumber of any species.

C. For concealed boards, provide lumber with 15 percent maximum moisture content and any of the following species and grades:

1. Mixed southern pine; No. 3 grade; SPIB.
2. Hem-fir or hem-fir (north); Standard or No. 3 Common grade; NLGA, WCLIB, or WWPA.
3. Spruce-pine-fir (south) or spruce-pine-fir; Standard or No. 3 Common grade; NeLMA, NLGA, WCLIB, or WWPA.
4. Northern species; No. 3 Common grade; NLGA.

D. For blocking not used for attachment of other construction, Utility, Stud, or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.

E. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.

F. For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.

2.3 PLYWOOD BACKING PANELS

A. Backing Panels: DOC PS 1, fire-retardant treated, in thickness indicated or, if not indicated, not less than 1/2-inch nominal thickness.

1. Plywood shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2. Use stainless steel screws to attach all fire-retardant treated wood.

2.4 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.

B. Nails, Brads, and Staples: ASTM F 1667.

C. Power-Driven Fasteners: NES NER-272.

D. Wood Screws: ASME B18.6.1.

E. For fire retardant wood, use stainless steel fasteners.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry to other construction; scribe and cope as needed for accurate fit. Locate nailers, blocking, and similar supports to comply with requirements for attaching other construction.

B. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.

C. Install plywood backing panels by fastening to substrate; coordinate locations with utilities requiring backing panels. Install fire-retardant treated plywood backing panels with classification marking of testing agency exposed to view, using stainless steel fasteners.

D. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.

E. Sort and select lumber so that natural characteristics will not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

F. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:

1. NES NER-272 for power-driven fasteners.

2. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code.

3.2 WOOD BLOCKING, AND NAILER INSTALLATION

A. Install where indicated and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.

B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.

3.3 PROTECTION

A. Protect rough carpentry from weather.

END OF SECTION 06 10 00

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 WORK INCLUDES

A. Base Bid: General Contractor and each trade contractor shall furnish all labor, materials, equipment and services necessary or incidental to the completion of all work of this section as shown on the drawings and herein specified, including:

1. Penetrations in horizontal assemblies.

B. Penetration firestopping in openings smaller than or equal to 4” shall be by the trade making the penetration.

C. Penetration firestopping for utilities openings greater than 4” and other openings shall be by the General Trades Contractor.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Submit Product Data: Manufacturer's specifications and technical data for each material including the composition and limitations, documentation of qualified firestop systems to be used and manufacturer's installation instructions to comply with Section 01 33 00.

B. Manufacturer's engineering judgment identification number and drawing details when no qualified tested system is available for an application. Engineering judgment must include both project name and contractor’s name who will install firestop system as described in document.

C. Product Schedule: For each penetration firestopping system. Include location, illustration of firestopping system, and design designation of qualified testing and inspecting agency.

1.5 COORDINATION

A. Coordinate construction of openings, penetrations and construction joints to ensure that the fire stop systems are installed according to specified requirements.

B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate through-penetration fire stop systems. Coordinate construction and sizing of joints to ensure that fire-resistive joint systems are installed according to specified requirements.

C. Coordinate fire stopping with other trades so that obstructions are not placed in the way prior to the installation of the fire stop systems.

D. Do not cover up through-penetration fire stop and joint system installations that will become concealed behind other construction until each installation has been examined by the authority having jurisdiction, per requirements of Section 109, International Building Code 2000, ed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics:

1. Perform penetration firestopping system tests by a qualified testing agency acceptable to authorities having jurisdiction.
2. Test per testing standards referenced in "Penetration Firestopping Systems" Article. Provide rated systems complying with the following requirements:

    a. Penetration firestopping systems shall bear classification marking of a qualified testing agency:

        1) UL Underwriters Laboratory, per "Fire Resistance Directory."

2.2 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with through penetration firestop systems (XHEZ), joint systems (XHBN), and perimeter firestop systems (XHDG) listed in Volume 2 of the UL Fire Resistance Directory; provide products of the following manufacturers as identified below

    a. Basis of Design: Hilti, Inc.
    b. 3M Fire Protection Products
    c. Specified Technologies, Inc.

1. Substitution requests shall be considered in accordance with contract provisions and the performance requirements outlined in this document and Division 01.

2.3 MATERIALS

A. Use only firestop products that have been UL 1479, ASTM E 814 or UL 2079 tested for specific fire-rated construction conditions conforming to construction assembly type, penetrating item type, annular space requirements, and fire-rating involved for each separate instance.

B. Pre-installed firestop devices for use with noncombustible and combustible pipes (closed and open systems), conduit, and/or cable bundles penetrating concrete floors and/or gypsum walls, the following basis of design products are acceptable:
   1. Hilti Cast-In Place Firestop Device (CP 680-P)
      a. Add Aerator Adaptor when used in conjunction with aerator system.
   2. Hilti Tub Box Kit (CP 681) for use with tub installations.
   3. Hilti Cast-In Place Firestop Device (CP 680-M) for use with noncombustible penetrants.
   4. Hilti Firestop Speed Sleeve (CP 653) for use with cable penetrations.
   5. Hilti Firestop Drop-In Device (CFS-DID) for use with noncombustible and combustible penetrants.
   6. Hilti Firestop Block (CFS-BL)

C. Sealants, caulking materials, or foams for use with non-combustible items including steel pipe, copper pipe, rigid steel conduit and electrical metallic tubing (EMT), the following basis of design products are acceptable:
   1. Hilti Intumescent Firestop Sealant (FS-ONE)
   2. Hilti Fire Foam (CP 620)
   3. Hilti Flexible Firestop Sealant (CP 606)
   4. Hilti Firestop Silicone Sealant Gun Grade (CFS-S SIL GG)
   5. Hilti Firestop Silicone Sealant Self Leveling (CFS-S SIL SL)

D. Sealants or caulking materials for use with sheet metal ducts, the following basis of design products are acceptable:
   1. Hilti Silicone Sealant Gun Grade (CFS-S SIL GG)
   2. Hilti Flexible Firestop Sealant (CP 606)
   3. Hilti Intumescent Firestop Sealant (FS-ONE)

E. Pre-formed mineral wool designed to fit flutes of metal profile deck and gap between top of wall and metal profile deck; as a backer for spray material, the following basis of design products are acceptable.
   1. Hilti Speed Plugs (CP 777)
   2. Hilti Speed Strips (CP 767)

F. Intumescent sealants, caulking materials for use with combustible items (penetrants consumed by high heat and flame) including insulated metal pipe, PVC jacketed, flexible cable or cable bundles and plastic pipe, the following basis of design products are acceptable:
   1. Hilti Intumescent Firestop Sealant (FS-ONE)

G. Foams, intumescent sealants, or caulking materials for use with flexible cable or cable bundles, the following basis of design products are acceptable:
   1. Hilti Intumescent Firestop Sealant (FS-ONE)
   2. Hilti Fire Foam (CP 620)
   3. Hilti Flexible Firestop Sealant (CP 606)
   4. Hilti Firestop Silicone Sealant Gun Grade (CFS-S SIL GG)
   5. Hilti Firestop Silicone Sealant Self Leveling (CFS-S SIL SL)

H. Non-curing, re-penetrable intumescent putty or foam materials for use with flexible cable or cable bundles, the following basis of design products are acceptable:
   1. Hilti Firestop Putty Stick (CP 618)
   2. Hilti Firestop Plug (CFS-PL)

I. Provide a firestop system with a "F" Rating as determined by UL 1479 or ASTM E814 which is equal to the time rating of construction being penetrated.

J. Provide a firestop system with an Assembly Rating as determined by UL 2079 which is equal to the time rating of construction joint assembly.

K. Accessories: Provide all components for each penetration firestopping system that are needed to install fill materials and to maintain ratings required. Use only those components specified by penetration firestopping system manufacturer and approved by qualified testing and inspecting agency for conditions indicated.
   1. Permanent forming/damming/backing materials.
   2. Substrate primers.
   3. Collars.
   4. Steel sleeves.
   5. Labels.

2.4 MIXING

A. Penetration Firestopping Materials: For those products requiring mixing before application, comply with penetration firestopping system manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning: Before installing penetration firestopping systems, clean out openings immediately to comply with manufacturer's written instructions and with the following requirements:

   1. Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of penetration firestopping materials.
   2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with penetration firestopping materials. Remove loose particles remaining from cleaning operation.
   3. Remove laitance and form-release agents from concrete.

B. Prime substrates where recommended in writing by manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

3.3 INSTALLATION

A. General: Install penetration firestopping systems to comply with manufacturer's written installation instructions and published drawings for products and applications.

B. Install forming materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings.

1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not forming permanent components of firestopping.

C. Install fill materials by proven techniques to produce the following results:

1. Fill voids and cavities formed by openings, forming materials, accessories and penetrating items to achieve required fire-resistance ratings.
2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
3. For fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 IDENTIFICATION

A. Wall Identification: Permanently label walls containing penetration firestopping systems with the words "FIRE AND/OR SMOKE BARRIER - PROTECT ALL OPENINGS," using lettering not less than 3 inches high and with minimum 0.375-inch strokes.

1. Locate in accessible concealed floor, floor-ceiling, or attic space at 15 feet from end of wall and at intervals not exceeding 30 feet.

B. Penetration Identification: Identify each penetration firestopping system with legible metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches of penetration firestopping system edge so labels are visible to anyone seeking to remove penetrating items or firestopping systems. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:

1. The words "Warning - Penetration Firestopping - Do Not Disturb. Notify Building Management of Any Damage."
2. Contractor's name, address, and phone number.
3. Designation of applicable testing and inspecting agency.
4. Date of installation.
5. Manufacturer's name.
6. Installer's name.

3.5 FIELD QUALITY CONTROL

A. Owner will engage a qualified testing agency to perform tests and inspections according to ASTM E 2174.

B. Where deficiencies are found or penetration firestopping system is damaged or removed because of testing, repair or replace penetration firestopping system to comply with requirements.

C. Proceed with enclosing penetration firestopping systems with other construction only after inspection reports are issued and installations comply with requirements.

3.6 CLEANING AND PROTECTION

A. Clean off excess fill materials adjacent to openings as the Work progresses by methods and with cleaning materials that are approved in writing by penetration firestopping system manufacturers and that do not damage materials in which openings occur.

B. Provide final protection and maintain conditions during and after installation that ensure that penetration firestopping systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, immediately cut out and remove damaged or deteriorated penetration firestopping material and install new materials to produce systems complying with specified requirements.

3.7 PENETRATION FIRESTOPPING SYSTEM SCHEDULE

CONCRETE FLOORS		
TYPE OF PENETRANT	**F-RATING (HR)**	**BASIS OF DESIGN UL SYSTEM**
CIRCULAR BLANK OPENINGS	1	F-A-0006, C-AJ-0055, C-AJ-0090
	2	F-A-0006, C-AJ-0055, C-AJ-0090
	3	F-A-0006, C-AJ-0055, C-AJ-0086,
SINGLE METAL PIPES OR CONDUIT	1	C-AJ-1226, F-A-1028, F-A-1017
	2	C-AJ-1226, F-A-1028, F-A-1017
	3	C-AJ-1226, F-A-1017
	4	C-BJ -1037, C-BJ-1034
SINGLE NON-METALLIC PIPE OR CONDUIT (I.E. PVC, CPVC, ABS, FRP, ENT)	1	F-A-2053, F-A-2025, C-AJ-2109, C-AJ-2098, C-AJ-2271, C-AJ-2167,
	2	C-AJ-2098, C-AJ-2271, C-AJ-2167, C-BJ-2021, C-AJ-2371, C-AJ-2342
	3	F-A-2054, C-AJ-2109, C-AJ-2098, C-AJ-2371, C-AJ-2342
	4	C-BJ 2016, C-AJ-2017
SINGLE/CABLE BUNDLES	1	F-A-3007,C-AJ-3095,C-AJ-3180, C-AJ-3283
	2	F-A-3007,C-AJ-3095,C-AJ-3334, F-A-3060
	3	F-A-3007, C-AJ 3095, C-AJ-3285
CABLE TRAY	1	C-AJ-4034, C-AJ-4035
	2	C-AJ-4034, C-AJ-4035
	3	C-AJ-4034, C-AJ-4035
SINGLE INSULATED PIPES	1	F-A 5015, F-A 5017, C-AJ-5090, C-AJ-5091, C-AJ-5090, C-AJ-5048
	2	F-A 5015, F-A 5017, C-AJ-5090, C-AJ-5091, C-AJ-5090
	3	F-A 5016, C-AJ-5090, F-A-5018
	4	C-BJ-5006
ELECTRICAL BUSWAY	1	C-AJ-6006, C-AJ-6017, F-A-6002, C-AJ-6036
	2	C-AJ-6006, C-AJ-6017, F-A 6042, C-AJ-6036
	3	C-AJ-6006, C-AJ-6017

MECHANICAL DUCTWORK WITHOUT DAMPERS NON-INSULATED	1	C-AJ-7046, C-AJ-7051, C-AJ-7084
	2	C-AJ-7046, C-AJ-7051, C-AJ-7085
	3	C-AJ-7046, C-AJ-7051
MECHANICAL DUCTWORK WITHOUT DAMPERS INSULATED	N/A**	N/A**
MIXED PENETRANTS	1	C-AJ 8099, C-AJ-8056, C-AJ-8143
	2	C-AJ-8099, C-AJ-8056, C-AJ-8143
	3	C-AJ-8099, C-AJ-8056
	4	C-AJ-8095

END OF SECTION 07 84 13

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 WORK INCLUDES

A. Base Bid: General Contractor shall furnish all labor, materials, equipment and services necessary or incidental to the completion of all work of this section as shown on the drawings and herein specified, including: Work includes all labor and material for the following:

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each joint-sealant product.

B. Joint-Sealant Schedule: Include the following information:

1. Joint-sealant application, joint location, and designation.
2. Joint-sealant manufacturer and product name.
3. Joint-sealant formulation.
4. Joint-sealant color.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified testing agency.

1.6 FIELD CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:

1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F.
2. When joint substrates are wet.
3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.7 WARRANTY

A. Special Installer's Warranty: Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

B. Special Manufacturer's Warranty: Manufacturer agrees to furnish joint sealants to repair or replace those joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

C. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:

1. Movement of the structure caused by stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
2. Disintegration of joint substrates from causes exceeding design specifications.
3. Mechanical damage caused by individuals, tools, or other outside agents.
4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PRODUCTS

2.1 JOINT SEALANTS, GENERAL

A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.

B. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.2 MILDEW-RESISTANT JOINT SEALANTS

A. Mildew-Resistant Joint Sealants: Formulated for prolonged exposure to humidity with fungicide to prevent mold and mildew growth.

B. Silicone, Mildew Resistant, Acetoxy Curing, S, NS, 25, NT: Mildew-resistant, single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, acetoxy-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 25, Use NT.

2.3 JOINT-SEALANT BACKING

A. Sealant Backing Material, General: Nonstaining; compatible with joint substrates, sealants, primers, and other joint fillers; and approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin), and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

2.4 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.

B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

1. Do not leave gaps between ends of sealant backings.
2. Do not stretch, twist, puncture, or tear sealant backings.
3. Remove absorbent sealant backings that have become wet before sealant application, and replace them with dry materials.

D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:

1. Place sealants so they directly contact and fully wet joint substrates.
2. Completely fill recesses in each joint configuration.
3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.

1. Remove excess sealant from surfaces adjacent to joints.
2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
3. Provide concave joint profile per Figure 8A in ASTM C 1193 unless otherwise indicated.
4. Provide flush joint profile to suit location otherwise, according to Figure 8B in ASTM C 1193.
5. Use masking tape to protect surfaces adjacent to recessed tooled joints.

3.4 FIELD QUALITY CONTROL

A. Field-Adhesion Testing: Field test joint-sealant adhesion to joint substrates.

B. Evaluation of Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

3.5 CLEANING

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

3.6 PROTECTION

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

3.7 JOINT-SEALANT SCHEDULE

A. Joint-Sealant Application: Mildew-resistant interior joints in vertical surfaces and horizontal nontraffic surfaces.
   1. Manufacturers:
      a. Tremco Incorporated Tremseal 200
      b. DAP Silicone Plus
      c. Pecora Corporation 860

   2. Joint Locations:

      a. Joints between plumbing fixtures and adjoining walls, floors, and counters.
      b. Tile control, expansion and perimeter joints where indicated.
      c. Joints at the window perimeter and interior finish.
      d. Joints at the window sill.
      e. Joints at counters, back splashes and side splashed.
      f. Other joints as indicated on drawings.

   3. Joint Sealant: Silicone, mildew resistant, acid curing, S, NS, 25, NT.
   4. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

END OF SECTION 07 92 00

PART 1 - GENERAL

1.1 WORK INCLUDES

A. Base Bid:

1. General Contractor shall provide ALL labor, materials, equipment and services necessary or incidental to the completion of all work of this section as shown on the drawings herein specified or otherwise required.
2. Steel (hollow metal) acoustic doors and frames, glazing stops, reinforcement for all finish hardware.
3. Anchors and accessories required for proper installation of frames.

1.2 RELATED DOCUMENTS

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

1.3 SUMMARY

A. Section includes metal sound control door assemblies.

B. Related Requirements:
1. Section 07 92 00 – Joint Sealants
2. Section 09 22 16 – Non Structural Metal Framing.
3. Section 09 29 00 – Gypsum Board.

1.4 COORDINATION

A. Coordinate installation of anchorages for sound control door assemblies. Furnish setting drawings, templates, and directions for installing anchorages. Deliver sleeves, inserts, anchor bolts, and items with integral anchors to Project site in time for installation.

1.5 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review procedures for coordinating frame and anchor installation with wall construction.
2. Review required field quality-control procedures.

1.6 ACTION SUBMITTALS

A. Product Data: For each type of product. Include sound ratings, construction details, material descriptions, core descriptions and finishes.

B. Shop Drawings: For sound control door assemblies.

1. Include elevations of each door design.
2. Include details of sound control seals, door bottoms, and thresholds.
3. Include details of doors, including vertical- and horizontal-edge details and metal thicknesses.
4. Include frame details for each frame type, including dimensioned profiles and metal thicknesses.
5. Include details of anchorages, joints, field splices, and connections.
6. Include details of accessories.

C. Schedule: Provide a schedule of sound control door assemblies prepared using same reference numbers for details and openings as those on Drawings. Coordinate with the Door Hardware Schedule.

1.7 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer.

B. Product Certificates: For each type of sound control door assembly.

C. Product Test Reports: For each sound control door assembly, for tests performed by a qualified testing agency.

D. Sample Warranty: For manufacturer's special warranties.

1.8 CLOSEOUT SUBMITTALS

A. Maintenance Data: For sound control door assemblies to include in maintenance manuals.

1.9 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

B. Acoustical Testing Agency Qualifications: An independent agency accredited as an acoustical laboratory according to the National Voluntary Laboratory Accreditation Program of NIST.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Deliver doors and frames palletized, wrapped, or crated to provide protection during transit and Project-site storage. Avoid the use of nonvented plastic.

1. Provide additional protection to prevent damage to factory-finished units.

B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

C. Store doors and frames vertically under cover at Project site with head up. Place on minimum 4-inch-(102-mm-) high wood blocking. Provide minimum 1/4-inch (6-mm) space between each stacked door to permit air circulation.

1.11 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of sound control door assemblies that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Failure to meet sound rating requirements.
b. Faulty operation of sound seals.
c. Deterioration of metals, metal finishes, and other materials beyond normal use or weathering.

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Sound Rating: Provide sound control door assemblies identical to those of assemblies tested as sound-retardant units by an acoustical testing agency, and have the following minimum rating:

1. STC Rating: 46 as calculated by ASTM E 413 when tested in an operable condition according to ASTM E 90.

2.2 STEEL SOUND CONTROL DOORS

A. Basis of Design:

1. Ceco Door, ASSA ABLOY, “Sound-Tech Express System”.
2. Acceptable alternate: Subject to meeting the requirements.
   a. Amwold International,Inc.
   b. Krieger Specialty Products.

B. Source Limitations: Obtain steel sound control door assemblies, including doors, frames, sound control seals, hinges, thresholds, and other items essential for sound control, from single source from single manufacturer.

C. Doors: Flush-design sound control doors, thickness as required to provide STC rating, of seamless construction; with manufacturer's standard sound-retardant core as required to provide STC rating indicated. Construct doors with smooth, flush surfaces without visible joints or seams on exposed faces or stile edges. Fabricate according to NAAMM-HMMA 865.
1. Interior Doors: Fabricate from cold-rolled steel sheet unless otherwise indicated, 0.048-inch (1.21-mm) nominal thickness or thicker as required to achieve STC rating indicated.
2. Core: Manufacturer's standard sound control core.
3. Top and Bottom Channels: Closed with continuous channels of same material as face sheets, spot welded to face sheets not more than 6 inches (152 mm) o.c.
4. Hardware Reinforcement: Same material as face sheets.

D. Materials:

1. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B, suitable for exposed applications.
2. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.

E. Finishes:

1. Prime Finish: Apply manufacturer's standard primer immediately after cleaning and pretreating.

a. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with SDI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

2.3 SOUND CONTROL FRAMES

A. Frames: Fabricate sound control door frames with corners mitered, reinforced, and continuously welded the full depth and width of frame. Fabricate according to NAAMM-HMMA 865.

1. Weld frames according to NAAMM-HMMA 820.
2. Interior Frames: Fabricate from cold-rolled steel sheet unless otherwise indicated, 0.075-inch (1.90-mm) nominal thickness or thicker as required to provide STC rating indicated.
3. Hardware Reinforcement: Fabricate according to NAAMM-HMMA 865 of same material as face sheets.
4. Head Reinforcement: Metallic-coated steel channel or angle stiffener, 0.108-inch (2.74-mm) nominal thickness.
5. Jamb Anchors:
   a. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.048-inch (1.21-mm) nominal-thickness uncoated steel unless otherwise indicated.

6. Floor Anchors: Not less than 0.079-inch (2.01-mm) nominal-thickness metallic-coated steel, and as follows:

   a. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.

B. Materials:

1. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B, suitable for exposed applications.
2. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.
3. Powder-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching sound control door frames of type indicated.
4. Mineral-Fiber Insulation: Insulation composed of rock-wool fibers, slag-wool fibers, or glass fibers.

C. Finishes:

1. Prime Finish: Apply manufacturer's standard primer immediately after cleaning and pretreating.

a. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with SDI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

2.4 HARDWARE

A. Sound Control Door Hardware: Manufacturer's standard sound control system, including head and jamb seals, door bottoms and thresholds, as required by testing to achieve STC rating indicated.

1. Head and Jamb Seals:

a. Neoprene Compression Seals: One-piece units consisting of closed-cell sponge neoprene seal held in place by metal retainer, with retainer cover of same material as door frame; attached to door frame with concealed screws.

2. Door Bottoms: Neoprene or silicone gasket held in place by metal housing; mortised into bottom edge of door.
3. Thresholds: Flat, smooth, unfluted type as recommended by manufacturer; fabricated from aluminum.

a. Finish: Clear anodic finish.

B. Other Hardware: Comply with requirements in Section 087100 "Door Hardware.

2.5 SOUND CONTROL ACCESSORIES

A. Grout: Comply with ASTM C 476, with a slump of not more than 4 inches (102 mm) as measured according to ASTM C 143/C 143M.

2.6 FABRICATION

A. Steel Sound Control Door Fabrication: Sound control doors to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal.
1. Seamless Edge Construction: Fabricate doors with faces joined at vertical edges by welding; welds shall be ground, filled, and dressed to make them invisible and to provide a smooth, flush surface.
2. Hardware Preparation: Factory prepare sound control doors to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping.

a. Reinforce doors to receive nontemplated mortised and surface-mounted door hardware.
b. Locate door hardware as indicated, or if not indicated, according to NAAMM-HMMA 831, "Recommended Hardware Locations for Custom Hollow Metal Doors and Frames."

3. Tolerances: Fabricate doors to tolerances indicated in NAAMM-HMMA 865.

B. Sound Control Frame Fabrication: Fabricate sound control frames to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.

1. Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible. Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated from same thickness metal as frames.
2. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
3. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
4. Jamb Anchors: Provide number and spacing of anchors as follows:

    a. Stud-Wall Type: Locate anchors not more than 18 inches (457 mm) from top and bottom of frame. Space anchors not more than 32 inches (813 mm) o.c. and as follows:

        1) Three anchors per jamb up to 60 inches (1524 mm) in height.
        2) Four anchors per jamb from 60 to 90 inches (1524 to 2286 mm) in height.
        3) Two anchors per head for frames more than 42 inches (1066 mm) wide and mounted in metal-stud partitions.

    b. Postinstalled Expansion Type: Locate anchors not more than 6 inches (152 mm) from top and bottom of frame. Space anchors not more than 26 inches (660 mm) o.c.
5. Hardware Preparation: Factory prepare sound control frames to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping.

    a. Reinforce frames to receive nontemplated mortised and surface-mounted door hardware.
    b. Locate hardware as indicated, or if not indicated, according to NAAMM-HMMA 831, "Recommended Hardware Locations for Custom Hollow Metal Doors and Frames."

6. Plaster Guards: Weld guards to frame at back of hardware cutouts and glazing-stop screw and sound control seal preparations to close off interior of openings in frames to be grouted.
7. Tolerances: Fabricate frames to tolerances indicated in NAAMM-HMMA 865.

PART 3 - EXECUTION

3.1 EXAMINATION

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

B. Examine roughing-in for embedded and built-in anchors to verify actual locations of sound control door frame connections before frame installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.

B. Prior to installation, adjust and securely brace sound control door frames to the following tolerances:

1. Squareness: Plus or minus 1/16 inch (1.6 mm), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
2. Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.
3. Twist: Plus or minus 1/16 inch (1.6 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
4. Plumbness: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a perpendicular line from head to floor.

C. Drill and tap doors and frames to receive nontemplated mortised and surface-mounted door hardware.

3.3 INSTALLATION

A. General: Install sound control door assemblies plumb, rigid, properly aligned, and securely fastened in place; comply with manufacturer's written instructions.

B. Frames: Install sound control door frames in sizes and profiles indicated.

1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.
   a. Where frames are fabricated in sections due to shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, and dress; make splice smooth, flush, and invisible on exposed faces.
   b. Remove temporary braces only after frames or bucks have been properly set and secured.
   c. Check squareness, twist, and plumbness of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
   d. Apply corrosion-resistant coating to backs of frames to be filled with mortar, grout, and plaster containing antifreezing agents.

2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with postinstalled expansion anchors.

   a. Floor anchors may be set with powder-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.

3. Metal-Stud Partitions: Fully fill frames with mineral-fiber insulation.
4. Installation Tolerances: Adjust sound control door frames for squareness, alignment, twist, and plumbness to the following tolerances:

   a. Squareness: Plus or minus 1/16 inch (1.6 mm), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
   b. Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.
   c. Twist: Plus or minus 1/16 inch (1.6 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
   d. Plumbness: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a perpendicular line from head to floor.

C. Doors: Fit sound control doors accurately in frames, within clearances indicated below. Shim as necessary.

1. Non-Fire-Rated Doors: Fit non-fire-rated doors accurately in frames with the following clearances:

a. Jambs: 1/8 inch (3 mm).
b. Head with Butt Hinges: 1/8 inch (3 mm).
c. Head with Cam-Lift Hinges: As required by manufacturer, but not more than 3/8 inch (9.5 mm).
d. Sill: Manufacturer's standard.
e. Between Edges of Pairs of Doors: 1/8 inch (3 mm).

D. Sound Control Seals: Where seals have been factory prefit and preinstalled and subsequently removed for shipping, reinstall seals and adjust according to manufacturer's written instructions.

E. Thresholds: Set thresholds in full bed of sealant complying with requirements in Section 079200 "Joint Sealants."

3.4 FIELD QUALITY CONTROL

A. Testing Agency: At the Owner’s option, the Owner will engage a qualified testing agency to perform tests and inspections.

B. Testing Services: Perform testing for verification that assembly complies with STC rating requirements.

1. Acoustical testing and inspecting agency shall select one sound control door(s) at random from sound control door assemblies that are completely installed for testing.
2. Field tests shall be conducted according to ASTM E 336, with results calculated according to ASTM E 413. Acceptable field NIC values shall be within 5 dB of laboratory STC values.
3. Inspection Report: Acoustical testing agency shall submit report in writing to Architect and Contractor within 24 hours after testing.
4. If tested door fails, replace or rework all sound control door assemblies to bring them into compliance at Contractor's expense.

a. Additional testing and inspecting at Contractor's expense will be performed to determine if replaced or additional work complies with specified requirements.

C. Prepare test and inspection reports.

3.5 ADJUSTING AND CLEANING

A. Final Adjustments: Check and adjust seals, door bottoms, and other sound control hardware items right before final inspection. Leave work in complete and proper operating condition.

B. Remove and replace defective work, including defective or damaged sound seals and doors and frames that are warped, bowed, or otherwise unacceptable.

1. Adjust gaskets, gasket retainers, and retainer covers to provide contact required to achieve STC rating.

C. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible, rust-inhibitive, air-drying primer.

END OF SECTION 08 34 73.13

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Base Bid: General Contractor shall furnish all labor, materials, equipment and services necessary or incidental to the completion of all work of this section and herein specified, including:
   1. Door hardware for wood
   2. Key bond.
   3. Jobsite visit necessary for keying conference(s).

1.2 REFERENCES

A. ANSI/ICC A117.1 - American National Standard for Accessible and Usable Buildings and Facilities; International Code Council; 2003.

B. AWI - Architectural Woodwork Institute; current edition.

C. BHMA A156.1 - American National Standard for Butts and Hinges; Builders Hardware Manufacturers Association, Inc.; 2006 (ANSI/BHMA A156.1).

D. BHMA A156.5 - American National Standard for Auxiliary Locks & Associated Products; Builders Hardware Manufacturers Association; 2001 (ANSI/BHMA A156.5).

E. BHMA A156.6 - American National Standard for Architectural Door Trim; Builders Hardware Manufacturers Association; 2005 (ANSI/BHMA A156.6).

F. BHMA A156.7 - American National Standard for Template Hinge Dimensions; Builders Hardware Manufacturers Association; 2003 (ANSI/BHMA A156.7).

G. BHMA A156.8 - American National Standard for Door Controls - Overhead Stops and Holders; Builders Hardware Manufacturers Association, Inc.; 2005 (ANSI/BHMA A156.8).

H. BHMA A156.13 - American National Standard for Mortise Locks & Latches; Builders Hardware Manufacturers Association; 2005 (ANSI/BHMA A156.13).

I. BHMA A156.15 - American National Standard for Release Devices - Closer Holder, Electromagnetic and Electromechanical; Builders Hardware Manufacturers Association; 2006 (ANSI/BHMA A156.15).

J. BHMA A156.16 - American National Standard for Auxiliary Hardware; Builders Hardware Manufacturers Association; 2002 (ANSI/BHMA A156.16).

K. BHMA A156.18 - American National Standard for Materials and Finishes; Builders Hardware Manufacturers Association, Inc.; 2006 (ANSI/BHMA A156.18).

L. BHMA A156.21 - American National Standard for Thresholds; Builders Hardware Manufacturers Association; 2006 (ANSI/BHMA A156.21).

M. BHMA A156.115 - Hardware Preparation in Steel Doors and Steel Frames; 2006.

N. BHMA A156.115W - Hardware Preparation in Wood Doors with Wood or Steel Frames; 2006.

O. DHI (LOCS) - Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames; Door and Hardware Institute; 2004.

P. DHI WDHS.3 - Recommended Locations for Architectural Hardware for Flush Wood Doors; Door and Hardware Institute; 1993; also in WDHS-1/WDHS-5 Series, 1996.

Q. ITS (DIR) - Directory of Listed Products; Intertek Testing Services NA, Inc.; current edition.

R. NFPA 80 - Standard for Fire Doors and Fire Windows; National Fire Protection Association; 2007.

S. NFPA 101 - Code for Safety to Life from Fire in Buildings and Structures; National Fire Protection Association; 2006.

T. SDI - Steel Door Institute.

U. UL (BMD) - Building Materials Directory; Underwriters Laboratories Inc.; current edition.

V. WHI - Warnock Hersey Incorporated; current edition.

1.3 SPECIFIED ELSEWHERE:

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the manufacture, fabrication, and installation of products onto which door hardware will be installed.

B. Furnish templates for door and frame preparation to manufacturers and fabricators of products requiring internal reinforcement for door hardware.

C. Convey Owner's keying requirements to manufacturers.

D. Preinstallation Meeting: Convene a preinstallation meeting one week prior to commencing work of this section; require attendance by all affected installers.

E. Sequence installation to ensure utility connections are achieved in an orderly and expeditious manner.

1.5 ACTION SUBMITTALS

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

B. Shop Drawings: Details of electrified door hardware.

C. Samples: For each exposed product and for each color and texture specified.

D. Other Action Submittals:

1. Door Hardware Schedule: Prepared by or under the supervision of Installer, detailing fabrication and assembly of door hardware, as well as installation procedures and diagrams. Coordinate final door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
    a. Format: Use same scheduling sequence and format and use same door numbers as in the Contract Documents. Use DHI vertical format.
    b. Content: Include the following information:
        i. Identification number, location, hand, fire rating, size, and material of each door and frame.
        ii. Locations of each door hardware set, cross-referenced to Drawings on floor plans and to door and frame schedule.
        iii. Complete designations, including name and manufacturer, type, style, function, size, quantity, function, and finish of each door hardware product.
        iv. Description of electrified door hardware sequences of operation and interfaces with other building control systems.
2. Keying Schedule: Prepared by owner. Contractor to furnish Medeco vendor contact information for coordination of keying.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Supplier of products and an employer of workers trained and approved by product manufacturers and an Architectural Hardware Consultant who is available during the course of the Work to consult with Contractor, Architect, and Owner about door hardware and keying.

B. Architectural Hardware Consultant Qualifications: A person who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project and who is currently certified by DHI as follows:
    1. For door hardware, an Architectural Hardware Consultant (AHC) or Architectural Openings Consultant (AOC).

C. Source Limitations: Provide electrified door hardware from same manufacturer as mechanical door hardware, unless otherwise indicated.

D. Fire-Rated Door Assemblies: Where fire-rated door assemblies are indicated, provide door hardware rated for use in assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C, unless otherwise indicated.

E. Smoke- and Draft-Control Door Assemblies: Where smoke- and draft-control door assemblies are required, provide door hardware that meet requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105.
    1. Air Leakage Rate: Maximum air leakage of 0.3 cfm/sq. ft. (3 cu. m per minute/sq. m) at the tested pressure differential of 0.3-inch wg (75 Pa) of water.

F. Electrified Door Hardware: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.

G. Means of Egress Doors: Latches do not require more than 15 lbf (67 N) to release the latch. Locks do not require use of a key, tool, or special knowledge for operation.

H. Accessibility Requirements: For door hardware on doors in an accessible route, comply with the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines, ICC/ANSI A117.1 and HUD's "Fair Housing Accessibility Guidelines".

1. Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf (22.2 N).

2. Comply with the following maximum opening-force requirements:

a. Interior, Non-Fire-Rated Hinged Doors: 5 lbf (22.2 N) applied perpendicular to door.
b. Sliding or Folding Doors: 5 lbf (22.2 N) applied parallel to door at latch.
c. Fire Doors: Minimum opening force allowable by authorities having jurisdiction.

3. Bevel raised thresholds with a slope of not more than 1:2. Provide thresholds not more than 1/2 inch (13 mm) high.

4. Adjust door closer sweep periods so that, from an open position of 70 degrees, the door will take at least 3 seconds to move to a point 3 inches (75 mm) from the latch, measured to the leading edge of the door.

I. Coordination Meetings.

1. Preinstallation Meeting: Prior to the start of hardware installation, the hardware manufacturer's representative will be scheduled to conduct a pre-installation meeting with the hardware installers, supplier, lock, exit device, and door closer manufacturer's representatives and related trades to coordinate materials and techniques.

2. Contractor shall provide signed and executed Key Bond in the penal sum of $250,000 (Two hundred and fifty thousand dollars, U.S.) naming the College of DuPage as Obligee, payable upon Contractor's failure to return to the College of DuPage the core removal key(s) and great great grand master key(s), in original form and loaned by the College of DuPage to the Contractor for use during construction. A sample copy of required Key Bond may be obtained from the College of DuPage.

3. Keying Conference: Conducted by Owner at Project site to comply with requirements in Section 013100 "Project Management and Coordination."

4. Post installation inspection to be performed by Hardware manufacturer's representative with a copy of the report to be forwarded to the contractor and to C.O.D.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver keys.

1. All keys, key blanks, and cores are shipped directly from Medeco to C.O.D. Lockshop.

B. Deliver keys and permanent cores to Owner by registered mail or overnight package service.

1.8 SEQUENCING AND COORDINATION

A. Reinforce walls for wall stops.

B. Coordinate finish floor materials and floor-mounted hardware.

C. Coordinate conduit and raceways as needed for electrical and electronic hardware items, fire and life safety system interfacing, point-to-point wiring diagrams, and riser diagrams to related other Trade Contractors.

D. Furnish manufacturer templates to door and frame fabricators.

1.9 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion, unless otherwise indicated.

a. Provide ten years mechanical, two years electrical warranty for door closers.
b. Provide three year warranty for mortise locksets.
c. Provide three year warranty for exit devices.
d. Provide lifetime warranty for hinges.
e. Provide two year warranty for all other hardware not listed above.

1.10 COMMISSIONING

A. Test door hardware operation with climate control system and stairwell pressurization system both at rest and while in full operation.

B. Test electrical hardware systems for satisfactory operation.

C. Test hardware interfaced with Fire/Life Safety, Access Control, and Handicapped Operator systems for proper operation and release.

D. Perform final completion inspection with hardware manufacturer’s representative. Submit report of inspection.

1.11 MAINTENANCE

A. Instruct Owner in proper adjustments and maintenance of door hardware and hardware finishes during final adjustment phase of hardware installation.

B. Key biting list in "blind code" form and letter of authorization shall be delivered by the College of DuPage to Contractor for coordination of keying. Contractor is to provide the College of DuPage with total quantity and description of all Medeco KeyMark product prior to obtaining bitting list and letter of authorization from the College of DuPage.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

ITEM	MANUFACTURER	ACCEPTABLE SUBSTITUTE
Hinges	(HAG) Hager	Bommer, McKinney, Stanley
Continuous Hinges	(HAG) Hager	No Substitutions
Key System	(MED) Medeco	No Substitution
Locks	(SCH) Schlage	No Substitution
Access Controllers	(CON) Continental Instruments	No Substitution
Exit Devices	(VON) Von Duprin	No Substitution
Closers	(LCN) LCN	No Substitution
ADA Door Operators	(REC) Record USA	No Substitutions
Flush Bolts	(IVE) Ives	Rockwood
Coordinators	(IVE) Ives	No Substitutions
Push & Pull Plates	(ROC) Rockwood	No Substitutions
Kickplates	(ROC) Rockwood	Hiawatha, Ives
Stops & Holders	(IVE) Ives	Hiawatha, Rockwood, Trimco
Overhead Stops	(GLY) Glynn Johnson	No Substitution
Thresholds	(PEM) Pemko	No Substitution
Seals & Bottoms	(PEM) Pemko	Reese, Zero

A. Provide hardware items required to complete the work in accordance with these specifications and manufacturers' instructions.

1. Include items inadvertently omitted from this specification, where such items are typically provided as industry standard practice, are required for proper door operation, or are necessary for compliance with Life Safety Codes, Fire Codes, and/or applicable Building Codes. Note these items in submittal for review. There will not be any extras allowed for items that should have been included during bidding.

2. Where scheduled item is now obsolete, bid and furnish updated item at no additional cost to the project.

2.2 GENERAL REQUIREMENTS FOR DOOR HARDWARE PRODUCTS

A. Provide products that comply with the following:

1. Applicable provisions of federal, state, and local codes.
2. ANSI/ICC A117.1, American National Standard for Accessible and Usable Buildings and Facilities.
3. Applicable provisions of NFPA 101, Life Safety Code.
4. Fire-Rated Doors: NFPA 80.
5. All Hardware on Fire-Rated Doors: Listed and classified by UL as suitable for the purpose specified and indicated.
6. Products Requiring Electrical Connection: Listed and classified by UL as suitable for the purpose specified and indicated.
7. Finishes: As indicated.

2.3 SCHEDULED DOOR HARDWARE

A. Provide door hardware for each door as scheduled in Part 3 "Door Hardware Schedule" Article to comply with requirements in this Section.

1. Door Hardware Sets: Provide quantity, item, size, finish or color indicated.
2. Sequence of Operation: Provide electrified door hardware function, sequence of operation, and interface with other building control systems indicated. See example, last page of this section.
3. Coordinate all electronic locks and switches into building controls, reporting to
4. Glen Ellyn campus, with override for lockdown at reception desk. See 28 13 00.

B. Designations: Requirements for design, grade, function, finish, size, and other distinctive qualities of each type of door hardware are indicated in Part 3 "Door Hardware Schedule" Article. Products are identified by descriptive titles corresponding to requirements specified in Part 2.

2.4 HANGING MEANS

A. Conventional Hinges: Hinge open widths minimum, but, of sufficient throw to permit maximum door swing. Steel or stainless steel pins and standard ball bearings.

1. Three hinges per leaf to 7 feet, 6 inch height. Add one for each additional 30 inches in height, or any fraction thereof.
2. Extra heavy weight hinges on doors over 3 feet, 5 inches in width.
3. Outswinging exterior doors: non-ferrous with non-removable (NRP) pins; outswinging lockable interior doors to have non-removable (NRP) pins.
4. Non-ferrous material exteriors and at doors subject to corrosive atmospheric conditions.
5. Provide shims and shimming instructions for proper door adjustment.
6. Scheduled Hinges are Hager.
7. Finish of hinges: ferrous satin chrome plates, US26D; non-ferrous satin stainless steel, US32D.
8. Accepted substitutions: Hager, McKinney, Stanley.

2.5 LOCKS, LATCHES, DEADBOLTS

A. Mortise Locksets and Latchsets:

1. Chassis: cold-rolled steel, handing field changeable without disassembly.
2. Latchbolts: 3/4 inch throw stainless steel anti-friction type.
3. Lever Trim: through-bolted, accessible design, cast lever or solid extruded type levers as scheduled. Filled hollow tube design unacceptable.
    a. Spindles: security design independent break-away. Breakage of outside lever does not allow access to inside lever's hubworks to gain wrongful entry.
    b. Thumbturns: L583-363 accessible design not requiring pinching or twisting motions to operate.
    c. Deadbolts: stainless steel 1-inch throw.
    d. Strikes: 16 gage curved steel, bronze or brass with 1 inch deep box construction, lips of sufficient length to clear trim and protect clothing.
    e. Scheduled Lock Series and Design: Schlage L9000BD series, 06N design.
    f. Anti-Ligature locks to be by Schlage (Trim # SK1XL11-000X630) as indicated in hardware sets.
    g. Certifications:
        i. ANSI A156.13, 1994, Grade 1 Operational, Grade 1 Security.
        ii. ANSI/ASTM F476-84 Grade 31 UL Listed.
    h. Accepted Substitutions: No substitutions allowed.
    i. Vertical clearance between latch tongue and strike plate shall be 1/8” (min.)
        i. Strike filing is not an acceptable adjustment.

2.6 LOCK CYLINDERS

A. Lock Cylinders: Tumbler type, constructed from brass or bronze, stainless steel, or nickel silver.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Medeco Security Locks, Inc.; an ASSA ABLOY Group company.
      b. No Substitutions.
      c. Model Medeco KeyMark SFIC core #33K700007 – 9G – 26 x MK x (SL-Stamp-Lok)

B. High-Security Lock Cylinders: BHMA A156.30; Grade 1; permanent cores that are SFIC removable; face finished to match lockset.
   1. Number of Pins: Seven.
   2. Type: Mortise and Rim type.

C. Construction Cores: Provide construction cores that are replaceable by permanent cores. Provide 10 construction master keys.
   1. Owner will send Letter of Authorization to Medeco supplier (Contractor to provide contact info) and the key schedule and bitting list to Medeco. Medeco to send all cut keys, key blanks, and keyed cores directly to Owner. Owner will release cores to contractor after they have been checked and prepared for install. Receipt of the Key Bond (see 3.1) is also required for release of cores.

D. Provide Locking Function As Follows:
   1. Classroom – Intruder function, no closer.
   2. Common Room Control – Lock/unlock (L9070).
   3. Passage – Stairwells never locked (L9010).
   4. Storeroom (L9080x06N)
   5. Access Control/Prox – North and south entry doors.
   6. Offices - (L9056x06N x L583-363 thumb turn).

2.7 KEYING

A. Keying System: Factory registered, complying with guidelines in BHMA A156.28, Appendix A. Incorporate decisions made in keying conference.
   1. Existing System:
      a. Master key or grand master key locks to Owner's existing system.

B. Keys:

C. Identification and Delivery: All key blanks and cylinders/cores shall be shipped direct from Medeco to the following address:

College of Dupage
Facilities Operations & Maintenance – Lock Shop
425 Fawell Boulevard
Glenn Ellyn, IL. 60137-6599

2.8 MECHANICAL STOPS AND HOLDERS

A. Provide stops to protect walls, casework or other hardware .

B. Wall-Stops: BHMA A156.16; wrought steel base metal.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Scheduled concave wall stops: Ives WS406CVX or WS407CVS.

b. Schedule convex wall stops: Ives WS406CCV or WX407CCV.

C. Wall Bumpers: Grade 1; with rubber bumper; 2-1/2-inch (64-mm) diameter, minimum 3/4-inch (19-mm) projection from wall; with backplate for concealed fastener installation; with convex bumper configuration.

2.9 FLUSH BOLTS AND DUSTPROOF STRIKES, COORDINATORS

A. Manual Flush Bolts shall be provided in pairs, be non-handed, fit standard ANSI metal door prep and be UL listed for use on doors with fire ratings up to 3 hours. Bolts shall have minimum 5/8" bolt throw with 7/8" vertical adjustment. Top bolt rod shall be provided in length to position activating lever not more than 80 inches above the finished floor.

1. Scheduled manual flush bolts: Ives FB458 with DP1 strike.
2. Finish of manual flush bolts is to be satin chrome plated, 626.

B. Dustproof Strikes are to be spring loaded plunger type, with locking ring for use with threshold, or mounting flange for installation where no threshold is present.

1. Scheduled dustproof strikes: Ives DP2.
2. Finish of dustproof strike is to be satin chrome plated, 626

2.10 OTHER HARDWARE

A. Fasteners: Generally, exposed screws to be Phillips or Robertson drive. Pinned TORX drive at high security areas. Flat head sleeve anchors (FHSL) may be slotted drive. Sheet metal and wood screws: full-thread. Sleeve nuts: full length to prevent door compression. Provide manufacturers' thru bolts for exit devices and door closers without exception.

B. Silencers: Interior hollow metal frames, 3 for single doors, 2 for pairs of doors. Omit where adhesive mounted seal occurs. Leave no unfilled/uncovered pre-punched silencer holes.

C. Key Bond: Contractor shall provide signed and executed Key Bond in the penal sum of $250,000 (Two Hundred and Fifty Thousand Dollars, U.S.) naming College of DuPage as Obligee, payable upon Contractor's failure to return to College of DuPage the core removal key(s) and great great grand master key(s), in original form and quantity loaned by College of DuPage to the Contractor for use during construction. A sample copy of required Key Bond may be obtained from College of DuPage.

2.11 KEYING REQUIREMENTS

A. Key System: Medeco KeyMark 7-pin patented keyway, small format interchangeable core throughout.

1. Existing factory registered master key system.

2. Provide 7-pin SFIC thick head cores, factory keyed to the existing Medeco KeyMark great-grand-masterkey system.
3. Key blanks available only from factory-direct sources, not available from after-market key blank manufacturers.
4. For estimate, use factory Keyway 26 MK and SL-STAMP-LOK charges, number 33K700007.
5. Initiate and conduct meetings with Owner to determine systems keyways and structure.
6. Furnish Owner's written approval of the system.
7. Owner's Lockshop will apply Medeco KeyMark nomenclature to approved keying schedule and forward to Medeco.

B. The following specialty items must be furnished with Medeco KeyMark 7-pin SFIC ext. face cores. Consult Owner for specific details:

1. Elevators with Keyed Switches
2. Built-in Cabinets and Audio / Visual Equipment Cabinets

C. Construction Keying: Furnish temporary keyed-alike cylinder cores.

1. Remove at substantial completion and install permanent cylinder cores in Owner's presence.
2. Demonstrate that construction key no longer operates.
3. Provide Owner with two (2) copies of keys used in each type/keyset of temporary cylinder cores at the time of temporary cylinder core installation.
4. Temporary cylinder cores remain Supplier's property.
5. Furnish 15 construction keys.
6. Furnish 2 construction control keys.
7. Re-combinate entire project at no expense to the Owner if missing any of the project keys.

D. Cylinder Cores: Keyed at factory of core manufacturer where permanent records are maintained.

E. Supply one (1) original Medeco KeyMark cut keys per keyset. Supply two (2) Custom Coined Medeco KeyMark keyblanks for each Medeco KeyMark core provided. All keyblanks are to be custom coined to the College of DuPage existing coining die.

1. Provide key blanks in full box quantities. If project requires less than full box quantity, provide full box quantity.

F. All "SL" stamped (face stamp lock) cores, keys, and coined keyblanks are to be shipped, each under separate cover, via registered mail with delivery receipt required, directly from Medeco to:
College of DuPage
Facilities Operations and Maintenance - Lock Shop 425 Fawell Boulevard
Glen Ellyn, IL 60137-4599

G. Instruct cylinder and key manufacturer to clearly label keys, boxed key blanks, and keyed cylinders per order and with keying instructions included. Each type of key shall be tagged and bagged for easy identification.

H. Core boxes are to be tagged by the manufacturer with both SL_STAMP LOK and Door numbers and not tagged in any other way. Installation of cylinder cores will be by the appropriate Trade Contractor.

I. Factory is to be instructed to stamp all cut keys with appropriate key set.

2.12 FABRICATION

A. Fasteners: Provide door hardware manufactured to comply with published templates prepared for machine, wood, and sheet metal screws. Provide screws that comply with commercially recognized industry standards for application intended, except aluminum fasteners are not permitted. Provide Phillips flat-head screws with finished heads to match surface of door hardware, unless otherwise indicated.

1. Concealed Fasteners: For door hardware units that are exposed when door is closed, except for units already specified with concealed fasteners. Do not use through bolts for installation where bolt head or nut on opposite face is exposed unless it is the only means of securely attaching the door hardware. Where through bolts are used on hollow door and frame construction, provide sleeves for each through bolt.
2. Fire-Rated Applications:
    a. Wood or Machine Screws: For the following:
        i. Hinges mortised to doors or frames; use threaded-to-the-head wood screws for wood doors and frames.
        ii. Strike plates to frames.
        iii. Closers to doors and frames.
    b. Steel Through Bolts: For the following:
        i. Surface hinges to doors.
        ii. Closers to doors and frames.
        iii. Surface-mounted exit devices.
3. Spacers for Bolts: For through bolting of hollow-metal doors.
4. Fasteners for Wood Doors: Comply with requirements in DHI WDHS.2, "Recommended Fasteners for Wood Doors."
5. Gasketing Fasteners: Provide noncorrosive fasteners for exterior applications and elsewhere as indicated.

2.13 GENERAL REQUIREMENTS FOR DOOR HARDWARE PRODUCTS

A. Provide products that comply with the following:
1. Applicable provisions of federal, state, and local codes.
2. ANSI/ICC A117.1, American National Standard for Accessible and Usable Buildings and Facilities.
3. Applicable provisions of NFPA 101, Life Safety Code.
4. Fire_Rated Doors: NFPA 80.
5. All Hardware on Fire_Rated Doors: Listed and classified by UL as suitable for the purpose specified and indicated.
6. Products Requiring Electrical Connection: Listed and classified by UL as suitable for the purpose specified and indicated.
7. Finishes: As indicated.

2.14 FINISHES

A. Provide finishes complying with BHMA A156.18 as indicated in door hardware schedule.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that doors and frames are ready to receive work and dimensions are as indicated on shop drawings.

3.2 INSTALLATION

A. Install hardware in accordance with manufacturer's instructions and applicable codes.

B. Use templates provided by hardware item manufacturer.

C. Install hardware on fire-rated doors and frames in accordance with code and NFPA 80.

D. Mounting heights for hardware from finished floor to center line of hardware item: As listed in Schedule, unless otherwise noted:

1. For steel doors and frames: Comply with DHI "Recommended Locations for Architectural Hardware for Steel Doors and Frames."
2. For wood doors: Comply with DHI "Recommended Locations for Architectural Hardware for Wood Flush Doors."

E. Door Closers: Take note on the degree of swing and type of arm installation as well as other hardware that may interfere if not properly templated. All door closers shall receive sex nuts and bolts (SNB).

F. Wall Stops: All wall stops shall be installed and the substrate wall reinforced so as to prevent knob/lever from striking or damaging wall. For block walls use rawl or plastic plugs; for gypsum board walls use full threaded fastener applicable for substrate reinforcement.

G. Fastening: Furnish hardware complete with all screws, through bolts and other fastenings of suitable type and size to ensure a permanent concealed attachment, with the finish to match the hardware.

H. Thresholds: Install in one continuous piece, full width of opening. Set in full bed of mastic and fasten with countersunk anchors at manufacturer's recommended spacing. Apply clear sealant to outside edges to prevent water infiltration.

I. Fitting: Fit all hardware accurately and properly. Remove exposed parts until after painter's finishing is completed then reinstall (this includes door frame silencers). Securely fasten all fixed parts. Fit faces of mortised parts snug and flush. Make sure operating parts move freely and smoothly without binding, sticking, or excessive clearance.

J. Adjustment:

1. Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit.
2. Replace units that cannot be adjusted to operate as intended.

3. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.
4. Strike filling is not an acceptable adjustment.

3.3 FIELD QUALITY CONTROL

A. Provide an Architectural Hardware Consultant to inspect installation and certify that hardware and installation has been furnished and installed in accordance with manufacturer's instructions and as specified..

3.4 ADJUSTING

A. Adjust work per specifications.

B. Adjust hardware for smooth operation.

C. Adjust each operating item of hardware to manufacturer's recommendations. Check each door to ensure proper operation and function of every unit. Adjust door control devices to proper speed and power.

D. Lubricate moving parts with type of lubrication recommended by manufacturer.

E. Clean all exposed surfaces.

F. Replace unit that cannot be adjusted and lubricated to operate freely, smoothly, and quietly within manufacturers'' specifications as intended for the application.

G. Filing or strike plates or any other hardware component is an unacceptable adjustment method.

H. Trade Contractor shall be responsible to replace a mis-templated door if there is an adjustment or and alignment issue.

3.5 DOOR HARDWARE SCHEDULE

A. Furnish products as listed in the following hardware sets:

B. Manufacturers, finish and their abbreviations used in the schedule:

HAG	Hager
MED	Medeco High Security
ROC	Rockwood
ROT	Roton Hinge
SCH	Schlage Locks
600	Primed Coat
628	Anodized Aluminum
630	Satin Stainless Steel
652	Steel/Satin Chrome
689	Aluminum
SP28	Aluminum

AMS	All Machine Screws
AWS	All Wood Screws
MS	Machine Screws
MS/ES	Machine Screws/Expansion Shields
WS	Wood Screws
SMS	Sheet Metal Screws
SNB	Sex Nuts & Bolts
STMS	Strike Template Machine Screws
T.B.	Toggle Bolt
.050	16 Gauge

HARDWARE SET 1

6	EA	HINGES	BB1279 4.5 X 4.5 NRP	652 HAG
1	PR	FLUSH BOLT	555	626 ROC
1	EA	DUST PROOF STRIKE	570	626 ROC
1	EA	STOREROOM	L9080L	626 SCH
1	EA	CYLINDER	MEDECO KEYMARK SFIC	626 MED
2	EA	WALL STOP	409	630 ROC
1	SET	SEALS	BY DOOR MANUFACTURER	

HARDWARE SET 2

3	EA	HINGES	BB1279 4.5 X 4.5 NRP	652 HAG
1	EA	STOREROOM	L9080L	626 SCH
1	EA	CYLINDER	MEDECO KEYMARK SFIC	626 MED
1	EA	WALL STOP	409	630 ROC
1	SET	SEALS	BY DOOR MANUFACTURER	

END OF SECTION 08 71 00

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 WORK INCLUDES

A. Base Bid: General Contractor shall furnish all labor, materials, equipment and services necessary or incidental to the completion of all work of this section as shown on the drawings and herein specified, including: Work includes all labor and material for the following:

1. Non-load-bearing steel framing systems for interior partitions.
2. Wall reinforcement backing plates.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Studs and Runners: Provide documentation that framing members' certification is according to SIFA's "Code Compliance Certification Program for Cold-Formed Steel Structural and Non-Structural Framing Members."

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Horizontal Deflection: For wall assemblies, limited to 1/240 of the wall height based on horizontal loading of 10 lbf/sq. ft..

2.2 FRAMING SYSTEMS

A. Steel studs from North America conforming to the requirements of this section.

B. Framing Members, General: Comply with ASTM C 754 for conditions indicated.

1. Steel Sheet Components: Comply with ASTM C 645 requirements for metal unless otherwise indicated.
2. Protective Coating: , hot-dip galvanized unless otherwise indicated.

C. Studs and Runners: ASTM C 645.

1. Steel Studs and Runners:

a. Minimum Base-Metal Thickness: 0.0329 inch.
b. Depth: As indicated on Drawings 3-5/8 inches, minimum.

D. Slip-Type Head Joints: Where indicated, provide the following:
1. Deflection Track: Steel sheet top runner manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.

E. Flat Strap and Backing Plate: Steel sheet for blocking and bracing for support of mounted casework and equipment.
1. Minimum Base-Metal Thickness: 0.0598 inch.

F. Hat-Shaped, Rigid Furring Channels: ASTM C 645.
1. Minimum Base-Metal Thickness: 0.0329 inch.
2. Depth: As required for application: 7/8 inch and 1-1/2 inches.

2.3 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards.

1. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

B. Isolation Strip at Exterior Walls: Provide the following:

1. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch thick, in width to suit steel stud size.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Installation Standard: ASTM C 754.

1. Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.

B. Install framing and accessories plumb, square, and true to line, with connections securely fastened.

C. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.

D. Install bracing at terminations in assemblies.

E. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

3.3 INSTALLING FRAMED ASSEMBLIES

A. Install framing system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.

1. Single-Layer Application: As required by horizontal deflection performance requirements minimum 16 inches o.c. unless otherwise indicated.
2. Multilayer Application: As required by horizontal deflection performance requirements minimum 16 inches o.c. unless otherwise indicated.

B. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.

C. Install studs so flanges within framing system point in same direction.

D. Install tracks (runners) at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts that penetrate partitions above ceiling.

1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.

    a. Install two studs at each jamb unless otherwise indicated.
    b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch clearance from jamb stud to allow for installation of control joint in finished assembly.
    c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.

3. Other Framed Openings: Frame openings other than door openings the same as required for door openings unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.

E. Direct Furring:

1. Screw to framing.

F. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by faces of adjacent framing.

G. Install wall backing plates to studs to support wall-supported items where indicated.

H. Install multiple-stud, built-up stud and nested stud post sections where indicated.

I. Install studs anchored to miscellaneous steel sections, where indicated.

END OF SECTION 09 22 16

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 WORK INCLUDES

A. Base Bid: General Contractor shall furnish all labor, materials, equipment and services necessary or incidental to the completion of all work of this section as shown on the drawings and herein specified, including: Work includes all labor and material for the following:

1. Interior gypsum board.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.4 DELIVERY, STORAGE AND HANDLING

A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

1.5 FIELD CONDITIONS

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

B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.

C. Do not install panels that are wet, moisture damaged, and mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 INTERIOR GYPSUM BOARD

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. American Gypsum.

2. CertainTeed Corp.
3. Georgia-Pacific Gypsum LLC.
4. National Gypsum Company.
5. USG Corporation.

B. Gypsum Wallboard: ASTM C 1396/C 1396M.

1. Thickness: 1/2 inch unless noted otherwise.
2. Long Edges: Tapered for prefilling.

C. Gypsum Board, Type X: ASTM C 1396/C 1396M.

1. Thickness: 5/8 inch, Typical.
2. Long Edges: Tapered for prefilling.

2.2 TRIM ACCESSORIES

A. Interior Trim: ASTM C 1047.

1. Material: Galvanized or aluminum-coated steel sheet or rolled zinc.
2. Shapes:

    a. Cornerbead.
    b. LC-Bead: J-shaped; exposed long flange receives joint compound.
    c. L-Bead: L-shaped; exposed long flange receives joint compound.

2.3 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C 475/C 475M.

B. Joint Tape:

1. Interior Gypsum Board: Paper.
2. Exterior Gypsum Soffit Board: Paper.
3. Glass-Mat Gypsum Sheathing Board: 10-by-10 glass mesh.
4. Tile Backing Panels: As recommended by panel manufacturer.

C. Joint Compound for Interior Gypsum Board: For each coat, use formulation that is compatible with other compounds applied on previous or for successive coats.

1. Prefilling: At open joints, beveled panel edges, and damaged surface areas, use setting-type taping compound.
2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use drying-type, all-purpose compound.

    a. Use setting-type compound for installing paper-faced metal trim accessories.

3. Fill Coat: For second coat, use drying-type, all-purpose compound.
4. Finish Coat: For third coat, use drying-type, all-purpose compound.

D. Sound-Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.

E. Acoustical Sealant: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates including welded hollow-metal frames and support framing, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.

B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLYING AND FINISHING PANELS, GENERAL

A. Comply with ASTM C 840.

B. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.

C. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.

D. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

E. Install sound attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side. Install sound insulation blankets to infill existing to match where existing partitions patched.

3.3 APPLYING INTERIOR GYPSUM BOARD

A. Single-Layer Application:

1. On partitions/walls, apply gypsum panels vertically (parallel to framing) unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.

    a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
    b. At stairwells and other high walls, install panels horizontally unless otherwise indicated or required by fire-resistance-rated assembly.

2. On Z-shaped furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
3. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

B. Multilayer Application:

1. On ceilings, apply gypsum board indicated for base layers before applying base layers on walls/partitions; apply face layers in same sequence. Apply base layers at right angles to framing members and offset face-layer joints one framing member, 16 inches minimum, from parallel base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly.
2. On partitions/walls, apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.
3. On Z-shaped furring members, apply base layer vertically (parallel to framing) and face layer either vertically (parallel to framing) or horizontally (perpendicular to framing) with vertical joints offset at least one furring member. Locate edge joints of base layer over furring members.
4. Fastening Methods: Fasten base layers and face layers separately to supports with screws.

3.4 APPLYING TILE BACKING PANELS

A. Glass-Mat, Water-Resistant Backing Panels: Comply with manufacturer's written installation instructions and install at locations indicated to receive tile. Install with 1/4-inch gap where panels abut other construction or penetrations.

B. Locate where tile finishes are indicated.

3.5 INSTALLING TRIM ACCESSORIES

A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

B. Control Joints: Install control joints according to ASTM C 840 and in specific locations approved by Architect for visual effect.

C. Interior Trim: Install in the following locations:

1. Cornerbead: Use at outside corners.
2. Bullnose Bead: Use at outside corners.
3. LC-Bead: Use at exposed panel edges.
4. L-Bead: Use where required.
5. U-Bead: Use at exposed panel edges.

3.6 FINISHING GYPSUM BOARD

A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.

B. Prefill open joints, beveled edges, and damaged surface areas.

C. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.

D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C 840:

1. Level 4: At panel surfaces that will be exposed to view unless otherwise indicated and typically unless noted otherwise.

a. Primer and its application to surfaces are specified in Section 099123 "Interior Painting."

E. Transitions to existing Gypsum board:
1. Float both new and existing exposed surfaces full-height to align and make level. Transition outward from joint and feather finish to make un-noticeable.

3.7 PROTECTION

A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.

B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

C. Remove and replace panels that are wet, moisture damaged, and mold damaged.
1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 09 29 00

PART 1 - GENERAL

1.1 WORK INCLUDES

A. Base Bid: General contractor shall furnish all labor, materials, equipment and services necessary or incidental to the completion of all work of this section as shown on the drawings and herein specified, including:
   1. Acoustic panels provided in exposed grid suspension system.
   2. Exposed grid suspension systems.

1.2 RELATED WORK

A. Specified elsewhere:

   1. Section 07 92 00 – Joint Sealants

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's technical data for each type of acoustical component and suspension.

B. Samples: Submit samples, in triplicate, of the following:

   1. 6" square samples of each acoustical panel pattern and color.
   2. Set of 12" long samples of exposed runners and molding for each suspension system type required.

1.4 QUALITY ASSURANCE

A. Surface Burning Characteristics: As follows, tested per ASTM E 84:

   1. Flame Spread: 25 or less
   2. Smoke Developed: 50 or less

B. Coordination of Work: Coordination layout and installation of acoustical ceiling units and suspension system components with other construction supported by, or penetrating through, ceilings, including light fixtures, HVAC equipment, partition system and similar elements.

1.5 DELIVERY, STORAGE AND HANDLING

A. Deliver acoustical ceiling units to project site in original, unopened packages and store them in a fully enclosed space where they will be protected against damage from moisture, direct sunlight, surface contamination or other causes.

B. Before installing acoustical ceiling units, permit them to reach room temperature and a stabilized moisture content.

C. Handle acoustical ceiling units carefully to avoid chipping edges or damaging units in any way.

1.6 PROJECT CONDITIONS

A. Space Enclosure: Do not install interior acoustical ceilings until space is enclosed and weatherproof, wet work in space is completed and nominally dry, construction above ceilings is complete, and ambient conditions of temperature and humidity will be continuously maintained at values near those indicated for final occupancy.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Acoustical Ceiling Panels: Full-size panels equal to 4 percent of quantity installed, minimum six (6) panels.
2. Suspension-System Components: Quantity of each exposed component equal to 4 percent of quantity installed.

PART 2 - PRODUCTS

2.1 ACOUSTICAL CEILING UNITS, GENERAL

A. Standard for Acoustical Ceiling Units: Provide manufacturer's standard units of configuration indicated, which are prepared for the mounting method designated, and which comply with FS SS-S-118 requirements, including those indicated by reference to type, form, pattern, grade, light reflectance coefficient, edge detail and joint detail.

B. Colors, Textures and Patterns: Provide products matching appearance characteristics of items selected or approved by the A/E, of quality designed.

2.2 ACOUSTICAL TILES AND SUSPENSION SYSTEM

A. Provide manufacturer’s tile units suspension system complying with the following requirements under type and prepared for mounting system indicated.

B. Acoustical panel ceilings and exposed grid suspension system:

1. ACT 1: as indicated on the finish legend, sheet G001.
2. Alternate as acceptable to the Architect.

C. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.

D. Recycled Content: Postconsumer recycled content plus one-half of pre-consumer recycled content not less than 25 percent.

PART 3 - EXECUTION

3.1 PREPARATION

A. Coordination: Furnish layouts for inserts, clips or other supports required to be installed by other trades for support of acoustical ceiling systems.

B. Measure each ceiling area and establish layout of acoustical units to balance border width at opposite edges of each ceiling. Avoid use of less-than-half-widths units at borders, and comply with reflected ceiling plans carefully.

3.2 INSTALLATION

A. Install anchors, wires and exposed grid to match existing system. Install acoustical panels in coordination with suspension system, with edges concealed by support of suspension members. Scribe and cut panels to fit accurately at borders and at penetrations. Marry new replacement grid with existing grid construction to make a seamless installation. Provide new structural tees, components and miscellaneous hardware as required.

B. Prior to the beginning of ceiling work, the ceiling contractor and other contractors whose work is related to the ceiling installation shall identify all areas of potential interference between ceiling components and components from other trades. The ceiling contractor shall coordinate layout requirements with plumbing, heating, and ventilating and electrical contractors.

C. All areas of the interference which arise following the beginning of ceiling construction shall be reported by the contractor involved to the general contractor as soon as the interference is observed. Such interference shall be resolved by the general contractor with the assistance of the contractors involved.

D. In instances where unauthorized modification and/or loading of the ceiling causes unsatisfactory ceiling performance, the responsible party, as determined by the general contractor, will be financially responsible for correction of the condition in an acceptable manner.

E. All mechanical equipment shall be self-supporting and shall not exert any detrimental loads on the ceiling assembly.

F. Where duct work occurs, making it impossible to maintain spacing of hangers, provide additional hangers as required to support larger runners necessary for longer spans. Punching of ducts and extending hangers through ducts will not be permitted. Re-hang existing grid as may be required for new duct installations.

3.3 CLEANING

A. Clean exposed surfaces of ceiling systems specified in this Section, including trim, edge moldings, and suspension members. Comply with manufacturers' instructions for cleaning and touch-up of minor finish damage. Remove and replace components which cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 09 51 13

PART 1 - GENERAL

1.1 WORK INCLUDES

A. General Contractor shall provide all labor, materials, equipment and supplies necessary.
   1. Resilient base indicated and as specified.
   2. Transition strips in profiles as indicated on drawings and as specified.

1.2 RELATED DOCUMENTS

A. Drawings.

B. General provisions of the contract including General and Supplemental Conditions.

C. Division 01 Specifications.

1.3 SUBMITTALS

A. Product Data: Product data for each type of product specified.

B. Samples: Submit samples in manufacturer's standard sizes, but not less than 4 inches long, of each different color and pattern of product specified.

1.4 QUALITY ASSURANCE

A. Conform to all recommendations for materials and installation from all authorities having jurisdiction. The references below are the current editions of the American Society for Testing and Materials, unless otherwise noted.

B. Single-Source Responsibility for Products: Obtain each type and color of product specified from a single source with resources to provide products of consistent quality in appearance and physical properties without delaying progress of the Work.

C. Fire Performance Characteristics: Provide products with the following fire performance characteristics as determined by testing products per ASTM test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.
   1. Critical Radiant Flux: 0.45 watts per sq. cm or more per ASTM E 648.
   2. Smoke Density: Less than 450 per ASTM E 662.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to Project site in original manufacturer's unopened cartons and containers, each bearing names of product and manufacturer, Project identification, and shipping and handling instructions.

B. Store products in dry spaces protected from the weather with ambient temperatures maintained between 50 deg F (10 deg C) and 90 deg F (32 deg C).

C. Move products into spaces where they will be installed at least 48 hours in advance of installation.

1.6 PROJECT CONDITIONS

A. Maintain a minimum temperature of 70 deg F (21 deg C) in spaces to receive products specified in this Section for at least 48 hours prior to installation, during installation, and for not less than 48 hours after installation. After this period, maintain a temperature of not less than 55 deg F (13 deg C).

B. Do not install products until they are at the same temperature as that of the space where they are to be installed.

C. Close spaces to traffic during installation of products specified in this Section.

1.7 SEQUENCING AND SCHEDULING

A. Sequence installing products specified in this Section with other construction to minimize possibility of damage and soiling during remainder of construction period.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Roppe

B. Johnsonite

C. Burke Mercer.

2.2 RESILIENT BASE

A. 4” Rubber Wall Base: Complying with ASTM F 1861, Type TS, Group I, solid.

B. Provide and install inside and outside corner pieces by same manufacturer.

C. Colors: As indicated on the Finish Legend, sheet G001.

2.3 TRANSITIONS STRIPS

A. Between new epoxy flooring and existing VCT flooring, and as indicated in the drawings.

2.4 ACCESSORIES

A. Adhesives: Water-resistant type recommended by manufacturer to suit resilient flooring product and substrate conditions indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas where installation of products specified in this Section will occur, with Installer present, to verify that substrates and conditions are satisfactory for installation and comply with manufacturer's requirements and those specified in this Section.

3.2 PREPARATION

A. General: Comply with manufacturer's installation specifications for preparing substrates indicated to receive products indicated.

B. Use trowelable patching compounds per manufacturer's directions to fill cracks, holes, and depressions in substrates.

C. Clean substrates to be covered immediately before installing products specified in this Section. Following cleaning, examine substrates for moisture, alkaline salts, carbonation, or dust.

3.3 INSTALLATION

A. General: Install products specified in this Section using methods indicated according to manufacturer's installation directions.

B. Apply resilient wall base to walls, columns, pilasters, casework, and other permanent fixtures in rooms and areas where base is required. Install wall base in lengths as long as practicable. Tightly adhere wall base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
   1. On irregular substrates, fill voids along top edge of resilient wall base with manufacturer's recommended adhesive filler material.
   2. Install inside and exterior corners before installing straight pieces.
   3. Us manufacturer's inside and outside corner pieces.

3.4 CLEANING AND PROTECTION

A. Perform the following operations immediately after completing installation:
   1. Remove visible adhesive and other surface blemishes using cleaner recommended by manufacturers of resilient product involved.
   2. Damp-mop resilient accessories to remove black marks and soil.

B. Protect against mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

END OF SECTION 09 65 13

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 WORK INCLUDES

A. Base Bid: General Contractor shall furnish all labor, materials, equipment and services necessary or incidental to the completion of all work of this section as shown on the drawings and herein specified, including: Work includes all labor and material for the following:

1. Surface preparation and application of paint systems on interior substrates:
   a. Steel.
   b. Gypsum board.
2. Surface preparation of paint systems on exterior surfaces.
   a. Galvanized metal.

1.3 DEFINITIONS

A. MPI Gloss Level 1: Not more than five units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523.

B. MPI Gloss Level 2: Not more than 10 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.

C. MPI Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.

D. MPI Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523.

E. MPI Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523.

F. MPI Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D 523.

G. MPI Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D 523.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.
   1. Indicate VOC content.

B. Color Samples: 9x10 pant draw-downs.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Paint: 5 percent, but not less than 1 gal. of each material and color applied.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.

1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.

1.7 FIELD CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.

B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide all products by one of the following:
1. Benjamin Moore & Co.
2. PPG Architectural Finishes, Inc.
3. Sherwin-Williams Company (The).

2.2 PAINT, GENERAL

A. Material Compatibility:

1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.

B. Colors: As indicated in the Finish Legend in the Drawings and as noted in the Drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:

1. Gypsum Board: 12 percent.

C. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.

D. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.

E. Proceed with coating application only after unsatisfactory conditions have been corrected.

1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.

C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.

1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.

D. Steel Substrates: Remove rust, loose mill scale, and shop primer, if any. Clean using methods recommended in writing by paint manufacturer**.**
1. SSPC-SP 5.

E. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming for touching up shop-primed surfaces.

F. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.

3.3 APPLICATION

A. Apply paints according to manufacturer's written instructions and to recommendations in "MPI Manual."

1. Use applicators and techniques suited for paint and substrate indicated.
2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
3. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
4. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.

B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.

C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

E. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:

1. Paint the following work where exposed in occupied spaces:

a. Pipe hangers and supp Uninsulated metal piping.
b. Uninsulated plastic piping.
c. orts.
d. Metal conduit.
e. Plastic conduit.
f. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
g. Mechanical Grilles.
h. Other items as directed by Architect.

3.4 FIELD QUALITY CONTROL

A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.

1. Contractor shall touch up and restore painted surfaces damaged by testing.
2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for completed and future testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.5 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.6 PAINTING SCHEDULE

A. System I-1, Low-Lustre (Eggshell) Emulsion Finish: Apply to all gypsum wallboard where indicated.

1. First Coat: Interior Latex Base Primer Coat .
   a. Moore: Ultra Spec 500 Interior Primer
   b. Pittsburgh: Speedhide Zero VOC 6-4900XI
   c. Sherwin Williams: S-W Pro-Mar 200 Zero VOC Latex Wall Primer

2. Second and Third Coats: Interior Eggshell Finish Latex Base Paint
   a. Moore: Ultra Spec 500 Interior Latex Eggshell
   b. Pittsburgh: Speedhide Zero VOC Eggshell
   c. Sherwin Williams: ProMar 200 Zero VOC Interior Latex Egshel

B. System 1-2, Waterborne PreCatalyzed Epoxy Finish: Apply to gypsum board surfaces called to be painted, unless some other finish is specifically designated.

1. Prime Coat:: Interior Latex Primer
   a. Moore: Ultra Spec 500 Latex Primer
   b. Pittsburgh: Speedhide Zero VOC Primer, 6-4900
   c. Sherwin-Williams: ProMar 200 Zero VOC Primer

2. First Coat: PreCatalyzed Epoxy Semi-Gloss
   a. Moore: Corotech Pre-Catalyzed WB Epoxy Semi-Gloss
   b. Pittsburgh: Pitt-Glaze WB1 Pre-Catalyzed S/G
   c. Sherwin-Williams: Pro Industrial PreCatalyzed WB Epoxy, Semi-Gloss

3. Second Coat: PreCatalyzed Epoxy Semi-Gloss
   a. Moore: Corotech Pre-Catalyzed WB Epoxy Semi-Gloss
   b. Pittsburgh: Pitt-Glaze WB1 Pre-Catalyzed S/G
   c. Sherwin-Williams: Pro Industrial PreCatalyzed WB Epoxy, Semi-Gloss

C. System I-3, interior PreCatalyzed Epoxy Semi-Gloss Finish: Apply to ferrous hollow metal door frames

1. Prime Coat: Acrylic Metal Primer (FS TT-P-86). (Prime coat is not required on items delivered shop primed or pre-painted, but prime coats shall be touched up as required.)

a. Sherwin Williams: Pro Industrial ProCryl Primer
b. Or Approved Equal by Moore or Pittsburg

2. First Coat: Interior PreCatalyzed Epoxy
   a. Sherwin Williams: Pro Industrial PreCatalyzed WB Epoxy, SemiGloss
   b. Or Approved Equal by Moore or Pittsburg

3. Second Coat: Interior PreCatalyzedSemi-Gloss Enamel (FS TT-E-509).
   a. Sherwin Williams: Pro Industrial PreCatalzyed WB Epoxy, Semi-Gloss
   b. Or Approved Equal by Moore or Pittsburg

D. System E-1, Exterior Latex Finish, MPI EXT 5.3A: Apply to Galvanized-Metal Substrates

1. Latex System: MPI EXT 5.3A
2. Intermediate Coat: Latex, exterior, matching topcoat.
3. Topcoat: Latex, exterior, semi-gloss (MPI Gloxx Level 5), MPI #11

END OF SECTION 09 91 23

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 PIPE LABELS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Actioncraft Products, Inc.; a division of Industrial Test Equipment Co., Inc.
2. Brady Corporation.
3. Brimar Industries, Inc.
4. Carlton Industries, LP.
5. Champion America.
6. Craftmark Pipe Markers.
7. Emedco.
8. Kolbi Pipe Marker Co.
9. LEM Products Inc.
10. Marking Sevices Inc.
11. Seton Identification Products.

B. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service and showing flow direction according to ASME A13.1.

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 1/2 inch for viewing distances up to 72 inches and proportionately larger lettering for greater viewing distances.

E. Pipe-Label Colors:

1. Background Color: Safety Red.
2. Letter Color: White.

PART 2 - EXECUTION

2.1 PREPARATION

A. Clean piping and equipment surfaces of incompatible primers, paints, and encapsulants, as well as dirt, oil, grease, release agents, and other substances that could impair bond of identification devices.

2.2 GENERAL INSTALLATION REQUIREMENTS

A. Install identifying devices before installing acoustical ceilings and similar concealment.

2.3 PIPE LABEL INSTALLATION

A. Pipe-Label Locations: Locate pipe labels where piping is above accessible ceilings in finished spaces as follows:

1. Near each valve and control device.
2. Near each branch connection excluding short takeoffs. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations and on both sides of through walls, floors, ceilings, and inaccessible enclosures.
4. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to in areas of congested piping and equipment.
5. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

B. Directional Flow Arrows: Arrows shall be used to indicate direction of flow in pipes including pipes where flow is allowed in both directions.

END OF SECTION 21 05 53

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 DEFINITIONS

A. Standard-Pressure Sprinkler Piping: Wet-pipe sprinkler system piping designed to operate at working pressure of 175-psig maximum.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: For wet-pipe sprinkler systems.

1. Include plans, elevations, sections, attachment details, and hydraulic calculations.

C. Delegated-Design Submittal: For wet-pipe sprinkler systems indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by a qualified professional engineer, a licensed architect, or a holder of a valid NICET level 3 or 4 certification in fire protection technology automatic sprinkler system layout, who is responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

1. Domestic water piping.
2. Plumbing vent.
3. Items penetrating finished ceiling include the following:

a. Lighting fixtures.
b. Air outlets and inlets.

4. HVAC Ductwork.

B. Qualification Data: For qualified Installer and professional engineer.

C. Approved Sprinkler Piping Drawings: Working plans, prepared according to NFPA 13, that have been approved by authorities having jurisdiction, including hydraulic calculations if applicable.

D. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For wet-pipe sprinkler systems and specialties to include maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1.7 QUALITY ASSURANCE

A. Installer Qualifications:

1. Installer's responsibilities include designing, fabricating, and installing sprinkler systems and providing professional engineering services needed to assume engineering responsibility. Base calculations on results of fire-hydrant flow test.

1.8 FIELD CONDITIONS

A. Interruption of Existing Sprinkler Service: Do not interrupt sprinkler service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary sprinkler service according to requirements indicated:

1. Notify Architect, Construction Manager or Owner no fewer than seven days in advance of proposed interruption of sprinkler service.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Sprinkler system equipment, specialties, accessories, installation, and testing shall comply with the following:

1. NFPA 13.

B. Standard-Pressure Piping System Component: Listed for 175-psig minimum working pressure.

C. Delegated Design: Engage a qualified professional engineer to design wet-pipe sprinkler systems.

1. Sprinkler system design shall be approved by authorities having jurisdiction.

a. Margin of Safety for Available Water Flow and Pressure: 10 percent, including losses through water-service piping, valves, and backflow preventers.
b. Sprinkler Occupancy Hazard Classifications:

1) Classrooms, Laboratories Office and Public Areas: Light Hazard.

2. Minimum Density for Automatic-Sprinkler Piping Design:

    a. Light-Hazard Occupancy: 0.10 gpm over 1500-sq. ft.
    b. Ordinary-Hazard, Group 1 Occupancy: 0.15 gpm over 1500-sq. ft.

3. Maximum Protection Area per Sprinkler: According to UL listing.
4. Maximum Protection Area per Sprinkler:

    a. Classrooms, Laboratories Office Spaces: 225 sq. ft.
    b. Storage Areas: 130 sq. ft.
    c. Other Areas: According to NFPA 13 recommendations unless otherwise indicated.

2.2 STEEL PIPE AND FITTINGS

A. Standard-Weight, Black Steel Pipe: ASTM A 53/A 53M, Type E Grade B. Pipe ends may be factory or field formed to match joining method.

B. Galvanized and Black Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M, standard-weight, seamless steel pipe with threaded ends.

C. Uncoated, Gray-Iron Threaded Fittings: ASME B16.4, Class 125, standard pattern.

D. Malleable- or Ductile-Iron Unions: UL 860.

2.3 SPRINKLER PIPING SPECIALTIES

A. Branch Outlet Fittings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Anvil International.
    b. National Fittings, Inc.
    c. Shurjoint Piping Products.
    d. Tyco Fire & Building Products LP.
    e. Victaulic Company.

2. Standard: UL 213.
3. Pressure Rating:175-psig minimum.
4. Body Material: Ductile-iron housing with EPDM seals and bolts and nuts.
5. Type: Mechanical-tee and -cross fittings.
6. Configurations: Snap-on and strapless, ductile-iron housing with branch outlets.
7. Size: Of dimension to fit onto sprinkler main and with outlet connections as required to match connected branch piping.
8. Branch Outlets: Grooved, plain-end pipe, or threaded.

B. Branch Line Testers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Elkhart Brass Mfg. Co., Inc.
    b. Fire-End & Croker Corporation.

c. Potter Roemer LLC.

2. Standard: UL 199.

3. Pressure Rating: 175 psig.
4. Body Material: Brass.
5. Size: Same as connected piping.
6. Inlet: Threaded.
7. Drain Outlet: Threaded and capped.
8. Branch Outlet: Threaded, for sprinkler.

C. Adjustable Drop Nipples:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Aegis Technologies, Inc.
b. CECA, LLC.
c. Corcoran Piping System Co.
d. Merit Manufacturing.

2. Standard: UL 1474.
3. Pressure Rating: 250-psig minimum.
4. Body Material: Steel pipe with EPDM-rubber O-ring seals.
5. Size: Same as connected piping.
6. Length: Adjustable.
7. Inlet and Outlet: Threaded.

D. Flexible Sprinkler Hose Fittings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Fivalco Inc.
b. FlexHead Industries, Inc.
c. Gateway Tubing, Inc.
d. Victaulic Company.

2. Standard: UL 1474.
3. Type: Flexible hose for connection to sprinkler, and with bracket for connection to ceiling grid.
4. Pressure Rating: 175-psig minimum 300 psig.
5. Size: Same as connected piping, for sprinkler.

2.4 SPRINKLERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Globe Fire Sprinkler Corporation.
2. Reliable Automatic Sprinkler Co., Inc. (The).
3. Venus Fire Protection Ltd.
4. Victaulic Company.
5. Viking Corporation.

B. Listed in UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."

C. Sprinkler Finishes: Chrome plated.

D. Sprinkler Escutcheons: Materials, types, and finishes for the following sprinkler mounting applications. Escutcheons for concealed, flush, and recessed-type sprinklers are specified with sprinklers.

1. Ceiling Mounting: Chrome-plated steel, one piece, flat, Chrome-plated steel, two piece, with 1-inch vertical adjustment.

E. Sprinkler Guards:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Reliable Automatic Sprinkler Co., Inc. (The).
b. Tyco Fire & Building Products LP.
c. Victaulic Company.
d. Viking Corporation.

2. Standard: UL 199.

3. Type: Wire cage with fastening device for attaching to sprinkler.

PART 3 - EXECUTION

3.1 PREPARATION

A. Perform fire-hydrant flow test according to NFPA 13 and NFPA 291. Use results for system design calculations required in "Quality Assurance" Article.

B. Report test results promptly and in writing.

3.2 PIPING INSTALLATION

A. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated on approved working plans.

1. Coordinate layout and installation of sprinklers with other construction that penetrates ceilings, including light fixtures, HVAC equipment, and partition assemblies.

B. Piping Standard: Comply with NFPA 13 requirements for installation of sprinkler piping.

C. Use listed fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.

D. Install unions adjacent to each valve in pipes NPS 2 and smaller.

E. Install sprinkler piping with drains for complete system drainage.

F. Install sprinkler control valves, test assemblies, and drain risers adjacent to standpipes when sprinkler piping is connected to standpipes.

G. Install automatic (ball drip) drain valve at each check valve for fire-department connection, to drain piping between fire-department connection and check valve. Install drain piping to and spill over floor drain or to outside building.

H. Install hangers and supports for sprinkler system piping according to NFPA 13. Comply with requirements for hanger materials in NFPA 13.

I. Fill sprinkler system piping with water.

3.3 JOINT CONSTRUCTION

A. Install couplings, flanges, flanged fittings, unions, nipples, and transition and special fittings that have finish and pressure ratings same as or higher than system's pressure rating for aboveground applications unless otherwise indicated.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

C. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

D. 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.

E. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

3.4 SPRINKLER INSTALLATION

A. Install sprinklers in suspended ceilings in center of narrow dimension of acoustical ceiling panels.

B. Install sprinklers into flexible, sprinkler hose fittings, and install hose into bracket on ceiling grid.

3.5 IDENTIFICATION

A. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 13.

3.6 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Leak Test: After installation, charge systems and test for leaks. Repair leaks and retest until no leaks exist.

2. Flush, test, and inspect sprinkler systems according to NFPA 13, "Systems Acceptance" Chapter.
3. Energize circuits to electrical equipment and devices.

B. Sprinkler piping system will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.7 CLEANING

A. Clean dirt and debris from sprinklers.

B. Only sprinklers with their original factory finish are acceptable. Remove and replace any sprinklers that are painted or have any other finish than their original factory finish.

3.8 PIPING SCHEDULE

A. Standard-pressure, wet-pipe sprinkler system, NPS 2 and smaller shall be the following:

1. Standard-weight, black-steel pipe with threaded ends; uncoated, gray-iron threaded fittings; and threaded joints.

3.9 SPRINKLER SCHEDULE

A. Use sprinkler types in subparagraphs below for the following applications:

1. Rooms with Suspended Ceilings: Pendent sprinklers

B. Provide sprinkler types in subparagraphs below with finishes indicated.

1. Recessed Sprinklers: Bright chrome, with bright chrome escutcheon.
2. Pendent Sprinklers: Chrome plated in finished spaces exposed to view; rough bronze in unfinished spaces not exposed to view; wax coated where exposed to acids, chemicals, or other corrosive fumes.

END OF SECTION 21 13 13

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Floor drains.

1.3 DEFINITIONS

A. FRP: Fiberglass-reinforced plastic.

B. HDPE: High-density polyethylene plastic.

C. PE: Polyethylene plastic.

D. PP: Polypropylene plastic.

E. PVC: Polyvinyl chloride plastic.

1.4 ACTION SUBMITTALS

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

1. Floor drains.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For drainage piping specialties to include in emergency, operation, and maintenance manuals.

1.6 QUALITY ASSURANCE

A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic sanitary piping specialty components.

PART 2 - PRODUCTS

2.1 FLOOR DRAINS

A. Cast-Iron Floor Drains:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Jay R. Smith Mfg. Co.
   b. Josam Company.
   c. Watts; a Watts Water Technologies company.
   d. Wade

2. Standard: ASME A112.6.3.

3. Pattern: Floor drain.
4. Body Material: Gray iron.
5. Double Drainage Flange: Required.
6. Clamping Device: Reversible clamping collar.
7. Outlet: Bottom.
8. Coating on Interior and Exposed Exterior Surfaces: Acid-resistant enamel.
9. Sediment Bucket: Not required.
10. Top or Strainer Material: Nickel bronze or Stainless steel.
11. Top of Body and Strainer Finish: Nickel bronze.
12. Top Shape: Round.
13. Top Loading Classification: Heavy Duty.
14. Funnel: Not required.
15. Inlet Fitting: Not required.
16. Trap Material: Cast iron.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.

1. Position floor drains for easy access and maintenance.
2. Set floor drains below elevation of surrounding finished floor to allow floor drainage. Set with grates depressed according to the following drainage area radii:

   a. Radius, 30 Inches or Less: Equivalent to 1 percent slope, but not less than 1/4-inch total depression.

3. Install floor-drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.
4. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.

B. Install floor-drain, trap-seal primer fittings on inlet to floor drains that require trap-seal primer connection.

1. Exception: Fitting may be omitted if trap has trap-seal primer connection.
2. Size: Same as floor drain inlet.

3.2 CONNECTIONS

A. Install piping adjacent to equipment to allow service and maintenance.

3.3 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.4 PROTECTION

A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.

B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 22 13 19

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Base Bid: General Contractor Shall furnish all labor, materials, equipment and services necessary or incidental to the completion of all work of this section and herein specified.

1.2 ACTION SUBMITTALS

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

B. Samples: For color, letter style, and graphic representation required for each identification material and device.

C. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.

D. Valve numbering scheme.

E. Valve Schedules: For each piping system to include in maintenance manuals.

1.3 COORDINATION

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Plastic Labels for Equipment:

1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch 1/8 inch thick, and having predrilled holes for attachment hardware.
2. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
3. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
4. 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.
5. Fasteners: Stainless-steel rivets or self-tapping screws.
6. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. 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.

C. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch (A4) 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 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.

2.3 DUCT LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.

B. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

C. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

D. 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.

E. Fasteners: Stainless-steel rivets or self-tapping screws.

F. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

G. 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.

2.4 STENCILS

A. Stencils: Prepared with letter sizes according to ASME A13.1 for piping; minimum letter height of 1-1/4 inches for ducts; and minimum letter height of 3/4 inch for access panel and door labels, equipment labels, and similar operational instructions.

1. Stencil Material: Aluminum.
2. Stencil Paint: Exterior, gloss, black unless otherwise indicated. Paint may be in pressurized spray-can form.
3. Identification Paint: Exterior, in colors according to ASME A13.1 unless otherwise indicated.

2.5 VALVE TAGS

A. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers.

1. Tag Material: Brass, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Fasteners: Brass beaded chain.

B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch (A4) bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.

1. Valve-tag schedule shall be included in operation and maintenance data.

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 by Owner.

B. Stenciled Pipe Label Option: Stenciled labels may be provided instead of manufactured pipe labels, at Installer's option. Install stenciled pipe labels per Owner’s colors on each piping system.

1. Identification Paint: Use for contrasting background.
2. Stencil Paint: Use for pipe marking.

C. 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.

D. Pipe Label Color Schedule:

1. Per Owner's colors.

3.4 DUCT LABEL INSTALLATION

A. Install plastic-laminated self-adhesive duct labels with permanent adhesive on air ducts in the following color codes:

1. Per Owner's colors

B. Stenciled Duct Label Option: Stenciled labels, showing service and flow direction, may be provided instead of plastic-laminated duct labels, at Installer's option, if lettering larger than 1 inch high is needed for proper identification because of distance from normal location of required identification.

C. 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.

3.5 VALVE-TAG INSTALLATION

A. Install tags on valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; shutoff valves; faucets; convenience and lawn-watering hose connections; and HVAC terminal devices and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.

B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following subparagraphs:

1. Valve-Tag Size and Shape:
   a. Hot Water: 1-1/2 inches, round.
   b. Gas: 1-1/2 inches, round.
2. Valve-Tag Color:
   a. Per Owner's colors.
3. Letter Color:
   a. Per Owner's colors.

END OF SECTION 23 05 53

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Balancing Air Systems:

1.2 DEFINITIONS

A. AABC: Associated Air Balance Council.

B. NEBB: National Environmental Balancing Bureau.

C. TAB: Testing, adjusting, and balancing.

D. TABB: Testing, Adjusting, and Balancing Bureau.

E. TAB Specialist: An independent entity meeting qualifications to perform TAB work.

F. TDH: Total dynamic head.

1.3 ACTION SUBMITTALS

A. TAB Report: Documentation indicating that Work complies with ASHRAE/IES 90.1, Section 6.7.2.3 - "System Balancing."

1.4 INFORMATIONAL SUBMITTALS

A. Certified TAB reports.

1.5 QUALITY ASSURANCE

A. TAB Specialists Qualifications: Certified by AABC.

1. TAB Field Supervisor: Employee of the TAB specialist and certified by AABC.
2. TAB Technician: Employee of the TAB specialist and certified by AABC as a TAB technician.

B. TAB Specialists Qualifications: Certified by NEBB.

1. TAB Field Supervisor: Employee of the TAB specialist and certified by NEBB.
2. TAB Technician: Employee of the TAB specialist and certified by NEBB as a TAB technician.

C. Instrumentation Type, Quantity, Accuracy, and Calibration: Comply with requirements in ASHRAE 111, Section 4, "Instrumentation."

D. ASHRAE/IES 90.1 Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6.7.2.3 - "System Balancing."

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems designs that may preclude proper TAB of systems and equipment.

B. Examine installed systems for balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are applicable for intended purpose and are accessible.

C. Examine the approved submittals for HVAC systems and equipment.

D. Examine design data including HVAC system descriptions, statements of design assumptions for environmental conditions and systems output, and statements of philosophies and assumptions about HVAC system and equipment controls.

E. Examine equipment performance data including fan and pump curves.

1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
2. Calculate system-effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from the conditions used to rate equipment performance. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," or in SMACNA's "HVAC Systems - Duct Design." Compare results with the design data and installed conditions.

F. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.

G. Examine test reports specified in individual system and equipment Sections.

H. Examine HVAC equipment and verify that bearings are greased, belts are aligned and tight, filters are clean, and equipment with functioning controls is ready for operation.

I. Examine terminal units, such as variable-air-volume boxes, and verify that they are accessible and their controls are connected and functioning.

J. Examine heat-transfer coils for correct piping connections and for clean and straight fins.

K. Examine operating safety interlocks and controls on HVAC equipment.

L. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.2 PREPARATION

A. Prepare a TAB plan that includes strategies and step-by-step procedures for balancing the systems.

B. Perform system-readiness checks of HVAC systems and equipment to verify system readiness for TAB work. Include, at a minimum, the following:

1. Airside:

a. Duct systems are complete with terminals installed.
b. Dampers are open and functional.
c. Clean filters are installed.
d. Fans are operating, free of vibration, and rotating in correct direction.
e. Variable-frequency controllers' startup is complete and safeties are verified.
f. Automatic temperature-control systems are operational.
g. Ceilings are installed.
h. Windows and doors are installed.
i. Suitable access to balancing devices and equipment is provided.

3.3 GENERAL PROCEDURES FOR TESTING AND BALANCING

A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Total System Balance" ASHRAE 111 NEBB's, "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" , and SMACNA's "HVAC Systems - Testing, Adjusting, and Balancing" and in this Section.

B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.

1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.
2. After testing and balancing, install test ports and duct access doors that comply with requirements in Section 233300 "Air Duct Accessories."

C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.

D. Take and report testing and balancing measurements in inch-pound (IP) units.

3.4 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Cross-check the summation of required outlet volumes with required fan volumes.

B. Prepare schematic diagrams of systems' "as-built" duct layouts.

C. For variable-air-volume systems, develop a plan to simulate diversity.

D. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.

E. Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust-air dampers through the supply-fan discharge and mixing dampers.

F. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.

G. Verify that motor starters are equipped with properly sized thermal protection.

H. Check dampers for proper position to achieve desired airflow path.

I. Check for airflow blockages.

J. Check condensate drains for proper connections and functioning.

K. Check for proper sealing of air-handling-unit components.

L. Verify that air duct system is sealed as specified in Section 233113 "Metal Ducts."

3.5 PROCEDURES FOR VARIABLE-AIR-VOLUME SYSTEMS

A. Adjust the variable-air-volume systems as follows:

1. Verify that the system static pressure sensor is located two-thirds of the distance down the duct from the fan discharge.
2. Verify that the system is under static pressure control.
3. Select the terminal unit that is most critical to the supply-fan airflow. Measure inlet static pressure, and adjust system static pressure control set point so the entering static pressure for the critical terminal unit is not less than the sum of the terminal-unit manufacturer's recommended minimum inlet static pressure plus the static pressure needed to overcome terminal-unit discharge system losses.
4. Calibrate and balance each terminal unit for maximum and minimum design airflow as follows:

    a. Adjust controls so that terminal is calling for maximum airflow. Some controllers require starting with minimum airflow. Verify calibration procedure for specific project.
    b. Measure airflow and adjust calibration factor as required for design maximum airflow. Record calibration factor.
    c. When maximum airflow is correct, balance the air outlets downstream from terminal units.
    d. Adjust controls so that terminal is calling for minimum airflow.
    e. Measure airflow and adjust calibration factor as required for design minimum airflow. Record calibration factor. If no minimum calibration is available, note any deviation from design airflow.
    f. When in full cooling or full heating, ensure that there is no mixing of hot-deck and cold-deck airstreams unless so designed.
    g. On constant volume terminals, in critical areas where room pressure is to be maintained, verify that the airflow remains constant over the full range of full cooling to full heating. Note any deviation from design airflow or room pressure.

5. After terminals have been calibrated and balanced, test and adjust system for total airflow. Adjust fans to deliver total design airflows within the maximum allowable fan speed listed by fan manufacturer.

a. Set outside-air, return-air, and relief-air dampers for proper position that simulates minimum outdoor-air conditions.
b. Set terminals for maximum airflow. If system design includes diversity, adjust terminals for maximum and minimum airflow so that connected total matches fan selection and simulates actual load in the building.
c. Where duct conditions allow, measure airflow by Pitot-tube traverse. If necessary, perform multiple Pitot-tube traverses to obtain total airflow.
d. Where duct conditions are not suitable for Pitot-tube traverse measurements, a coil traverse may be acceptable.
e. If a reliable Pitot-tube traverse or coil traverse is not possible, measure airflow at terminals and calculate the total airflow.

6. Measure fan static pressures as follows:

a. Measure static pressure directly at the fan outlet or through the flexible connection.
b. Measure static pressure directly at the fan inlet or through the flexible connection.
c. Measure static pressure across each component that makes up the air-handling system.
d. Report any artificial loading of filters at the time static pressures are measured.

7. Set final return and outside airflow to the fan while operating at maximum return airflow and minimum outdoor airflow.

a. Balance the return-air ducts and inlets the same as described for constant-volume air systems.
b. Verify that terminal units are meeting design airflow under system maximum flow.

8. Re-measure the inlet static pressure at the most critical terminal unit and adjust the system static pressure set point to the most energy-efficient set point to maintain the optimum system static pressure. Record set point and give to controls contractor.
9. Verify final system conditions as follows:

a. Re-measure and confirm that minimum outdoor, return, and relief airflows are within design. Readjust to match design if necessary.
b. Re-measure and confirm that total airflow is within design.
c. Re-measure final fan operating data, rpms, volts, amps, and static profile.
d. Mark final settings.
e. Test system in economizer mode. Verify proper operation and adjust if necessary. Measure and record all operating data.
f. Verify tracking between supply and return fans.

3.6 TOLERANCES

A. Set HVAC system's airflow rates and water flow rates within the following tolerances:

1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus or minus 5 percent.

B. Maintaining pressure relationships as designed shall have priority over the tolerances specified above.

3.7 FINAL REPORT

A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.

1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
2. Include a list of instruments used for procedures, along with proof of calibration.
3. Certify validity and accuracy of field data.

B. Final Report Contents: In addition to certified field-report data, include the following:

1. Field test reports prepared by system and equipment installers.
2. Other information relative to equipment performance; do not include Shop Drawings and Product Data.

C. General Report Data: In addition to form titles and entries, include the following data:

1. Title page.
2. Name and address of the TAB specialist.
3. Project name.
4. Project location.
5. Architect's name and address.
6. Engineer's name and address.
7. Contractor's name and address.
8. Report date.
9. Signature of TAB supervisor who certifies the report.
10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
11. Summary of contents including the following:

    a. Indicated versus final performance.
    b. Notable characteristics of systems.
    c. Description of system operation sequence if it varies from the Contract Documents.

12. Nomenclature sheets for each item of equipment.
13. Data for terminal units, including manufacturer's name, type, size, and fittings.
14. Notes to explain why certain final data in the body of reports vary from indicated values.

D. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:

1. Quantities of outdoor, supply, return, and exhaust airflows..
2. Duct, outlet, and inlet sizes.
3. Terminal units.
4. Balancing stations.
5. Position of balancing devices.

E. Air-Terminal-Device Reports:

1. Unit Data:

a. System and air-handling unit identification.
b. Location and zone.
c. Apparatus used for test.
d. Area served.
e. Make.
f. Number from system diagram.
g. Type and model number.
h. Size.
i. Effective area in sq. ft..

2. Test Data (Indicated and Actual Values):

a. Airflow rate in cfm.
b. Air velocity in fpm.
c. Preliminary airflow rate as needed in cfm.
d. Preliminary velocity as needed in fpm.
e. Final airflow rate in cfm.
f. Final velocity in fpm.
g. Space temperature in deg F.

3.8 VERIFICATION OF TAB REPORT

A. The TAB specialist's test and balance engineer shall conduct the inspection in the presence of Owner.

B. Owner shall randomly select measurements, documented in the final report, to be rechecked. Rechecking shall be limited to either 10 percent of the total measurements recorded or the extent of measurements that can be accomplished in a normal 8-hour business day.

C. If rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."

D. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the testing and balancing shall be considered incomplete and shall be rejected.

E. If TAB work fails, proceed as follows:

1. TAB specialists shall recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes; resubmit the final report and request a second final inspection.
2. If the second final inspection also fails, Owner may contract the services of another TAB specialist to complete TAB work according to the Contract Documents and deduct the cost of the services from the original TAB specialist's final payment.
3. If the second verification also fails, Owner or Architect may contact AABC Headquarters regarding the AABC National Performance Guaranty.

F. Prepare test and inspection reports.

3.9 ADDITIONAL TESTS

A. Within 90 days of completing TAB, perform additional TAB to verify that balanced conditions are being maintained throughout and to correct unusual conditions.

B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional TAB during near-peak summer and winter conditions.

END OF SECTION 23 05 93

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Base Bid: General Contractor Shall furnish all labor, materials, equipment and services necessary or incidental to the completion of all work of this section and herein specified.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory- and field-applied if any).

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.

C. Field quality-control reports.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing 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 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.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.6 COORDINATION

A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."

B. Coordinate clearance requirements with duct Installer for duct insulation application. Before preparing ductwork Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

C. Coordinate installation and testing of heat tracing.

1.7 SCHEDULING

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Comply with requirements in "Duct Insulation Schedule, General," "Indoor Duct and Plenum Insulation Schedule," and "Aboveground, Outdoor Duct and Plenum Insulation 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. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type III with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Products: Subject to compliance with requirements, provide one of the following:

a. CertainTeed Corp.; SoftTouch Duct Wrap.
b. Johns Manville; Microlite.
c. Knauf Insulation; Friendly Feel Duct Wrap.
d. Manson Insulation Inc.; Alley Wrap.
e. Owens Corning; SOFTR All-Service Duct Wrap.

G. Mineral-Fiber Board Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IA or Type IB. For duct and plenum applications, provide insulation with factory-applied ASJ. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Products: Subject to compliance with requirements, provide one of the following:

a. CertainTeed Corp.; Commercial Board.
b. Johns Manville; 800 Series Spin-Glas.
c. Knauf Insulation; Insulation Board.
d. Manson Insulation Inc.; AK Board.
e. Owens Corning; Fiberglas 700 Series.

2.2 FIRE-RATED INSULATION SYSTEMS

A. Fire-Rated Board: Structural-grade, press-molded, xonolite calcium silicate, fireproofing board suitable for operating temperatures up to 1700 deg F. Comply with ASTM C 656, Type II, Grade 6. Tested and certified to provide a 2-hour fire rating by an NRTL acceptable to authorities having jurisdiction.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Johns Manville; Super Firetemp M.

B. Fire-Rated Blanket: High-temperature, flexible, blanket insulation with FSK jacket that is tested and certified to provide a 2-hour fire rating by an NRTL acceptable to authorities 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 Fire Stop Products; Nelson FSB Flameshield Blanket.
d. Thermal Ceramics; FireMaster Duct Wrap.
e. 3M; Fire Barrier Wrap Products.
f. Unifrax Corporation; FyreWrap.

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. 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 LLC; Armaflex 520 Adhesive.
c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-75.K-Flex USA; R-373 Contact Adhesive.

2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. Products: Subject to compliance with requirements, provide one of the following:

   a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-127.Eagle Bridges - Marathon Industries; 225.
   b. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-60/85-70.Mon-Eco Industries, Inc.; 22-25.

2. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

D. ASJ Adhesive, and FSK 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 Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-82.
   b. Eagle Bridges - Marathon Industries; 225.
   c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-50.Mon-Eco Industries, Inc.; 22-25.

2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.4 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.

1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below ambient services.

1. Products: Subject to compliance with requirements, provide one of the following:

   a. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-80/30-90.

b. Vimasco Corporation; 749.

2. Water-Vapor Permeance: ASTM E 96/E 96M, 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, 58 percent by volume and 70 percent by weight.
5. Color: White.

C. Vapor-Barrier Mastic: Solvent based; suitable for indoor use on below ambient services.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-30.
b. Eagle Bridges - Marathon Industries; 501.
c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-35.
d. Mon-Eco Industries, Inc.; 55-10.

2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 35-mil dry film thickness.
3. Service Temperature Range: 0 to 180 deg F.
4. Solids Content: ASTM D 1644, 44 percent by volume and 62 percent by weight.
5. Color: White.

D. Vapor-Barrier Mastic: Solvent based; suitable for outdoor use on below ambient services.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Encacel.
b. Eagle Bridges - Marathon Industries; 570.
c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 60-95/60-96.

2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 30-mil dry film thickness.
3. Service Temperature Range: Minus 50 to plus 220 deg F.
4. Solids Content: ASTM D 1644, 33 percent by volume and 46 percent by weight.
5. Color: White.

E. 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 Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-10.
b. Eagle Bridges - Marathon Industries; 550.
c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 46-50.
d. Mon-Eco Industries, Inc.; 55-50.
e. Vimasco Corporation; WC-1/WC-5.

2. Water-Vapor Permeance: ASTM F 1249, 1.8 perms at 0.0625-inch dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F.
4. Solids Content: 60 percent by volume and 66 percent by weight.
5. Color: White.

2.5 LAGGING ADHESIVES

A. Description: Comply with MIL-A-3316C, Class I, Grade A and shall be compatible with insulation materials, jackets, and substrates.

1. For indoor applications, use lagging adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Products: Subject to compliance with requirements, provide one of the following:

    a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-50 AHV2.Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-36.
    b. Vimasco Corporation; 713 and 714.

3. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over duct insulation.
4. Service Temperature Range: 0 to plus 180 deg F.
5. Color: White.

2.6 SEALANTS

A. FSK and Metal Jacket Flashing Sealants:

1. Products: Subject to compliance with requirements, provide one of the following:

    a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.Eagle Bridges - Marathon Industries; 405.
    b. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 95-44.
    c. Mon-Eco Industries, Inc.; 44-05.

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, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
7. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

B. ASJ Flashing Sealants, and Vinyl and PVC Jacket Flashing Sealants:

1. Products: Subject to compliance with requirements, provide one of the following:

a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 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, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
7. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.7 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. Vinyl Jacket: White vinyl with a permeance of 1.3 perms when tested according to ASTM E 96/E 96M, Procedure A, and complying with NFPA 90A and NFPA 90B.

2.8 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. ABI, Ideal Tape Division; 428 AWF ASJ.
b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0836.
c. Compac Corporation; 104 and 105.
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. ABI, Ideal Tape Division; 491 AWF FSK.
b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0827.
c. Compac Corporation; 110 and 111.
d. Venture Tape; 1525 CW NT, 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.

2.9 SECUREMENTS

A. Bands:

1. Products: Subject to compliance with requirements, provide one of the following:

a. ITW Insulation Systems; Gerrard Strapping and Seals.
b. RPR Products, Inc.; Insul-Mate Strapping, Seals, and Springs.

2. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304 or Type 316; 0.015 inch thick, **3/4 inch** wide with wing seal or closed seal.
3. Springs: Twin spring set constructed of stainless steel with ends flat and slotted to accept metal bands. Spring size determined by manufacturer for application.

B. Insulation Pins and Hangers:

1. Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, **0.135-inch-** diameter shank, length to suit depth of insulation indicated.

a. Products: Subject to compliance with requirements, provide one of the following:

1) AGM Industries, Inc.; CWP-1.
2) GEMCO; CD.
3) Midwest Fasteners, Inc.; CD.
4) Nelson Stud Welding; TPA, TPC, and TPS.

2. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, **0.135-inch-** diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.

a. Products: Subject to compliance with requirements, provide one of the following:

1) AGM Industries, Inc.; CHP-1.

2) GEMCO; Cupped Head Weld Pin.
3) Midwest Fasteners, Inc.; Cupped Head.
4) Nelson Stud Welding; CHP.

3. 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 Perforated Base Insul-Hangers.
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.

4. 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.

5. 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 Self-Adhering Insul-Hangers.
2) GEMCO; Peel & Press.
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.

6. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- thick, stainless-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.

7. 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. Manufacturers: Subject to compliance with requirements, provide products by 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.

2.10 CORNER ANGLES

A. Stainless-Steel Corner Angles: 0.024 inch thick, minimum 1 by 1 inch, stainless steel according to ASTM A 167 or ASTM A 240/A 240M, Type 304 or Type 316.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.

1. Verify that systems to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of ducts and fittings.

B. Install insulation materials, vapor barriers or retarders, jackets, and thicknesses required for each item of duct 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. Keep insulation materials dry during application and finishing.

G. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

H. Install insulation with least number of joints practical.

I. 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.

J. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

K. 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. 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, according to insulation material manufacturer's written instructions, to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct flanges and fittings.

L. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

M. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

N. 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.

3.4 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 Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

C. Insulation Installation at Fire-Rated Wall and Partition Penetrations: 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 Section 078413 "Penetration Firestopping" firestopping and fire-resistive joint sealers.

D. Insulation Installation at Floor Penetrations:

1. Duct: 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.

3.5 INSTALLATION OF MINERAL-FIBER INSULATION

A. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.
2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:

a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
b. On duct sides with dimensions larger than 18 inches, place pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
d. Do not overcompress insulation during installation.
e. Impale insulation over pins and attach speed washers.
f. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.

   a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
   b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches.

5. Overlap unfaced blankets a minimum of 2 inches on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18 inches o.c.
6. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
7. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch-wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

B. Board Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.
2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:

   a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
   b. On duct sides with dimensions larger than 18 inches, space pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
   c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
   d. Do not overcompress insulation during installation.
   e. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.

    a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
    b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches.

5. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Groove and score insulation to fit as closely as possible to outside and inside radius of elbows. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
6. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch-wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

3.6 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.

3.7 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Perform tests and inspections.

C. 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.

D. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.8 DUCT INSULATION SCHEDULE, GENERAL

A. Plenums and Ducts Requiring Insulation:

1. Indoor, concealed supply air.

2. Indoor, concealed return located in unconditioned space.
3. Indoor, concealed exhaust between isolation damper and penetration of building exterior.
4. Outdoor supply and return ductwork.

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.

3.9 INDOOR DUCT AND PLENUM INSULATION SCHEDULE

A. Concealed, round, supply-air duct insulation shall be the following:
1. Mineral-Fiber Blanket: 2 inches thick and 0.75-lb/cu. ft. nominal density.

B. Concealed, round and flat-oval, return-air duct insulation shall be the following:
1. Mineral-Fiber Blanket: 2 inches thick and 0.75-lb/cu. ft. nominal density.

C. Concealed, rectangular, supply-air duct insulation shall be one of the following:
1. Mineral-Fiber Blanket: 2 inches thick and 0.75-lb/cu. ft. nominal density.

D. Concealed, rectangular, return-air duct insulation shall be one of the following:
1. Mineral-Fiber Blanket: 2 inches thick and 0.75-lb/cu. ft. nominal density.

E. Concealed, rectangular, exhaust-air duct insulation between isolation damper and penetration of building exterior shall be the following:
1. Mineral-Fiber Blanket: 2 inches thick and 0.75-lb/cu. ft. nominal density.

F. Outside, rectangular, supply air and return-air duct insulation shall be one of the following:
1. Mineral-Fiber Board: 2 inches thick and 3.0-lb/cu. ft. nominal density with aluminum jacket.

END OF SECTION 23 07 13

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes insulating the following HVAC piping systems:

1. Chilled-water and brine piping, indoors and outdoors.

1.2 ACTION SUBMITTALS

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

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

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.
6. Detail application of field-applied jackets.
7. Detail application at linkages of control devices.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.4 QUALITY ASSURANCE

A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to 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 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. Products shall not contain asbestos, lead, mercury, or mercury compounds.

B. 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.

C. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

D. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

E. 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. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. Johns Manville Corp.
b. Owens Corning Corp
c. Certain Teed Corp.

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.

F. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Armacell LLC.

2.2 INSULATING CEMENTS

A. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. Ramco Insulation, Inc.

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 Adhesive: Two-component, thermosetting urethane adhesive containing no flammable solvents, with a service temperature range of minus 100 to plus 200 deg F.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. Foster Brand; H. B. Fuller Construction Products.

2. Adhesives shall have a VOC content of 50 g/L or less.
3. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

C. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Armacell LLC.

2. Adhesives shall have a VOC content of 50 g/L or less.
3. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2.4 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.

1. VOC Content: 300 g/L or less.
2. Low-Emitting Materials: Mastic coatings shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below-ambient services.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Childers Brand; H. B. Fuller Construction Products.
b. Foster Brand; H. B. Fuller Construction Products.
c. Knauf Insulation.
d. Vimasco Corporation.

2. Water-Vapor Permeance: ASTM E 96/E 96M, 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, 58 percent by volume and 70 percent by weight.
5. Color: White.

C. Breather Mastic: Water based; suitable for indoor and outdoor use on above-ambient services.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Childers Brand; H. B. Fuller Construction Products.
   b. Eagle Bridges - Marathon Industries.
   c. Foster Brand; H. B. Fuller Construction Products.
   d. Knauf Insulation.
   e. Mon-Eco Industries, Inc.
   f. Vimasco Corporation.

2. Water-Vapor Permeance: ASTM F 1249, 1.8 perms at 0.0625-inch dry film thickness.

3. Service Temperature Range: Minus 20 to plus 180 deg F.
4. Solids Content: 60 percent by volume and 66 percent by weight.
5. Color: White.

2.5 SEALANTS

A. Joint Sealants:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Childers Brand; H. B. Fuller Construction Products.
   b. Eagle Bridges - Marathon Industries.
   c. Foster Brand; H. B. Fuller Construction Products.
   d. Mon-Eco Industries, Inc.
   e. Pittsburgh Corning Corporation.

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. Sealant shall have a VOC content of 420 g/L or less.

B. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

   a. Childers Brand; H. B. Fuller Construction Products.

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. Sealant shall have a VOC content of 420 g/L or less.

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. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Johns Manville; a Berkshire Hathaway company.
b. P.I.C. Plastics, Inc.

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.

C. Aluminum Jacket: Comply with ASTM B 209, Alloy 3003, 3005, 3105, or 5005, Temper H-14.

1. Sheet and roll stock ready for shop or field sizing.
2. Finish and thickness are indicated in field-applied jacket schedules.
3. Moisture Barrier for Indoor Applications: 3-mil-thick, heat-bonded polyethylene and kraft paper.
4. Moisture Barrier for Outdoor Applications: 3-mil-thick, heat-bonded polyethylene and kraft paper.
5. 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.

D. 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 cross-laminated polyethylene film covered with stucco-embossed aluminum-foil facing.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. Polyguard Products, Inc.

2.7 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Avery Dennison Corporation, Specialty Tapes Division.
b. Compac Corporation.
c. Ideal Tape Co., Inc., an American Biltrite Company.
d. Knauf Insulation.
e. Venture Tape.

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. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Compac Corporation.
b. Ideal Tape Co., Inc., an American Biltrite Company.
c. Venture Tape.

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.

C. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Avery Dennison Corporation, Specialty Tapes Division.
b. Compac Corporation.
c. Ideal Tape Co., Inc., an American Biltrite Company.
d. Knauf Insulation.
e. Venture Tape.

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.

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 seal.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. ITW Insulation Systems; Illinois Tool Works, Inc.
b. RPR Products, Inc.

B. Staples: Outward-clinching insulation staples, nominal 3/4-inch-wide, stainless steel or Monel.

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 piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of 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, according to insulation material manufacturer's written instructions, 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.

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.

B. 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.

C. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

D. 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 Section 078413 "Penetration Firestopping" for firestopping and fire-resistive joint sealers.

E. Insulation Installation at Floor Penetrations:

1. Pipe: Install insulation continuously through floor penetrations.
2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

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. 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 INSTALLATION OF CELLULAR-GLASS INSULATION

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. Instead, 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 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

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 PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints; for horizontal applications. 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.

B. 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.

C. Where PVDC jackets are indicated, install as follows:

3.8 FINISHES

A. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

B. 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.

3.11 INDOOR PIPING INSULATION SCHEDULE

A. Chilled Water and Brine, above 40 Deg F: Insulation shall be the following:

1. Cellular Glass: 2 inches thick.

B. Condensate Drains:

1. Flexible Elastomeric: ½ inch thick.

3.12 OUTDOOR, ABOVEGROUND PIPING INSULATION SCHEDULE

A. Chilled Water and Brine: Insulation shall be the following:

1. Cellular Glass: 3 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. PVC 30 mils thick.
2. Aluminum, Stucco Embossed: 0.016 inch thick.

D. Piping, Exposed:

1. PVC 30 mils thick.
2. Aluminum, Stucco Embossed: 0.016 inch thick.

3.14 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. Piping, Concealed:

D. Piping, Exposed:

1. PVC: 30 mils thick.

END OF SECTION 23 07 19

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes control equipment for HVAC systems and components, including control components for terminal heating and cooling units not supplied with factory-wired controls.

1.3 DEFINITIONS

A. DDC: Direct digital control.

B. I/O: Input/output.

C. LonWorks: A control network technology platform for designing and implementing interoperable control devices and networks.

D. MS/TP: Master slave/token passing.

E. PC: Personal computer.

F. PID: Proportional plus integral plus derivative.

G. RTD: Resistance temperature detector.

1.4 SYSTEM PERFORMANCE

A. Comply with the following performance requirements:
   1. Performance: Programmable controllers shall execute DDC PID control loops, and scan and update process values and outputs at least once per second.
   2. Reporting Accuracy and Stability of Control: Report values and maintain measured variables within tolerances as follows:

      a. Water Temperature: Plus or minus 1 deg F (0.5 deg C).
      b. Water Flow: Plus or minus 5 percent of full scale.
      c. Ducted Air Temperature: Plus or minus 1 deg F (0.5 deg C).
      d. Airflow (Terminal): Plus or minus 10 percent of full scale.

1.5 ACTION SUBMITTALS

A. Product Data: Include manufacturer's technical literature for each control device. Indicate dimensions, capacities, performance characteristics, electrical characteristics, finishes for materials, and installation and startup instructions for each type of product indicated.

1. DDC System Hardware: Bill of materials of equipment indicating quantity, manufacturer, and model number. Include technical data for operator workstation equipment, interface equipment, control units, transducers/transmitters, sensors, actuators, valves, relays/switches, control panels, and operator interface equipment.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1. Bill of materials of equipment indicating quantity, manufacturer, and model number.
2. Schematic flow diagrams showing fans, pumps, coils, dampers, valves, and control devices.
3. Wiring Diagrams: Power, signal, and control wiring.
4. Details of control panel faces, including controls, instruments, and labeling.
5. Written description of sequence of operation.
6. Schedule of valves including flow characteristics.
7. DDC System Hardware:

    a. Wiring diagrams for control units with termination numbers.
    b. Schematic diagrams and floor plans for field sensors and control hardware.
    c. Schematic diagrams for control, communication, and power wiring, showing trunk data conductors and wiring between operator workstation and control unit locations.

8. Control System Software: List of color graphics indicating monitored systems, data (connected and calculated) point addresses, output schedule, and operator notations.
9. Controlled Systems:

    a. Schematic diagrams of each controlled system with control points labeled and control elements graphically shown, with wiring.
    b. Scaled drawings showing mounting, routing, and wiring of elements including bases and special construction.
    c. Written description of sequence of operation including schematic diagram.
    d. Points list.

C. Samples for Initial Selection: For each color required, of each type of thermostat or sensor cover with factory-applied color finishes.

D. Samples for Verification: For each color required, of each type of thermostat or sensor cover.

1.6 INFORMATIONAL SUBMITTALS

A. Data Communications Protocol Certificates: Certify that each proposed DDC system component complies with ASHRAE 135.

B. Data Communications Protocol Certificates: Certify that each proposed DDC system component complies with LonWorks.

C. Qualification Data: For Installer.

D. Software Upgrade Kit: For Owner to use in modifying software to suit future systems revisions or monitoring and control revisions.

E. Field quality-control test reports.

1.7 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For HVAC instrumentation and control system to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

1. Maintenance instructions and lists of spare parts for each type of control device.
2. Interconnection wiring diagrams with identified and numbered system components and devices.
3. Inspection period, cleaning methods, cleaning materials recommended, and calibration tolerances.

1.8 QUALITY ASSURANCE

A. Installer Qualifications: Automatic control system manufacturer's authorized representative who is trained and approved for installation of system components required for this Project.

B. 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.

C. Comply with ASHRAE 135 for DDC system components.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Factory-Mounted Components: Where control devices specified in this Section are indicated to be factory mounted on equipment, arrange for shipping of control devices to equipment manufacturer.

B. System Software: Update to latest version of software at Project completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. 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. Extend existing controls.

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 ELECTRONIC SENSORS

A. Description: Vibration and corrosion resistant; for wall, immersion, or duct mounting as required.

B. Thermistor Temperature Sensors and Transmitters:

1. Manufacturers:

a. Honeywell International Inc.

2. Accuracy: Plus or minus 0.5 deg F (0.3 deg C) at calibration point.
3. Wire: Twisted, shielded-pair cable.

a. Set-Point Adjustment: Exposed.
b. Set-Point Indication: Exposed.
c. Thermometer: Concealed.
d. Color: White
e. Orientation: Vertical.

2.4 ACTUATORS

A. Electric Motors: Size to operate with sufficient reserve power to provide smooth modulating action or two-position action.

1. 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.
2. Nonspring-Return Motors for Valves Larger Than NPS 2-1/2 (DN 65): Size for running torque of 150 in. x lbf (16.9 N x m) and breakaway torque of 300 in. x lbf (33.9 N x m).
3. Spring-Return Motors for Valves Larger Than NPS 2-1/2 (DN 65): Size for running and breakaway torque of 150 in. x lbf (16.9 N x m).
4. Nonspring-Return Motors for Dampers Larger Than 25 Sq. Ft. (2.3 sq. m): Size for running torque of 150 in. x lbf (16.9 N x m) and breakaway torque of 300 in. x lbf (33.9 N x m).
5. Spring-Return Motors for Dampers Larger Than 25 Sq. Ft. (2.3 sq. m): Size for running and breakaway torque of 150 in. x lbf (16.9 N x m).

B. Electronic Actuators: Direct-coupled type designed for minimum 60,000 full-stroke cycles at rated torque.

1. Manufacturers:

a. Honeywell International Inc.

2. Valves: Size for torque required for valve close off at maximum pump differential pressure.

3. Coupling: V-bolt and V-shaped, toothed cradle.
4. Overload Protection: Electronic overload or digital rotation-sensing circuitry.
5. Fail-Safe Operation: Mechanical, spring-return mechanism. Provide external, manual gear release on nonspring-return actuators.
6. Power Requirements (Modulating): Maximum 10 VA at 24-V ac or 8 W at 24-V dc.
7. Temperature Rating: Minus 22 to plus 122 deg F.
8. Run Time: 120 seconds.

2.5 CONTROL VALVES

A. Manufacturers:

a. Honeywell International Inc.

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. 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 (860 kPa) and 250 deg F (121 deg C) operating conditions.
2. Sizing: 3-psig (21-kPa) 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.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that conditioned power supply is available to control units and operator workstation.

B. Verify that pneumatic piping and duct-, pipe-, and equipment-mounted devices are installed before proceeding with installation.

3.2 INSTALLATION

A. Verify location of thermostats, humidistats, and other exposed control sensors with Drawings and room details before installation. Install devices 48 inches above the floor.

1. Install averaging elements in ducts and plenums in crossing or zigzag pattern.

B. Install labels and nameplates to identify control components according to Section 23 05 53 "Identification for HVAC Piping and Equipment."

C. Install hydronic instrument wells, valves, and other accessories according to Section 23 21 16 Hydronic Piping Specialties."

3.3 ELECTRICAL WIRING AND CONNECTION INSTALLATION

A. Install raceways, boxes, and cabinets according to Section 26 05 33 "Raceways and Boxes for Electrical Systems."

B. Install building wire and cable according to Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."

C. Connect manual-reset limit controls independent of manual-control switch positions. Automatic duct heater resets may be connected in interlock circuit of power controllers.

D. Connect hand-off-auto selector switches to override automatic interlock controls when switch is in hand position.

3.4 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 electronic 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 installation of air supply for each instrument.
6. Check flow instruments. Inspect tag number and line and bore size, and verify that inlet side is identified and that meters are installed correctly.
7. Check pressure instruments, piping slope, installation of valve manifold, and self-contained pressure regulators.
8. Check temperature instruments and material and length of sensing elements.
9. Check control valves. Verify that they are in correct direction.
10. Check air-operated dampers. Verify that pressure gages are provided and that proper blade alignment, either parallel or opposed, has been provided.
11. 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.

3.5 ADJUSTING

A. Calibrating and Adjusting:

1. Calibrate instruments.
2. Make three-point calibration test for both linearity and accuracy for each analog instrument.
3. Calibrate equipment and procedures using manufacturer's written recommendations and instruction manuals. Use test equipment with accuracy at least double that of instrument being calibrated.
4. Control System Inputs and Outputs:

    a. Check analog inputs at 0, 50, and 100 percent of span.
    b. Check analog outputs using milliampere meter at 0, 50, and 100 percent output.
    c. Check digital inputs using jumper wire.
    d. Check digital outputs using ohmmeter to test for contact making or breaking.
    e. Check resistance temperature inputs at 0, 50, and 100 percent of span using a precision-resistant source.

5. Flow:

    a. Set differential pressure flow transmitters for 0 and 100 percent values with 3-point calibration accomplished at 50, 90, and 100 percent of span.
    b. Manually operate flow switches to verify that they make or break contact.

6. Pressure:

    a. Calibrate pressure transmitters at 0, 50, and 100 percent of span.
    b. Calibrate pressure switches to make or break contacts, with adjustable differential set at minimum.

7. Temperature:

a. Calibrate resistance temperature transmitters at 0, 50, and 100 percent of span using a precision-resistance source.
b. Calibrate temperature switches to make or break contacts.

8. Stroke and adjust control valves and dampers without positioners, following the manufacturer's recommended procedure, so that valve or damper is 100 percent open and closed.
9. Stroke and adjust control valves and dampers with positioners, following manufacturer's recommended procedure, so that valve and damper is 0, 50, and 100 percent closed.
10. Provide diagnostic and test instruments for calibration and adjustment of system.
11. Provide written description of procedures and equipment for calibrating each type of instrument. Submit procedures review and approval before initiating startup procedures.

B. Adjust initial temperature and humidity set points.

END OF SECTION 23 09 00

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes pipe and fitting materials and joining methods for the following:
   1. Chilled-water piping.
   2. Condensate-drain piping.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of the following:

   1. Pipe material.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Piping layout, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

   1. Suspended ceiling components.
   2. Other building services.
   3. Structural members.

B. Qualification Data: For Installer.

C. Welding certificates.

D. Field quality-control reports.

E. Water Analysis: Submit a copy of the water analysis to illustrate water quality available at Project site.

1.5 QUALITY ASSURANCE

A. Steel Support Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Pipe Welding: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code: Section IX.

   1. Comply with ASME B31.9, "Building Services Piping," for materials, products, and installation.

2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Hydronic piping components and installation shall be capable of withstanding the following minimum working pressure and temperature unless otherwise indicated:
1. Chilled-Water Piping: 125 psig at 200 deg F.
2. Condensate-Drain Piping: 150 deg F.

2.2 COPPER TUBE AND FITTINGS

A. Drawn-Temper Copper Tubing: ASTM B 88, Type L.

B. DWV Copper Tubing: ASTM B 306, Type DWV.

2.3 STEEL PIPE AND FITTINGS

A. Steel Pipe: ASTM A 53/A 53M, black steel with plain ends; welded and seamless, Grade B, and wall thickness as indicated in "Piping Applications" Article.

B. Malleable-Iron Threaded Fittings: ASME B16.3, Classes 150 and 300 as indicated in "Piping Applications" Article.

C. Malleable-Iron Unions: ASME B16.39; Classes 150, 250, and 300 as indicated in "Piping Applications" Article.

D. Wrought-Steel Fittings: ASTM A 234/A 234M, wall thickness to match adjoining pipe.

E. Wrought Cast- and Forged-Steel Flanges and Flanged Fittings: ASME B16.5, including bolts, nuts, and gaskets of the following material group, end connections, and facings:

1. Material Group: 1.1.
2. End Connections: Butt welding.
3. Facings: Raised face.

2.4 JOINING MATERIALS

A. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.

1. ASME B16.21, nonmetallic, flat, asbestos free, 1/8-inch (3.2-mm) maximum thickness unless otherwise indicated.

a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.

B. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

C. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

D. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for joining copper with copper; or BAg-1, silver alloy for joining copper with bronze or steel.

E. Welding Filler Metals: Comply with AWS D10.12M/D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

F. Solvent Cements for Joining Plastic Piping:

1. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.

G. Gasket Material: Thickness, material, and type suitable for fluid to be handled and working temperatures and pressures.

2.5 DIELECTRIC FITTINGS

A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.

B. Dielectric Flanges:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Capitol Manufacturing Company.
b. Central Plastics Company.
c. Matco-Norca.
d. Watts Regulator Co.
e. Zurn Industries, LLC; AquaSpec Commercial Faucet Products.

2. Description:

a. Standard: ASSE 1079.
b. Factory-fabricated, bolted, companion-flange assembly.
c. Pressure Rating: 125 psig minimum at 180 deg F.
d. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

A. Chilled-water piping shall be the following:

1. Type L drawn-temper copper tubing, wrought-copper fittings, and soldered brazed joints.
2. Schedule 40 steel pipe; Class 150, malleable-iron fittings; cast-iron flanges and flange fittings; and threaded joints.

B. Condensate-Drain Piping: Schedule 40 PVC plastic pipe and fittings and solvent-welded joints.

C. Air-Vent Piping:

1. Inlet: Same as service where installed with metal-to-plastic transition fittings for plastic piping systems according to piping manufacturer's written instructions.
2. Outlet: Type K (Type A), annealed-temper copper tubing with soldered or flared joints.

3.2 PIPING INSTALLATIONS

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. 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 to permit valve servicing.

F. Install piping at indicated slopes.

G. Install piping free of sags and bends.

H. Install fittings for changes in direction and branch connections.

I. Install piping to allow application of insulation.

J. Select system components with pressure rating equal to or greater than system operating pressure.

K. Install groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.

L. Install drains, consisting of a tee fitting, NPS 3/4 (DN 20) ball valve, and short NPS 3/4 (DN 20) threaded nipple with cap, at low points in piping system mains and elsewhere as required for system drainage.

M. Install piping at a uniform grade of 0.2 percent upward in direction of flow.

N. Reduce pipe sizes using eccentric reducer fitting installed with level side up.

O. Install flanges in piping, NPS 2-1/2 and larger, at final connections of equipment and elsewhere as indicated.

P. Install shutoff valve immediately upstream of each dielectric fitting.

Q. Comply with requirements in Section 230553 "Identification for HVAC Piping and Equipment" for identifying piping.

R. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 230517 "Sleeves and Sleeve Seals for HVAC Piping."

S. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 230517 "Sleeves and Sleeve Seals for HVAC Piping."

T. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 230518 "Escutcheons for HVAC Piping."

3.3 DIELECTRIC FITTING INSTALLATION

A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.

3.4 HANGERS AND SUPPORTS

A. Comply with requirements in Section 230529 "Hangers and Supports for HVAC Piping and Equipment" for hanger, support, and anchor devices. Comply with the following requirements for maximum spacing of supports.

B. Comply with requirements in Section 230548 "Vibration and Seismic Controls for HVAC" for seismic restraints.

C. Install the following pipe attachments:

1. Adjustable steel clevis hangers for individual horizontal piping less than 20 feet (6 m) long.
2. Adjustable roller hangers and spring hangers for individual horizontal piping 20 feet (6 m) or longer.
3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet (6 m) or longer, supported on a trapeze.
4. Spring hangers to support vertical runs.
5. Provide copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.

D. Install hangers for steel piping with the following maximum spacing and minimum rod sizes:

1. NPS 3/4 (DN 20): Maximum span, 7 feet (2.1 m).
2. NPS 1 (DN 25): Maximum span, 7 feet (2.1 m).
3. NPS 1-1/2 (DN 40): Maximum span, 9 feet (2.7 m).
4. NPS 2 (DN 50): Maximum span, 10 feet (3 m).
5. NPS 2-1/2 (DN 65): Maximum span, 11 feet (3.4 m).
6. NPS 3 (DN 80) and Larger: Maximum span, 12 feet (3.7 m).

E. Install hangers for drawn-temper copper piping with the following maximum spacing and minimum rod sizes:

1. NPS 3/4 (DN 20): Maximum span, 5 feet (1.5 m); minimum rod size, 1/4 inch (6.4 mm).
2. NPS 1 (DN 25): Maximum span, 6 feet (1.8 m); minimum rod size, 1/4 inch (6.4 mm).
3. NPS 1-1/4 (DN 32:)Maximum span, 7 feet (2.1 m); minimum rod size, 3/8 inch (10 mm).
4. NPS 1-1/2 (DN 40): Maximum span, 8 feet (2.4 m); minimum rod size, 3/8 inch (10 mm).
5. NPS 2 (DN 50): Maximum span, 8 feet (2.4 m); minimum rod size, 3/8 inch (10 mm).

6. NPS 2-1/2 (DN 65): Maximum span, 9 feet (2.7 m); minimum rod size, 3/8 inch (10 mm).
7. NPS 3 (DN 80) and Larger: Maximum span, 10 feet (3 m); minimum rod size, 3/8 inch (10 mm).

F. Support vertical runs at roof, at each floor, and at 10-foot (3-m) intervals between floors.

3.5 PIPE 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 pipe and fittings before assembly.

C. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.

D. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8/A5.8M.

E. 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 unless dry seal threading is specified.
2. 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.

F. Welded Joints: Construct joints according to AWS D10.12M/D10.12, using qualified processes and welding operators according to "Quality Assurance" Article.

G. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

3.6 TERMINAL EQUIPMENT CONNECTIONS

A. Sizes for supply and return piping connections shall be the same as or larger than equipment connections.

B. Install control valves in accessible locations close to connected equipment.

C. Install bypass piping with globe valve around control valve. If parallel control valves are installed, only one bypass is required.

D. Install ports for pressure gages and thermometers at coil inlet and outlet connections. Comply with requirements in Section 230519 "Meters and Gages for HVAC Piping."

3.7 CHEMICAL TREATMENT

A. Coordinate with the college to provide glycol and chemical treatment consistent with the existing.

3.8 FIELD QUALITY CONTROL

A. Prepare hydronic piping according to ASME B31.9 and as follows:

1. Leave joints, including welds, uninsulated and exposed for examination during test.
2. Provide temporary restraints for expansion joints that cannot sustain reactions due to test pressure. If temporary restraints are impractical, isolate expansion joints from testing.
3. Flush hydronic piping systems with clean water; then remove and clean or replace strainer screens.
4. Isolate equipment from piping. If a valve is used to isolate equipment, its closure shall be capable of sealing against test pressure without damage to valve. Install blinds in flanged joints to isolate equipment.
5. Install safety valve, set at a pressure no more than one-third higher than test pressure, to protect against damage by expanding liquid or other source of overpressure during test.

B. Perform the following tests on hydronic piping:

1. Use ambient temperature water as a testing medium unless there is risk of damage due to freezing. Another liquid that is safe for workers and compatible with piping may be used.
2. While filling system, use vents installed at high points of system to release air. Use drains installed at low points for complete draining of test liquid.
3. Isolate expansion tanks and determine that hydronic system is full of water.
4. Subject piping system to hydrostatic test pressure that is not less than 1.5 times the system's working pressure. Test pressure shall not exceed maximum pressure for any vessel, pump, valve, or other component in system under test. Verify that stress due to pressure at bottom of vertical runs does not exceed 90 percent of specified minimum yield strength or 1.7 times the "SE" value in Appendix A in ASME B31.9, "Building Services Piping."
5. After hydrostatic test pressure has been applied for at least 10 minutes, examine piping, joints, and connections for leakage. Eliminate leaks by tightening, repairing, or replacing components, and repeat hydrostatic test until there are no leaks.
6. Prepare written report of testing.

C. Perform the following before operating the system:

1. Open manual valves fully.
2. Inspect pumps for proper rotation.
3. Set makeup pressure-reducing valves for required system pressure.
4. Inspect air vents at high points of system and determine if all are installed and operating freely (automatic type), or bleed air completely (manual type).
5. Set temperature controls so all coils are calling for full flow.
6. Inspect and set operating temperatures of hydronic equipment, such as boilers, chillers, cooling towers, to specified values.
7. Verify lubrication of motors and bearings.

END OF SECTION 23 21 13

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes special-duty valves and specialties for the following:

1. Hydronic specialty valves.
2. Air-control devices.
3. Strainers.
4. Connectors.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of the following:

1. Hydronic Specialty Valves: Include flow and pressure drop curves based on manufacturer's testing for calibrated-orifice balancing valves and automatic flow-control valves.
2. Air-control devices.
3. Strainers
4. Connectors.

1.3 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.4 QUALITY ASSURANCE

A. ASME Compliance: Safety valves and pressure vessels shall bear the appropriate ASME label. Fabricate and stamp air separators and expansion tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

PART 2 - PRODUCTS

2.1 HYDRONIC SPECIALTY VALVES

A. Bronze, Calibrated-Orifice, Balancing Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Armstrong Pumps, Inc.
   b. Bell & Gossett; a Xylem brand.
   c. Grinnell Mechanical Products.
   d. Hays Fluid Controls.
   e. Nexus Valve, Inc.
   f. TACO Comfort Solutions, Inc.

g. Victaulic Company.

2. Body: Bronze, full port bell.
3. Ball: Brass or stainless steel.
4. Plug: Resin.
5. Seat: PTFE.
6. End Connections: Threaded or socket.
7. Pressure Gage Connections: Integral seals for portable differential pressure meter.
8. Handle Style: Lever, with memory stop to retain set position. Insulation extension
9. CWP Rating: Minimum 125 psig.
10. Maximum Operating Temperature: 250 deg F.

2.2 AIR-CONTROL DEVICES

A. Manual Air Vents:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. AMTROL, Inc.
   b. Armstrong Pumps, Inc.
   c. Bell & Gossett; a Xylem brand.
   d. TACO Comfort Solutions, Inc.

2. Body: Bronze.

3. Internal Parts: Nonferrous.
4. Operator: Screwdriver or thumbscrew.
5. Inlet Connection: NPS 1/2.
6. Discharge Connection: NPS 1/8.
7. CWP Rating: 150 psig.
8. Maximum Operating Temperature: 225 deg F.

B. Expansion Tanks:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. AMTROL, Inc.
   b. Armstrong Pumps, Inc.
   c. Bell & Gossett; a Xylem brand.
   d. TACO Comfort Solutions, Inc.

2. Tank: Welded steel, rated for 125-psig working pressure and 375 deg F maximum operating temperature, with taps in bottom of tank for tank fitting and taps in end of tank for gage glass. Tanks shall be factory tested after taps are fabricated and shall be labeled according to ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

3. Air-Control Tank Fitting: Cast-iron body, copper-plated tube, brass vent tube plug, and stainless-steel ball check, 100-gal. unit only; sized for compression-tank diameter. Provide tank fittings for 125-psig working pressure and 250 deg F maximum operating temperature.

4. Tank Drain Fitting: Brass body, nonferrous internal parts; 125-psig working pressure and 240 deg F maximum operating temperature; constructed to admit air to compression tank, drain water, and close off system.
5. Gage Glass: Full height with dual manual shutoff valves, 3/4-inch diameter gage glass, and slotted-metal glass guard.

C. In-Line Air Separators:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. AMTROL, Inc.
   b. Armstrong Products, Inc.
   c. Bell & Gossett; a Xylem brand.
   d. Spirotherm, Inc.
   e. TACO Comfort Solutions, Inc.

2. Tank: One-piece cast iron with an integral weir constructed to decelerate system flow to maximize air separation.

3. Maximum Working Pressure: Up to 175 psig.
4. Maximum Operating Temperature: Up to 300 deg F.

2.3 STRAINERS

A. 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; flanged ends for NPS 2-1/2 and larger.
3. Strainer Screen: Stainless-steel, 60 mesh strainer, or perforated stainless-steel basket.
4. CWP Rating: 125 psig.

2.4 CONNECTORS

A. Stainless-Steel Bellow, Flexible Connectors:

1. Body: Stainless-steel bellows with woven, flexible, bronze, wire-reinforcing protective jacket.
2. End Connections: Threaded or flanged to match equipment connected.
3. Performance: Capable of 3/4-inch misalignment.
4. CWP Rating: 150 psig.
5. Maximum Operating Temperature: 250 deg F.

PART 3 - EXECUTION

3.1 VALVE APPLICATIONS

A. Install shut-off duty valves at each branch connection to supply mains and at supply connection to each piece of equipment.

B. Install calibrated-orifice, balancing.

C. Install calibrated-orifice, balancing valves in the return pipe of each heating or cooling terminal.

D. Install check valves at each pump discharge and elsewhere as required to control flow direction.

E. Install safety valves at hot-water generators and elsewhere as required by ASME Boiler and Pressure Vessel Code. Install drip-pan elbow on safety-valve outlet and pipe without valves to the outdoors; pipe drain to nearest floor drain or as indicated on Drawings. Comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1, for installation requirements.

F. Install pressure-reducing valves at makeup-water connection to regulate system fill pressure.

3.2 HYDRONIC SPECIALTIES INSTALLATION

A. Install manual air vents at high points in piping, at heat-transfer coils, and elsewhere as required for system air venting.

B. Install in-line air separators in pump suction. Install drain valve on air separators NPS 2 and larger.

C. Install expansion tanks above the air separator. Install tank fitting in tank bottom and charge tank. Use manual vent for initial fill to establish proper water level in tank.

1. Install tank fittings that are shipped loose.
2. Support tank from floor or structure above with sufficient strength to carry weight of tank, piping connections, fittings, plus tank full of water. Do not overload building components and structural members.

D. Install expansion tanks on the floor. Vent and purge air from hydronic system, and ensure that tank is properly charged with air to suit system Project requirements.

END OF SECTION 23 21 16

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Round ducts and fittings.
2. Sheet metal materials.
3. Sealants and gaskets.
4. Hangers and supports.

B. Related Sections:

1. Section 230593 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.
2. Section 233300 "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

1.2 PERFORMANCE REQUIREMENTS

A. Delegated Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and performance requirements and design criteria indicated in "Duct Schedule" Article.

B. Structural Performance: Duct hangers and supports shall withstand the effects of gravity loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and ASCE/SEI 7.

C. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ANSI/ASHRAE 62.1.

1.3 ACTION SUBMITTALS

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

B. Shop Drawings:

1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
2. Factory- and shop-fabricated ducts and fittings.
3. Duct layout indicating sizes, configuration, and static-pressure classes.
4. Elevation of top of ducts.
5. Dimensions of main duct runs from building grid lines.
6. Fittings.
7. Reinforcement and spacing.
8. Seam and joint construction.

9. Penetrations through fire-rated and other partitions.
10. Equipment installation based on equipment being used on Project.
11. Locations for duct accessories, including dampers, turning vanes, and access doors and panels.
12. Hangers and supports, including methods for duct and building attachment and vibration isolation.

C. Delegated-Design Submittal:

1. Sheet metal thicknesses.
2. Joint and seam construction and sealing.
3. Reinforcement details and spacing.
4. Materials, fabrication, assembly, and spacing of hangers and supports.
5. Design Calculations: Calculations for selecting hangers and supports.

1.4 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.5 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports.
2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum," for aluminum supports.
3. AWS D9.1M/D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.

B. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-up."

C. ASHRAE/IES Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6.4.4 - "HVAC System Construction and Insulation."

PART 2 - PRODUCTS

2.1 ROUND DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Ductmate Industries, Inc.
b. Elgen Manufacturing.
c. Linx Industries (formerly Lindab).
d. McGill AirFlow LLC.
e. MKT Metal Manufacturing.
f. SEMCO LLC.
g. Sheet Metal Connectors, Inc.

h. Spiral Manufacturing Co., Inc.
i. Stamped Fittings Inc.

B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1. Transverse Joints in Ducts Larger Than 60 Inches in Diameter: Flanged.

C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Round Duct Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1. Fabricate round ducts larger Than 90 inches in diameter with butt-welded longitudinal seams.

D. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.2 SHEET METAL MATERIALS

A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.

1. Galvanized Coating Designation: G60.
2. Finishes for Surfaces Exposed to View: Mill phosphatized.

C. Carbon-Steel Sheets: Comply with ASTM A 1008/A 1008M, with oiled, matte finish for exposed ducts.

D. Reinforcement Shapes and Plates: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

1. Where black- and galvanized-steel shapes and plates are used to reinforce aluminum ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.

E. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.3 SEALANT AND GASKETS

A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.

B. Water-Based Joint and Seam Sealant:

1. Application Method: Brush on.
2. Solids Content: Minimum 65 percent.
3. Shore A Hardness: Minimum 20.
4. Water resistant.
5. Mold and mildew resistant.
6. VOC: Maximum 75 g/L (less water).
7. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
8. Service: Indoor or outdoor.
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

C. Flanged Joint Sealant: Comply with ASTM C 920.

1. General: Single-component, acid-curing, silicone, elastomeric.
2. Type: S.
3. Grade: NS.
4. Class: 25.
5. Use: O.
6. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
7. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

D. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.

E. Round Duct Joint O-Ring Seals:

1. Seal shall provide maximum leakage class of 3 cfm/100 sq. ft. at 1-inch wg and shall be rated for10-inch wg static-pressure class, positive or negative.
2. EPDM O-ring to seal in concave bead in coupling or fitting spigot.
3. Double-lipped, EPDM O-ring seal, mechanically fastened to factory-fabricated couplings and fitting spigots.

2.4 HANGERS AND SUPPORTS

A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.

B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.

C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."

D. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.

E. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.

F. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

G. Trapeze and Riser Supports:

PART 3 - EXECUTION

3.1 DUCT INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.

B. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.

C. Install ducts in maximum practical lengths.

D. Install ducts with fewest possible joints.

E. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.

F. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.

G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

H. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.

I. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.

J. Protect duct interiors from moisture, construction debris and dust, and other foreign materials. Comply with SMACNA's "IAQ Guidelines for Occupied Buildings Under Construction," Appendix G, "Duct Cleanliness for New Construction Guidelines."

3.2 INSTALLATION OF EXPOSED DUCTWORK

A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.

B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.

C. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.

D. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.

E. Repair or replace damaged sections and finished work that does not comply with these requirements.

3.3 DUCT SEALING

A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

B. Seal ducts at a minimum to the following seal classes according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible":

1. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
2. Conditioned Space, Exhaust Ducts: Seal Class B.

3.4 HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."

B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.

1. Where practical, install concrete inserts before placing concrete.
2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.
4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.
5. Do not use powder-actuated concrete fasteners for seismic restraints.

C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.

D. Hangers Exposed to View: Threaded rod and angle or channel supports.

E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet.

F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.5 CONNECTIONS

A. Make connections to equipment with flexible connectors complying with Section 233300 "Air Duct Accessories."

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.6 DUCT CLEANING

A. Clean new duct system(s) before testing, adjusting, and balancing.

B. Use service openings for entry and inspection.

1. Create new openings and install access panels appropriate for duct static-pressure class if required for cleaning access. Provide insulated panels for insulated or lined duct. Patch insulation and liner as recommended by duct liner manufacturer. Comply with Section 233300 "Air Duct Accessories" for access panels and doors.
2. Disconnect and reconnect flexible ducts as needed for cleaning and inspection.
3. Remove and reinstall ceiling to gain access during the cleaning process.

C. Particulate Collection and Odor Control:

1. When venting vacuuming system inside the building, use HEPA filtration with 99.97 percent collection efficiency for 0.3-micron-size (or larger) particles.
2. When venting vacuuming system to outdoors, use filter to collect debris removed from HVAC system, and locate exhaust downwind and away from air intakes and other points of entry into building.

D. Mechanical Cleaning Methodology:

1. Clean metal duct systems using mechanical cleaning methods that extract contaminants from within duct systems and remove contaminants from building.
2. Use vacuum-collection devices that are operated continuously during cleaning. Connect vacuum device to downstream end of duct sections so areas being cleaned are under negative pressure.
3. Use mechanical agitation to dislodge debris adhered to interior duct surfaces without damaging integrity of metal ducts, duct liner, or duct accessories.
4. Clean fibrous-glass duct liner with HEPA vacuuming equipment; do not permit duct liner to get wet. Replace fibrous-glass duct liner that is damaged, deteriorated, or delaminated or that has friable material, mold, or fungus growth.
5. Clean coils and coil drain pans according to NADCA 1992. Keep drain pan operational. Rinse coils with clean water to remove latent residues and cleaning materials; comb and straighten fins.
6. Provide drainage and cleanup for wash-down procedures.
7. Antimicrobial Agents and Coatings: Apply EPA-registered antimicrobial agents if fungus is present. Apply antimicrobial agents according to manufacturer's written instructions after removal of surface deposits and debris.

3.7 START UP

A. Air Balance: Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC."

3.8 DUCT SCHEDULE

A. Exhaust Ducts:

1. Ducts Connected to Fans Exhausting (ASHRAE 62.1, Class 1 and 2) Air:

a. Pressure Class: Negative 3-inch wg.
b. Minimum SMACNA Seal Class: C.
c. SMACNA Leakage Class for Round and Flat Oval: 6.

B. Elbow Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."

a. Velocity 1000 fpm or Lower:

1) Radius Type RE 1 with minimum 0.5 radius-to-diameter ratio.
2) Mitered Type RE 4 without vanes.

b. Velocity 1000 to 1500 fpm:

1) Radius Type RE 1 with minimum 1.0 radius-to-diameter ratio.
2) Radius Type RE 3 with minimum 0.5 radius-to-diameter ratio and two vanes.
3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

c. Velocity 1500 fpm or Higher:

1) Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
2) Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

2. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "Round Duct Elbows."

a. Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.

1) Velocity 1000 fpm or Lower: 0.5 radius-to-diameter ratio and three segments for 90-degree elbow.
2) Velocity 1000 to 1500 fpm: 1.0 radius-to-diameter ratio and four segments for 90-degree elbow.

3) Velocity 1500 fpm or Higher: 1.5 radius-to-diameter ratio and five segments for 90-degree elbow.
4) Radius-to Diameter Ratio: 1.5.

b. Round Elbows, 12 Inches and Smaller in Diameter: Stamped or pleated.

END OF SECTION 23 31 13

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Flexible connectors.
2. Duct accessory hardware.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

PART 2 - PRODUCTS

2.1 ASSEMBLY DESCRIPTION

A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

2.2 MATERIALS

A. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.

1. Galvanized Coating Designation: G60.

B. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.

C. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.3 FLEXIBLE CONNECTORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. CL WARD & Family Inc.
2. Ductmate Industries, Inc.
3. Duro Dyne Inc.
4. Elgen Manufacturing.
5. Hardcast, Inc.
6. JP Lamborn Co.
7. Ventfabrics, Inc.
8. Ward Industries; a brand of Hart & Cooley, Inc.

B. Materials: Flame-retardant or noncombustible fabrics.

C. Coatings and Adhesives: Comply with UL 181, Class 1.

D. Metal-Edged Connectors: Factory fabricated with a fabric strip[3-1/2 inches wide attached to two strips of 2-3/4-inch-wide, 0.028-inch-thick, galvanized sheet steel or 0.032-inch-thick aluminum sheets. Provide metal compatible with connected ducts.

E. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.

1. Minimum Weight: 26 oz./sq. yd..
2. Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.
3. Service Temperature: Minus 40 to plus 200 deg F.

2.4 DUCT ACCESSORY HARDWARE

A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct-insulation thickness.

B. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.

B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.

C. Set VAV box dampers to fully open position before testing, adjusting, and balancing.

D. Install test holes at fan inlets and outlets and elsewhere as indicated.

E. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:

F. Install flexible connectors to connect ducts to equipment.

G. Install duct test holes where required for testing and balancing purposes.

3.2 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Operate dampers to verify full range of movement.

END OF SECTION 23 33 00

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Shutoff, single-duct air terminal units.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of air terminal unit.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for air terminal units.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: For air terminal units.

1. Include plans, elevations, sections, and mounting details.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include diagrams for power, signal, and control wiring.
4. Hangers and supports, including methods for duct and building attachment and vibration isolation.

C. Delegated-Design Submittal:

1. Materials, fabrication, assembly, and spacing of hangers and supports.
2. Include design calculations for selecting hangers and supports.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Ceiling suspension assembly members.
2. Size and location of initial access modules for acoustic tile.

B. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For air terminal units to include in emergency, operation, and maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fan-Powered-Unit Filters: Furnish one spare filter(s) for each filter installed.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

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. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-up."

C. ASHRAE Compliance: Applicable requirements in ASHRAE/IES 90.1, "Section 6 - Heating, Ventilating, and Air Conditioning."

2.2 SHUTOFF, SINGLE-DUCT AIR TERMINAL UNITS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Price Industries.
2. Titus.
3. Trane.
4. Diakin.

B. Configuration: Volume-damper assembly inside unit casing with control components inside a protective metal shroud.

C. Casing: 0.034-inch thick galvanized steel, single wall.

1. Casing Liner: Comply with requirements in "Casing Liner" Article for fibrous-glass duct liner.
2. Air Inlet: Round stub connection or S-slip and drive connections for duct attachment.
3. Air Outlet: S-slip and drive connections, size matching inlet size.
4. Access: Removable panels for access to parts requiring service, adjustment, or maintenance; with airtight gasket.
5. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

D. Volume Damper: Galvanized steel with peripheral gasket and self-lubricating bearings.

1. Maximum Damper Leakage: AHRI 880 rated, 2percent of nominal airflow at 3-inch wg inlet static pressure.
2. Damper Position: Normally open.

E. Attenuator Section: 0.034-inch steel sheet.

1. Attenuator Section Liner: Comply with requirements in "Casing Liner" Article for fibrous-glass duct liner.
2. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

F. Direct Digital Controls: Bidirectional dampers and controller and room sensor. Control devices shall be compatible with temperature controls system specified in Section 230900 "Instrumentation and Control for HVAC."

1. Electronic Damper Actuator: 24 V, powered open return.

2. Terminal Unit Controller: Pressure-independent, variable-air-volume (VAV) controller with electronic airflow transducer with multipoint velocity sensor at air inlet, factory calibrated to minimum and maximum air volumes, and having the following features:

   a. Occupied and unoccupied operating mode.
   b. Remote reset of airflow or temperature set points.
   c. Adjusting and monitoring with portable terminal.
   d. Communication with temperature-control system specified in Section 230923 "Direct Digital Control (DDC) System for HVAC."

3. Room Sensor: Wall mounted with temperature set-point adjustment and access for connection of portable operator terminal.

G. Control Sequences:

1. Occupied:

   a. In a call for cooling, airflow will increase as the damper opens towards maximum setting to satisfy set point.
   b. In a call for less cooling, airflow will decrease as the damper closes towards minimum setting to satisfy set point.

2.3 CASING LINER

A. Casing Liner: Fibrous-glass duct liner, complying with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."

1. Minimum Thickness: 1/2 inch.

   a. Maximum Thermal Conductivity:

      1) Type I, Flexible: 0.27 Btu x in./h x sq. ft. x deg Fat 75 deg F mean temperature.
      2) Type II, Rigid: 0.23 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.

2. Antimicrobial Erosion-Resistant Coating: Apply to the surface of the liner that will form the interior surface of the duct to act as a moisture repellent and erosion-resistant coating. Antimicrobial compound shall be tested for efficacy by an NRTL and registered by the EPA for use in HVAC systems.
3. Solvent Based Liner Adhesive: Comply with NFPA 90A or NFPA 90B and with ASTM C 916.

    a. Adhesive VOC Content: 80 g/L or less.
    b. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

B. Casing Liner: Flexible elastomeric duct liner fabricated of preformed, cellular, closed-cell, sheet materials complying with ASTM C 534, Type II, Grade 1; and with NFPA 90A or NFPA 90B.

1. Minimum Thickness: 3/4 inch.
2. Surface-Burning Characteristics: Maximum flame-spread index of 25 and maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.
3. Liner Adhesive: As recommended by insulation manufacturer and complying with NFPA 90A or NFPA 90B.

    a. Adhesive VOC Content: 50 g/L or less.
    b. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2.4 SOURCE QUALITY CONTROL

A. Factory Tests: Test assembled air terminal units according to AHRI 880.

1. Label each air terminal unit with plan number, nominal airflow, maximum and minimum factory-set airflows, and AHRI certification seal.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT INSTALLATION

A. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.

1. Where practical, install concrete inserts before placing concrete.
2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes and for slabs more than 4 inches thick.
4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes and for slabs less than 4 inches thick.
5. Do not use powder-actuated concrete fasteners for seismic restraints.

B. Hangers Exposed to View: Threaded rod and angle or channel supports.

C. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.2 TERMINAL UNIT INSTALLATION

A. Install air terminal units according to NFPA 90A, "Standard for the Installation of Air Conditioning and Ventilating Systems."

B. Install air terminal units level and plumb. Maintain sufficient clearance for normal service and maintenance.

C. Install wall-mounted thermostats.

3.3 CONNECTIONS

A. Where installing piping adjacent to air terminal unit, allow space for service and maintenance.

B. Hot-Water Piping: Comply with requirements in Section 232113 "Hydronic Piping" and Section 232116 Hydronic Piping Specialties," and connect heating coils to supply with shutoff valve, strainer, control valve, and union or flange; and to return with balancing valve and union or flange.

C. Comply with requirements in Section 233113 "Metal Ducts" for connecting ducts to air terminal units.

D. Make connections to air terminal units with flexible connectors complying with requirements in Section 233300 "Air Duct Accessories."

3.4 IDENTIFICATION

A. Label each air terminal unit with plan number, nominal airflow, and maximum and minimum factory-set airflows. Comply with requirements in Section 230553 "Identification for HVAC Piping and Equipment" for equipment labels and warning signs and labels.

3.5 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

B. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. After installing air terminal units and after electrical circuitry has been energized, test for compliance with requirements.
2. Leak Test: After installation, fill water coils and test for leaks. Repair leaks and retest until no leaks exist.
3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.

4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Air terminal unit will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

3.6 STARTUP SERVICE

A. Perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.
2. Verify that inlet duct connections are as recommended by air terminal unit manufacturer to achieve proper performance.
3. Verify that controls and control enclosure are accessible.
4. Verify that control connections are complete.
5. Verify that nameplate and identification tag are visible.
6. Verify that controls respond to inputs as specified.

3.7 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain air terminal units.

END OF SECTION 23 36 00

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes packaged, air-cooled chillers.

1.2 DEFINITIONS

A. COP: Coefficient of performance. The ratio of the rate of heat removal to the rate of energy input using consistent units for any given set of rating conditions.

B. DDC: Direct digital control.

C. EER: Energy-efficiency ratio. The ratio of the cooling capacity given in terms of Btu/h to the total power input given in terms of watts at any given set of rating conditions.

D. IPLV: Integrated part-load value. A single-number part-load efficiency figure of merit calculated per the method defined by AHRI 550/590 and referenced to AHRI standard rating conditions.

E. kW/Ton: The ratio of total power input of the chiller in kilowatts to the net refrigerating capacity in tons at any given set of rating conditions.

F. NPLV: Nonstandard part-load value. A single-number part-load efficiency figure of merit calculated per the method defined by AHRI 550/590 and intended for operating conditions other than AHRI standard rating conditions.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings:

1. Include plans, elevations, sections, and attachment details.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include diagrams for power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Floor plans, drawn to scale, and coordinated with each other, using input from installers of the items involved.

B. Seismic Qualification Data: Certificates, for chillers, accessories, and components, from manufacturer.

C. Source quality-control reports.

D. Field Test Reports: Startup service reports.

E. Sample warranty.

1.5 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.6 QUALITY ASSURANCE

A. AHRI Certification: Certify chiller according to AHRI 590 certification program(s).

B. AHRI Rating: Rate chiller performance according to requirements in AHRI 550/590.

C. ASHRAE Compliance:

1. ASHRAE 15 for safety code for mechanical refrigeration.
2. ASHRAE 147 for refrigerant leaks, recovery, and handling and storage requirements.

D. ASHRAE/IES 90.1 Compliance: Applicable requirements in ASHRAE/IES 90.1.

E. ASME Compliance: Fabricate and label chiller to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1, and include an ASME U-stamp and nameplate certifying compliance.

F. Comply with NFPA 70.

G. Comply with requirements of UL and UL Canada and include label by a qualified testing agency showing compliance.

1.7 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of chillers that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Three years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Site Altitude: Chiller shall be suitable for altitude in which installed without affecting performance indicated. Make adjustments to affected chiller components to account for site altitude.

2.2 PACKAGED, AIR-COOLED CHILLERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Carrier Corporation; a unit of United Technologies Corp.
2. Daikin Applied.
3. Trane.

B. Description: Factory-assembled and run-tested chiller complete with base and frame, condenser casing, compressors, compressor motors and motor controllers, evaporator, condenser coils, condenser fans and motors, electrical power, controls, and accessories.

C. Fabricate base, frame, and attachment to chiller components strong enough to resist chiller movement during a seismic event when chiller base is anchored to field support structure.

D. Cabinet:

1. Base: Galvanized-steel base extending the perimeter of chiller. Secure frame, compressors, and evaporator to base to provide a single-piece unit.
2. Frame: Rigid galvanized-steel frame secured to base and designed to support cabinet, condenser, control panel, and other chiller components not directly supported by base.
3. Casing: Galvanized steel.

E. Compressors:

1. Description: Positive displacement, hermetically sealed.
2. Casing: Cast iron, precision machined for minimum clearance about periphery of rotors.
3. Rotors: Manufacturer's standard one- or two-rotor design.
4. Each compressor provided with suction and discharge shutoff valves, and suction strainer.

F. Service: Easily accessible for inspection and service.

G. Capacity Control: On-off compressor cycling and modulating slide-valve assembly or port unloaders combined with hot-gas bypass, if necessary, to achieve performance indicated.

1. Maintain stable operation throughout range of operation. Configure to achieve most energy-efficient operation possible.
2. Operating Range: From 100 to zero percent of design capacity.
3. Condenser-Air Unloading Requirements over Operating Range: Drop-in, entering condenser-air temperature of 5 deg F drop for each 10 percent in capacity reduction.

H. Oil Lubrication System: Consisting of pump if required, filtration, heater, cooler, factory-wired power connection, and controls.

1. Provide lubrication to bearings, gears, and other rotating surfaces at all operating, startup, shutdown, and standby conditions including power failure.
2. Thermostatically controlled oil heater properly sized to remove refrigerant from oil.
3. Factory-installed and pressure-tested piping with isolation valves and accessories.
4. Oil compatible with refrigerant and chiller components.
5. Positive visual indication of oil level.

I. Vibration Control:

1. Vibration Balance: Balance chiller compressors and drive assemblies to provide a precision balance that is free of noticeable vibration over the entire operating range.

    a. Overspeed Test: 25 percent above design operating speed.

2. Isolation: Mount individual compressors on vibration isolators.

J. Compressor Motors:

1. Hermetically sealed and cooled by refrigerant suction gas.
2. High-torque, induction type with inherent thermal-overload protection on each phase.

K. Compressor Motor Controllers:

1. Across the Line: NEMA ICS 2, Class A, full voltage, nonreversing.
2. Star-Delta, Reduced-Voltage Controller: NEMA ICS 2, closed transition.
3. Solid-state controller.
4. Variable-Frequency Controller:

    a. Motor controller shall be factory mounted and wired on the chiller to provide a single-point, field-power termination to the chiller and its auxiliaries.
    b. Description: NEMA ICS 2; listed and labeled as a complete unit and arranged to provide variable speed by adjusting output voltage and frequency.
    c. Enclosure: Unit mounted, NEMA 250, Type 3R, with hinged full-front access door with lock and key.
    d. Integral Disconnecting Means: Door-interlocked, UL 489, instantaneous-trip circuit breaker with lockable handle. Minimum withstand rating shall be as required by electrical power distribution system, but not less than 65,000 A.
    e. Technology: Pulse-width-modulated output suitable for constant or variable torque loads.
    f. Motor current at start shall not exceed the rated load amperes, providing no electrical inrush.

L. Refrigerant Circuits:

1. Refrigerant: Type as indicated on Drawings.
2. Refrigerant Type: R410A. Classified as Safety Group A1 according to ASHRAE 34.
3. Refrigerant Compatibility: Chiller parts exposed to refrigerants shall be fully compatible with refrigerants, and pressure components shall be rated for refrigerant pressures.
4. Refrigerant Circuit: Each shall include a thermal- or electronic-expansion valve, refrigerant charging connections, a hot-gas muffler, compressor suction and discharge shutoff valves, a liquid-line shutoff valve, a replaceable-core filter-dryer, a sight glass with moisture indicator, a liquid-line solenoid valve, and an insulated suction line.
5. Pressure Relief Device:

    a. Comply with requirements in ASHRAE 15 and in applicable portions of ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
    b. ASME-rated, spring-loaded pressure relief valve; single- or multiple-reseating type.

M. Evaporator:

1. Description: Shell-and-tube design.

    a. Direct-expansion type with fluid flowing through the shell, and refrigerant flowing through the tubes within the shell.
    b. Flooded type with fluid flowing through tubes and refrigerant flowing around tubes within the shell.

2. Code Compliance: Tested and stamped according to ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
3. Shell Material: Carbon steel.
4. Shell Heads: Removable carbon-steel heads located at each end of the tube bundle.
5. Fluid Nozzles: Terminated with flanged end connections for connection to field piping.
6. Tube Construction: Individually replaceable copper tubes with enhanced fin design, expanded into tube sheets.

N. Air-Cooled Condenser:

1. Plate-fin coil with integral subcooling on each circuit, rated at 450 psig.

    a. Construct coil casing of stainless steel.
    b. Construct coils of copper tubes mechanically bonded to aluminum fins.
    c. Coat coils with a corrosion-resistant coating after fabrication.
    d. Hail Protection: Provide condenser coils with louvers, baffles, or hoods to protect against hail damage.

2. Fans: Direct-drive propeller type with statically and dynamically balanced fan blades, arranged for vertical air discharge.
3. Fan Motors: Totally enclosed nonventilating or totally enclosed air over enclosure, with permanently lubricated bearings. Equip each motor with overload protection integral to either the motor or chiller controls.
4. Fan Guards: Steel safety guards with PVC.

O. Corrosion-Resistant Coating: Apply a corrosion-resistant coating capable of withstanding a 3,000 hour salt-spray test according to ASTM B 117 to base, frame, and casing.

1. Standards:

    a. ASTM B-117 for salt spray.
    b. ASTM D-2794 for minimum impact resistance of 100 in-lb
    c. ASTM B-3359 for cross-hatch adhesion of 5B.

2. Application: Spray.
3. Thickness: 1 mil.
4. Gloss: Minimum of 50 gloss units on a single-angle, 60-degree meter.
5. UV Protection: Spray-applied topcoat.

P. Electrical Power:

1. Factory-installed and -wired switches, motor controllers, transformers, and other electrical devices necessary shall provide a single-point, field-power connection to chiller.
2. House in a unit-mounted, NEMA 250, Type 3R enclosure with hinged access door with lock and key or padlock and key.
3. Wiring shall be numbered and color-coded to match wiring diagram.
4. Install factory wiring outside of an enclosure in a raceway.

5. Provide branch power circuit to each motor and to controls with one of the following disconnecting means:

    a. NEMA KS 1, heavy-duty, fusible switch with rejection-type fuse clips rated for fuses. Select and size fuses to provide Type 2 protection according to IEC 60947-4-1.
    b. UL 489, motor-circuit protector (circuit breaker) with field-adjustable, short-circuit-trip set point.

6. Provide each motor with overcurrent protection.
7. Overload relay sized according to UL 1995 or an integral component of chiller control microprocessor.
8. Phase-Failure and Undervoltage Relays: Solid-state sensing with adjustable settings.
9. Provide power factor correction capacitors to correct power factor to 0.90 at full load.
10. Control Transformer: Unit-mounted transformer with primary and secondary fuses and sized with enough capacity to operate electrical load plus spare capacity.

    a. Power unit-mounted controls where indicated.
    b. Power unit-mounted, ground fault interrupt duplex receptacle.

11. Control Relays: Auxiliary and adjustable time-delay relays.
12. For chiller electrical power supply, indicate the following:

    a. Current and phase to phase for all three phases.
    b. Voltage, phase to phase, and phase to neutral for all three phases.
    c. Three-phase real power (kilowatts).
    d. Three-phase reactive power (kilovolt amperes reactive).
    e. Power factor.
    f. Running log of total power versus time (kilowatt-hours).
    g. Fault log, with time and date of each.

Q. Controls:

1. Standalone and microprocessor based.
2. Enclosure: Share enclosure with electrical power devices or provide a separate enclosure.
3. Operator Interface: Multiple-character digital or graphic display with dynamic update of information and with keypad or touch-sensitive display located on front of control enclosure. In either imperial or metric units, display the following information:

    a. Date and time.
    b. Operating or alarm status.
    c. Operating hours.
    d. Outdoor-air temperature if required for chilled-water reset.
    e. Temperature and pressure of operating set points.

f. Entering and leaving temperatures of chilled water.
g. Refrigerant pressures in evaporator and condenser.
h. Saturation temperature in evaporator and condenser.
i. No cooling load condition.
j. Elapsed time meter (compressor run status).
k. Pump status.
l. Antirecycling timer status.
m. Percent of maximum motor amperage.
n. Current-limit set point.
o. Number of compressor starts.

4. Control Functions:

a. Manual or automatic startup and shutdown time schedule.
b. Entering and leaving chilled-water temperatures, control set points, and motor load limits. Chilled-water leaving temperature shall be reset based on space temperature.
c. Current limit and demand limit.
d. External chiller emergency stop.
e. Antirecycling timer.
f. Automatic lead-lag switching.
g. Variable evaporator flow.
h. Thermal storage.

5. Manually Reset Safety Controls: The following conditions shall shut down chiller and require manual reset:

a. Low evaporator pressure or high condenser pressure.
b. Low chilled-water temperature.
c. Refrigerant high pressure.
d. High or low oil pressure.
e. High oil temperature.
f. Loss of chilled-water flow.
g. Control device failure.

6. Trending: Capability to trend analog data of up to five parameters simultaneously over an adjustable period and frequency of polling.
7. Security Access: Provide electronic security access to controls through identification and password with at least three levels of access: view only; view and operate; and view, operate, and service.
8. Control Authority: At least four conditions: Off, local manual control at chiller, local automatic control at chiller, and automatic control through a remote source.
9. Interface with DDC System for HVAC: Factory-installed hardware and software to enable the DDC system for HVAC to monitor, control, and display chiller status and alarms.

a. ASHRAE 135 communication interface with the DDC system for HVAC shall enable the DDC system for HVAC operator to remotely control and monitor the chiller from an operator workstation. Control features and monitoring points displayed locally at chiller control panel shall be available through the DDC system for HVAC.

R. Insulation: Closed-cell, flexible elastomeric, thermal insulation complying with ASTM C 534, Type I for tubular materials and Type II for sheet materials.

S. Accessories:

1. Factory-furnished, chilled-water flow switches for field installation.
2. Individual compressor suction and discharge pressure gages with shutoff valves for each refrigerant circuit.
3. Factory-furnished neoprene isolators for field installation.

T. Capacities and Characteristics: See schedule in drawings.

2.3 SOURCE QUALITY CONTROL

A. Perform functional tests of chillers before shipping.

B. Factory run test each air-cooled chiller with water flowing through evaporator.

C. Factory performance test air-cooled chillers, before shipping, according to AHRI 550/590.

1. Test the following conditions:

a. Design conditions indicated.
b. Reduction in capacity from design to minimum load in steps of 10 with condenser air at design conditions.
c. At five point(s) of varying part-load performance to be selected by Owner at time of test.

2. Prepare test report indicating test procedures, instrumentation, test conditions, and results. Submit copy of results within one week of test date.

D. Factory sound test air-cooled chillers, before shipping, according to AHRI 370.

1. Test the following conditions:

a. Design conditions indicated.
b. Chiller operating at calculated worst-case sound condition.
c. At five point(s) of varying part-load performance to be selected by Owner at time of test.

2. Prepare test report indicating test procedures, instrumentation, test conditions, and results. Submit copy of results within one week of test date.

E. Factory test and inspect evaporator and condenser according to ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

F. For chillers located outdoors, rate sound power level according to AHRI 370.

PART 3 - EXECUTION

3.1 CHILLER INSTALLATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases.

B. Coordinate sizes, locations, and anchoring attachments of structural-steel support structures.

C. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

D. Install chillers on support structure indicated.

E. Equipment Mounting:

1. Install chillers on cast-in-place concrete equipment bases. Comply with requirements for equipment bases and foundations specified in Section 033000 "Cast-in-Place Concrete."

F. Maintain manufacturer's recommended clearances for service and maintenance.

G. Charge chiller with refrigerant and fill with oil if not factory installed.

H. Install separate devices furnished by manufacturer and not factory installed.

3.2 CONNECTIONS

A. Comply with requirements for piping specified in Section 232113 "Hydronic Piping," Section 232116 Hydronic Piping Specialties," Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to chiller to allow service and maintenance.

C. Evaporator Fluid Connections: Connect to evaporator inlet with shutoff valve, flexible connector, thermometer, and plugged tee with pressure gage. Connect to evaporator outlet with shutoff valve, balancing valve, flexible connector, flow switch, thermometer, plugged tee with shutoff valve and pressure gage, flow meter, and drain connection with valve. Make connections to chiller with a flange.

D. Condenser Fluid Connections: Connect to condenser inlet with shutoff valve, flexible connector, thermometer, and plugged tee with pressure gage. Connect to condenser outlet with shutoff valve, balancing valve, flexible connector, flow switch, thermometer, plugged tee with shutoff valve and pressure gage, flow meter, and drain connection with valve. Make connections to chiller with a flange.

E. Connect each chiller drain connection with a union and drain pipe, and extend pipe, full size of connection, to floor drain. Provide a shutoff valve at each connection.

3.3 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.
2. Verify that refrigerant charge is sufficient and chiller has been leak tested.
3. Verify that pumps are installed and functional.
4. Verify that thermometers and gages are installed.
5. Operate chiller for run-in period.
6. Check bearing lubrication and oil levels.
7. For chillers installed indoors, verify that refrigerant pressure relief device is vented outdoors.
8. Verify proper motor rotation.
9. Verify static deflection of vibration isolators, including deflection during chiller startup and shutdown.
10. Verify and record performance of fluid flow and low-temperature interlocks for evaporator and condenser.
11. Verify and record performance of chiller protection devices.
12. Test and adjust controls and safeties. Replace damaged or malfunctioning controls and equipment.

B. Inspect field-assembled components, equipment installation, and piping and electrical connections for proper assembly, installation, and connection.

C. Prepare test and inspection startup reports.

3.4 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain chillers.

END OF SECTION 23 64 26.21

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Single-zone air-handling units.

1.2 ACTION SUBMITTALS

A. Product Data: For each air-handling unit indicated.

1. Unit dimensions and weight.
2. Cabinet material, metal thickness, finishes, insulation, and accessories.
3. Fans:

a. Certified fan-performance curves with system operating conditions indicated.
b. Certified fan-sound power ratings.
c. Fan construction and accessories.
d. Motor ratings, electrical characteristics, and motor accessories.

4. Certified coil-performance ratings with system operating conditions indicated.
5. Filters with performance characteristics.

B. Delegated-Design Submittal: For vibration isolation 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. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.
2. Design Calculations: Calculate requirements for selecting vibration isolators and for designing vibration isolation bases.

1.3 INFORMATIONAL SUBMITTALS

A. Seismic Qualification Data: Certificates, for air-handling units, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

B. Source quality-control reports.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.5 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. NFPA Compliance: Comply with NFPA 90A for design, fabrication, and installation of air-handling units and components.

C. AHRI Certification: Air-handling units and their components shall be factory tested according to AHRI 430, "Performance Rating of Central-Station Air-Handling Unit Supply Fans," and shall be listed and labeled by AHRI.

D. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."

E. ASHRAE/IES 90.1 Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."

F. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design vibration isolation and seismic-restraint details, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

2.2 AIR HANDLING UNIT MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Carrier Corporation; a unit of United Technologies Corp.
2. Trane.

2.3 UNIT CASINGS

A. General Fabrication Requirements for Casings:

1. Forming: Form walls, roofs, and floors with at least two breaks at each joint.
2. Casing Joints: Sheet metal screws or pop rivets.
3. Sealing: Seal all joints with water-resistant sealant.
4. Factory Finish for Steel and Galvanized-Steel Casings: Apply manufacturer's standard primer immediately after cleaning and pretreating.
5. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

B. Casing Insulation and Adhesive:

1. Materials: ASTM C 1071, Type I.
2. Location and Application: Factory applied with adhesive and mechanical fasteners to the internal surface of section panels downstream from, and including, the cooling-coil section.

    a. Liner Adhesive: Comply with ASTM C 916, Type I.
    b. Mechanical Fasteners: Galvanized steel, suitable for adhesive attachment, mechanical attachment, or welding attachment to duct without damaging liner when applied as recommended by manufacturer and without causing leakage in cabinet.
    c. Liner materials applied in this location shall have air-stream surface coated with a temperature-resistant coating or faced with a plain or coated fibrous mat or fabric depending on service-air velocity.

3. Location and Application: Encased between outside and inside casing.

C. Inspection and Access Panels and Access Doors:

1. Panel and Door Fabrication: Formed and reinforced, single- or double-wall and insulated panels of same materials and thicknesses as casing.
2. Inspection and Access Panels:

    a. Fasteners: Two or more camlock type for panel lift-out operation. Arrangement shall allow panels to be opened against air-pressure differential.
    b. Gasket: Neoprene, applied around entire perimeters of panel frames.
    c. Size: Large enough to allow inspection and maintenance of air-handling unit's internal components.

3. Access Doors:

    a. Hinges: A minimum of two ball-bearing hinges or stainless-steel piano hinge and two wedge-lever-type latches, operable from inside and outside. Arrange doors to be opened against air-pressure differential.
    b. Gasket: Neoprene, applied around entire perimeters of panel frames.
    c. Fabricate windows in fan section doors of double-glazed, wire-reinforced safety glass with an air space between panes and sealed with interior and exterior rubber seals.
    d. Size: At least 18 inches wide by full height of unit casing up to a maximum height of 60 inches.

4. Locations and Applications:

    a. Fan Section: Doors.
    b. Access Section: Doors.

c. Coil Section: Inspection and access panel.
d. Damper Section: Inspection and access panels.
e. Filter Section: Inspection and access panels large enough to allow periodic removal and installation of filters.
f. Mixing Section: Doors.
g. Humidifier Section: Doors.

5. Service Light: 100-W vapor proof fixture with switched junction box located inside adjacent to door.

a. Locations: Each section accessed with door.

D. Condensate Drain Pans:

1. Fabricated with two percent slope in at least two planes to collect condensate from cooling coils (including coil piping connections, coil headers, and return bends) and from humidifiers and to direct water toward drain connection.

a. Length: Extend drain pan downstream from leaving face to comply with ASHRAE 62.1.
b. Depth: A minimum of 2 inches deep.

2. Integral part of floor plating.
3. Single-wall, galvanized-steel sheet.
4. Drain Connection: Located at lowest point of pan and sized to prevent overflow. Terminate with threaded nipple on one end of pan.

a. Minimum Connection Size: NPS 2.

5. Pan-Top Surface Coating: Asphaltic waterproofing compound.
6. Units with stacked coils shall have an intermediate drain pan to collect condensate from top coil.

E. Service Platform: Galvanized steel 42 inches wide running entire length of unit and located on service access side, with angle side rails, 4-inch kick plates, and expanded metal floor. Provide platform with a fixed ladder that extends from the top of the side rail to the floor.

F. Air-Handling-Unit Mounting Frame: Formed galvanized-steel channel or structural channel supports, designed for low deflection, welded with integral lifting lugs.

1. Seismic Fabrication Requirements: Fabricate mounting base and attachment to air-handling unit sections, accessories, and components with reinforcement strong enough to withstand seismic forces defined in Section 230548 "Vibration and Seismic Controls for HVAC" when air-handling unit frame is anchored to building structure.

2.4 FAN, DRIVE, AND MOTOR SECTION

A. Fan and Drive Assemblies: Statically and dynamically balanced and designed for continuous operation at maximum-rated fan speed and motor horsepower.

1. Shafts: Designed for continuous operation at maximum-rated fan speed and motor horsepower, and with field-adjustable alignment.

a. Turned, ground, and polished hot-rolled steel with keyway. Ship with a protective coating of lubricating oil.
b. Designed to operate at no more than 70 percent of first critical speed at top of fan's speed range.

B. Centrifugal Fan Housings: Formed- and reinforced-steel panels to form curved scroll housings with shaped cutoff and spun-metal inlet bell.

1. Bracing: Steel angle or channel supports for mounting and supporting fan scroll, wheel, motor, and accessories.
2. Horizontal-Flanged, Split Housing: Bolted construction.
3. Housing for Supply Fan: Attach housing to fan-section casing with metal-edged flexible duct connector.
4. Flexible Connector: Factory fabricated with a fabric strip 3-1/2 inches wide attached to 2 strips of 2-3/4-inch-wide, 0.028-inch-thick, galvanized-steel sheet or 0.032-inch-thick aluminum sheets; select metal compatible with casing.

a. Flexible Connector Fabric: Glass fabric, double coated with neoprene. Fabrics, coatings, and adhesives shall comply with UL 181, Class 1.

1) Fabric Minimum Weight: 26 oz./sq. yd..
2) Fabric Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.
3) Fabric Service Temperature: Minus 40 to plus 200 deg F.

C. Plenum Fan Housings: Steel frame and panel; fabricated without fan scroll and volute housing.

D. Backward-Inclined, Centrifugal Fan Wheels: Single-width-single-inlet and double-width-double-inlet construction with curved inlet flange, backplate, backward-inclined blades welded or riveted to flange and backplate; cast-iron or cast-steel hub riveted to backplate and fastened to shaft with set screws.

E. Forward-Curved, Centrifugal Fan Wheels: Inlet flange, backplate, and shallow blades with inlet and tip curved forward in direction of airflow and mechanically fastened to flange and backplate; cast-steel hub swaged to backplate and fastened to shaft with set screws.

F. Fan Shaft Bearings:

1. Prelubricated and Sealed, Ball Bearings: Self-aligning, pillow-block type with a rated life of 50,000 hours according to ABMA 9.
2. Grease-Lubricated, Tapered-Roller Bearings: Self-aligning, pillow-block type with double-locking collars and 2-piece, cast-iron housing with grease lines extended to outside unit and a rated life of 50,000 hours according to ABMA 11.
3. Grease-Lubricated Bearings: Self-aligning, pillow-block-type, ball or roller bearings with adapter mount and two-piece, cast-iron housing with grease lines extended to outside unit.

G. Belt Drives: Factory mounted, with adjustable alignment and belt tensioning, and with 1.2 service factor based on fan motor.

1. Pulleys: Cast iron or cast steel with split, tapered bushing; dynamically balanced at factory.
2. Motor Pulleys: Adjustable pitch for use with 5-hp motors and smaller; fixed pitch for use with motors larger than 5 hp. Select pulley size so pitch adjustment is at the middle of adjustment range at fan design conditions.

3. Belts: Oil resistant, nonsparking, and nonstatic; in matched sets for multiple-belt drives.
4. Belt Guards: Comply with requirements specified by OSHA and fabricate according to SMACNA's "HVAC Duct Construction Standards"; 0.1046-inch-thick, 3/4-inch diamond-mesh wire screen, welded to steel angle frame; prime coated.

H. Internal Vibration Isolation: Fans shall be factory mounted with manufacturer's standard vibration isolation mounting devices having a minimum static deflection of 1 inch.

2.5 COIL SECTION

A. General Requirements for Coil Section:

1. Comply with AHRI 410.
2. Fabricate coil section to allow removal and replacement of coil for maintenance and to allow in-place access for service and maintenance of coil(s).
3. For multizone units, provide air deflectors and air baffles to balance airflow across coils.
4. Coils shall not act as structural component of unit.
5. Corrosion-Resistant Coating: Coat coils with a corrosion-resistant coating capable of withstanding a 3,000-hour salt-spray test according to ASTM B 117.

    a. Standards:

        1) ASTM B-117 for salt spray.
        2) ASTM D-2794 for minimum impact resistance of 100 in-lb
        3) ASTM B-3359 for cross-hatch adhesion of 5B.

    b. Application: Spray.
    c. Thickness: 1 mil.
    d. Gloss: Minimum gloss of 50 gloss units on a single-angle 60-degree meter.
    e. UV Protection: Spray-applied topcoat.

B. Electrical Heating Coils, Controls, and Accessories: Comply with UL 1995.

1. Casing Assembly: Slip-in type with galvanized-steel frame.
2. Sheathed Heating Elements: Coiled resistance wire of 80 percent nickel and 20 percent chromium surrounded by compacted magnesium-oxide powder in tubular-steel sheath; with spiral-wound, copper-plated, steel fins continuously brazed to sheath.
3. Open Heating Elements: Resistance wire of 80 percent nickel and 20 percent chromium supported and insulated by floating ceramic bushings recessed into casing openings, fastened to supporting brackets, and mounted in galvanized-steel frame.
4. Overtemperature Protection: Disk-type, automatically resetting, thermal-cutout, safety device; serviceable through terminal box without removing heater from coil section.
5. Secondary Protection: Load-carrying, manually resetting or manually replaceable, thermal cutouts; factory wired in series with each heater stage.
6. Control Panel: Remote mounted with disconnecting means and overcurrent protection.

    a. Magnetic Mercury contactor.
    b. Solid-state, stepless pulse controller.
    c. Toggle switches, one per step.
    d. Step controller.

e. Time-delay relay.
f. Pilot lights, one per step.
g. Airflow proving switch.

2.6 AIR FILTRATION SECTION

A. General Requirements for Air Filtration Section:

1. Comply with NFPA 90A.
2. Provide minimum arrestance according to ASHRAE 52.1, and a minimum efficiency reporting value (MERV) according to ASHRAE 52.2.
3. Provide filter holding frames arranged for flat or angular orientation, with access doors on both sides of unit. Filters shall be removable from one side or lifted out from access plenum.

B. Disposable Panel Filters:

1. Factory-fabricated, viscous-coated, flat-panel type.
2. Thickness: 2 inches.
3. Arrestance (ASHRAE 52.1): 80.
4. MERV (ASHRAE 52.2): 13.
5. Media: Interlaced glass fibers sprayed with nonflammable adhesive and antimicrobial agent.
6. Frame: Galvanized steel, with metal grid on outlet side, steel rod grid on inlet side, hinged, and with pull and retaining handles.

C. Filter Gage:

1. 2-inch diameter, diaphragm-actuated dial in metal case.
2. Vent valves.
3. Black figures on white background.
4. Front recalibration adjustment.
5. 3 percent of full-scale accuracy.
6. Accessories: Static-pressure tips with integral compression fittings, 1/4-inch aluminum tubing, and 2- or 3-way vent valves.

2.7 CAPACITIES AND CHARACTERISTICS

A. See schedule in drawings:

2.8 SOURCE QUALITY CONTROL

A. Fan Sound-Power Level Ratings: Comply with AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Fans shall bear AMCA-certified sound ratings seal.

B. Fan Performance Rating: Factory test fan performance for airflow, pressure, power, air density, rotation speed, and efficiency. Rate performance according to AMCA 210, "Laboratory Methods of Testing Fans for Aerodynamic Performance Rating."

C. Water Coils: Factory tested to 300 psig according to AHRI 410 and ASHRAE 33.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Arrange installation of units to provide access space around air-handling units for service and maintenance.

B. Do not operate fan system until filters (temporary or permanent) are in place. Replace temporary filters used during construction and testing, with new, clean filters.

C. Install filter-gage, static-pressure taps upstream and downstream of filters. Mount filter gages on outside of filter housing or filter plenum in accessible position. Provide filter gages on filter banks, installed with separate static-pressure taps upstream and downstream of filters.

D. Comply with requirements for piping specified in other Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

E. Install piping adjacent to air-handling unit to allow service and maintenance.

F. Connect piping to air-handling units mounted on vibration isolators with flexible connectors.

G. Connect condensate drain pans using NPS 1-1/4, ASTM B 88, Type M copper tubing. Extend to nearest equipment or floor drain. Construct deep trap at connection to drain pan and install cleanouts at changes in direction.

H. Hot- and Chilled-Water Piping: Comply with applicable requirements in Section 232113 "Hydronic Piping" and Section 232116 "Hydronic Piping Specialties." Install shutoff valve and union or flange at each coil supply connection. Install balancing valve and union or flange at each coil return connection.

I. Refrigerant Piping: Comply with applicable requirements in Section 232300 "Refrigerant Piping." Install shutoff valve and union or flange at each supply and return connection.

J. Connect duct to air-handling units with flexible connections. Comply with requirements in Section 233300 "Air Duct Accessories."

END OF SECTION 23 73 13

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Electrical contractor to provide:
   1. Building wires and cables rated 600 V and less.
   2. Connectors, splices, and terminations rated 600 V and less.

1.2 RELATED DOCUMENTS

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

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

B. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of NETA or an NRTL.

   1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   1. Alpha Wire Company.
   2. Belden Inc.
   3. Cerro Wire LLC.
   4. Cooper Industries, Inc.
   5. Encore Wire Corporation.
   6. General Cable Technologies Corporation.
   7. General Cable; General Cable Corporation.
   8. Senator Wire & Cable Company.

9. Service Wire Co.
10. Southwire Company.
11. Thomas & Betts Corporation, A Member of the ABB Group.

B. Copper Conductors: Comply with NEMA WC 70/ICEA S-95-658.

C. Conductor Insulation: Comply with NEMA WC 70/ICEA S-95-658 for Type THHN/THWN-2.

2.2 CONNECTORS AND SPLICES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. 3M.
2. AFC Cable Systems; a part of Atkore International.
3. Gardner Bender.
4. Hubbell Power Systems, Inc.
5. Ideal Industries, Inc.
6. ILSCO.
7. NSi Industries LLC.
8. O-Z/Gedney; a brand of Emerson Industrial Automation.
9. Tyco Electronics Corp.

B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

2.3 SYSTEM DESCRIPTION

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 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. 12 AWG and smaller; stranded for No. 10 AWG and larger, which shall be extra flexible stranded.

3.2 CONDUCTOR INSULATION AND WIRING METHODS

A. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspaces: Type THHN/THWN-2, single conductors in raceway.

B. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN/THWN-2, single conductors in raceway.

C. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN/THWN-2, single conductors in raceway.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

A. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.

B. Complete raceway installation between conductor and cable termination points according to Section 260533 "Raceways and Boxes for Electrical Systems" prior to pulling conductors and cables.

C. 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.

D. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips that will not damage cables or raceway.

E. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

F. Support cables according to Section 260529 "Hangers and Supports for Electrical Systems."

3.4 CONNECTIONS

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.

B. Make splices, terminations, 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, termination, and tap for aluminum conductors.

C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches of slack.

3.5 IDENTIFICATION

A. Identify and color-code conductors and cables according to Section 260553 "Identification for Electrical Systems."

B. Identify each spare conductor at each end with identity number and location of other end of conductor, and identify as spare conductor.

3.6 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.7 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Section 078413 "Penetration Firestopping."

B. Cables will be considered defective if they do not pass tests and inspections.

END OF SECTION 26 05 19

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Electrical contractor to provide:
   1. Equipment grounding conductor.

1.2 RELATED DOCUMENTS

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

1.3 ACTION SUBMITTALS

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

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   1. Burndy; Part of Hubbell Electrical Systems.
   2. Dossert; AFL Telecommunications LLC.
   3. ERICO International Corporation.
   4. Fushi Copperweld Inc.
   5. Galvan Industries, Inc.; Electrical Products Division, LLC.
   6. Harger Lightning & Grounding.
   7. ILSCO.
   8. O-Z/Gedney; a brand of Emerson Industrial Automation.
   9. Robbins Lightning, Inc.
   10. Siemens Power Transmission & Distribution, Inc.
   11. Thomas & Betts Corporation, A Member of the ABB Group.

2.2 SYSTEM DESCRIPTION

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.

2.3 CONDUCTORS

A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.

2.4 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.

C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

D. Bus-Bar Connectors: Mechanical type, cast silicon bronze, solderless compression type wire terminals, and long-barrel, two-bolt connection to ground bus bar.

2.5 EQUIPMENT GROUNDING

A. Install insulated equipment grounding conductors with all feeders and branch circuits.

B. 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.

C. 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.

2.6 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

END OF SECTION 26 05 26

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Electrical contractor to provide:
   1. Hangers and supports for electrical equipment and systems.

1.2 RELATED DOCUMENTS

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

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for the following:

      a. Hangers.
      b. Steel slotted support systems.
      c. Trapeze hangers.
      d. Clamps.
      e. Sockets.
      f. Eye nuts.
      g. Saddles.
      h. Brackets.

   2. Include rated capacities and furnished specialties and accessories.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

   1. Suspended ceiling components.
   2. Structural members to which hangers and supports will be attached.
   3. Size and location of initial access modules for acoustical tile.
   4. Items penetrating finished ceiling, including the following:

      a. Lighting fixtures.
      b. Air outlets and inlets.
      c. Speakers.
      d. Sprinklers.
      e. Access panels.
      f. Projectors.

B. Seismic Qualification Certificates: For hangers and supports for electrical equipment and systems, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

C. Welding certificates.

1.5 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M.

B. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M.
2. AWS D1.2/D1.2M.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Hangers and supports shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. The term "withstand" means "the supported equipment and systems will remain in place without separation of any parts when subjected to the seismic forces specified and the system will be fully operational after the seismic event."
2. Component Importance Factor: 1.5.

B. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame Rating: Class 1.
2. Self-extinguishing according to ASTM D 635.

2.2 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Steel Slotted Support Systems: Comply with MFMA-4 factory-fabricated components for field assembly.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Allied Tube & Conduit; a part of Atkore International.
b. B-line, an Eaton business.
c. ERICO International Corporation.
d. Flex-Strut Inc.
e. GS Metals Corp.
f. G-Strut.
g. Haydon Corporation.

h. Metal Ties Innovation.
i. Thomas & Betts Corporation, A Member of the ABB Group.
j. Unistrut; Part of Atkore International.
k. Wesanco, Inc.

2. Material: Galvanized steel.

3. Channel Width: 1-5/8 inches.
4. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
5. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
6. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
7. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
8. Channel Dimensions: Selected for applicable load criteria.

B. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

C. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for nonarmored 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 made of malleable iron.

D. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M steel plates, shapes, and bars; black and galvanized.

E. 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. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1) Hilti, Inc.
2) ITW Ramset/Red Head; Illinois Tool Works, Inc.
3) MKT Fastening, LLC.
4) Simpson Strong-Tie Co., Inc.

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 where used.

a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1) B-line, an Eaton business.
2) Empire Tool and Manufacturing Co., Inc.

3) Hilti, Inc.
4) ITW Ramset/Red Head; Illinois Tool Works, Inc.
5) MKT Fastening, LLC.

3. Concrete Inserts: Steel or malleable-iron, slotted support system units are similar to MSS Type 18 units and comply with MFMA-4 or MSS SP-58.

4. Clamps for Attachment to Steel Structural Elements: MSS SP-58 units are 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.

2.3 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 Section 055000 "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 unless requirements in this Section are stricter.

B. Comply with requirements for raceways and boxes specified in Section 260533 "Raceways and Boxes for Electrical Systems."

C. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMTs, IMCs, and RMCs as required by NFPA 70. Minimum rod size shall be 1/4 inch in diameter.

D. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted or other 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 two-bolt conduit clamps.

E. 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, EMTs, IMCs, and RMCs may be supported by openings through structure members, according to 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 (MSS SP-58, Type 19, 21, 23, 25, or 27), complying with MSS SP-69.
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 comply with seismic-restraint strength and anchorage requirements].

E. Drill holes for expansion anchors in concrete at locations and to depths that avoid the need for reinforcing bars.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

A. Comply with installation requirements in Section 055000 "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 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 Section 099123 "Interior Painting" 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 26 05 29

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Metal conduits and fittings.
2. Boxes, enclosures, and cabinets.

1.2 RELATED DOCUMENTS

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

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Conduit routing plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of items involved:

1. Structural members in paths of conduit groups with common supports.
2. HVAC and plumbing items and architectural features in paths of conduit groups with common supports.

B. Seismic Qualification Data: Certificates, for enclosures, cabinets, and conduit racks and their mounting provisions, including those for internal components, from manufacturer.

PART 2 - PRODUCTS

2.1 METAL CONDUITS AND FITTINGS

A. Metal Conduit:

1. Listing and Labeling: Metal conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2. GRC: Comply with ANSI C80.1 and UL 6.
3. ARC: Comply with ANSI C80.5 and UL 6A.
4. IMC: Comply with ANSI C80.6 and UL 1242.

    a. Comply with NEMA RN 1.

b. Coating Thickness: 0.040 inch, minimum.

5. EMT: Comply with ANSI C80.3 and UL 797.
6. FMC: Comply with UL 1; zinc-coated steel.
7. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.

B. Conduit Color

1. Manufacturers: Setmark Semi-rigid plastic identification markers or equal.
2. Spacing: 20 feet on center.
3. Identify all conduit using coded identifying bands.
   a. Spacing:

      1) Minimum every 20'.
      2) Within 1' of each junction box.

4. For 208/120V:

   a. A-Phase – Black.
   b. B-Phase – Red.
   c. C-Phase – Blue.
   d. Neutral – White.

5. For 277/408V:

   a. A-Phase – Brown.
   b. B-Phase – Orange.
   c. C-Phase – Yellow.
   d. Neutral – Gray.

6. Conductor colors shall apply to all conductor sizes and apply to entire insulation. No exceptions for larger cables. Identifying colored tape shall not be allowed. Other colors allowed for branch circuits and switch leg conductors.
7. Fire Alarm System: Red

C. Metal Fittings: Comply with NEMA FB 1 and UL 514B.

1. Listing and Labeling: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Fittings, General: Listed and labeled for type of conduit, location, and use.
3. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 1203 and NFPA 70.
4. Fittings for EMT:

   a. Material: Steel.
   b. Type: Compression.

D. Joint Compound for IMC, GRC, or ARC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.2 BOXES, ENCLOSURES, AND CABINETS

A. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.

B. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.

C. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.

D. Metal Floor Boxes:

1. Material: Cast metal.
2. Type: Fully adjustable.
3. Shape: Rectangular.
4. Listing and Labeling: Metal floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

E. Luminaire Outlet Boxes: Nonadjustable, designed for attachment of luminaire weighing 50 lb. Outlet boxes designed for attachment of luminaires weighing more than 50 lb shall be listed and marked for the maximum allowable weight.

F. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

G. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, cast aluminum with gasketed cover.

H. Box extensions used to accommodate new building finishes shall be of same material as recessed box.

I. Device Box Dimensions: 4 inches square by 2-1/8 inches deep.

J. Gangable boxes are prohibited.

K. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, Type 1 with continuous-hinge cover with flush latch unless otherwise indicated.

1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
2. Nonmetallic Enclosures: Plastic.
3. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.

L. Cabinets:

1. NEMA 250, Type 1 galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
2. Hinged door in front cover with flush latch and concealed hinge.
3. Key latch to match panelboards.
4. Metal barriers to separate wiring of different systems and voltage.
5. Accessory feet where required for freestanding equipment.
6. Nonmetallic cabinets shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

A. Indoors: Apply raceway products as specified below unless otherwise indicated.

1. Exposed, Not Subject to Physical Damage: EMT. (Do not use as surface raceway).
2. Exposed, Not Subject to Severe Physical Damage: EMT. (Do not use as surface raceway).
3. Exposed and Subject to Severe Physical Damage: IMC.
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.

B. Minimum Raceway Size: 3/4-inch trade size.

C. 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. Comply with NEMA FB 2.10.
2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.
3. EMT: Use compression or steel fittings. Comply with NEMA FB 2.10.
4. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.

D. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.

E. Install surface raceways only where indicated on Drawings.

3.2 INSTALLATION

A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for hangers and supports.

B. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum conduits. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.

C. Do not install raceways or electrical items on any "explosion-relief" walls or rotating equipment.

D. Do not fasten conduits onto the bottom side of a metal deck roof.

E. 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.

F. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for hangers and supports.

G. Arrange stub-ups so curved portions of bends are not visible above finished slab.

H. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 12 inches of changes in direction.

I. Make bends in raceway using large-radius preformed ells. Field bending shall be according to NFPA 70 minimum radii requirements. Use only equipment specifically designed for material and size involved.

J. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.

K. Support conduit within 12 inches of enclosures to which attached.

L. 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. Secure raceways to reinforcement at maximum 10-foot intervals.
2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
3. Arrange raceways to keep a minimum of 1 inch.
4. Do not embed threadless fittings in concrete unless specifically approved by Architect for each specific location.

M. Stub-ups to Above Recessed Ceilings:

1. Use EMT, IMC, or RMC for raceways.
2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.

N. Threaded Conduit Joints: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.

O. Coat field-cut threads on PVC-coated raceway with a corrosion-preventing conductive compound prior to assembly.

P. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.

Q. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4-inch trade size and insulated throat metal bushings on 1-1/2-inch trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.

R. 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. Cap underground raceways designated as spare above grade alongside raceways in use.

S. Install raceway sealing fittings at accessible locations according to NFPA 70 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.

T. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all raceways at the following points:

1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
2. Where an underground service raceway enters a building or structure.
3. Conduit extending from interior to exterior of building.
4. Conduit extending into pressurized duct and equipment.
5. Conduit extending into pressurized zones that are automatically controlled to maintain different pressure set points.
6. Where otherwise required by NFPA 70.

U. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 72 inches] of flexible conduit for recessed 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.

V. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to center of box unless otherwise indicated.

W. 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. Prepare block surfaces to provide a flat surface for a raintight connection between the box and cover plate or the supported equipment and box.

X. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.

Y. Locate boxes so that cover or plate will not span different building finishes.

Z. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.

AA. Fasten junction and pull boxes to or support from building structure. Do not support boxes by

3.3 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.4 FIRESTOPPING

A. Install firestopping at penetrations of fire-rated floor and wall assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.5 PROTECTION

A. Protect coatings, finishes, and cabinets from damage and deterioration.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION 26 05 33

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Electrical contractor to provide:
   1. Sleeves for raceway and cable penetration of non-fire-rated construction walls and floors.

1.2 RELATED DOCUMENTS

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

B. Related Requirements:

   1. Section 078413 "Penetration Firestopping" for penetration firestopping installed in fire-resistance-rated walls, horizontal assemblies, and smoke barriers, with and without penetrating items.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 SLEEVES

A. Wall Sleeves:

   1. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, plain ends.
   2. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

B. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies: Galvanized-steel sheet; 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint, with tabs for screw-fastening the sleeve to the board.

C. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.

D. Molded-PVC Sleeves: With nailing flange for attaching to wooden forms.

E. Molded-PE or -PP Sleeves: Removable, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.

F. Sleeves for Rectangular Openings:

1. Material: Galvanized sheet steel.
2. Minimum Metal Thickness:

    a. For sleeve cross-section rectangle perimeter less than 50 inches and with no side larger than 16 inches, thickness shall be 0.052 inch.
    b. For sleeve cross-section rectangle perimeter 50 inches or more and one or more sides larger than 16 inches, thickness shall be 0.138 inch.

2.2 SLEEVE-SEAL SYSTEMS

A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. Advance Products & Systems, Inc.
    b. CALPICO, Inc.
    c. Metraflex Company (The).
    d. Pipeline Seal and Insulator, Inc.
    e. Proco Products, Inc.

2. Sealing Elements: EPDM rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
3. Pressure Plates: Carbon steel.
4. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating of length required to secure pressure plates to sealing elements.

2.3 SLEEVE-SEAL FITTINGS

A. Description: Manufactured plastic, sleeve-type, waterstop assembly made for embedding in concrete slab or wall. Unit shall have plastic or rubber waterstop collar with center opening to match piping OD.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

    a. HOLDRITE.

2.4 GROUT

A. Description: Nonshrink; recommended for interior and exterior sealing openings in non-fire-rated walls or floors.

B. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

C. Design Mix: 5000-psi, 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

2.5 SILICONE SEALANTS

A. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below.

1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces that are not fire rated.
2. Sealant shall have VOC content of when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

B. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION FOR NON-FIRE-RATED ELECTRICAL PENETRATIONS

A. Comply with NECA 1.

B. Comply with NEMA VE 2 for cable tray and cable penetrations.

C. Sleeves for Conduits Penetrating Above-Grade Non-Fire-Rated Concrete and Masonry-Unit Floors and Walls:

1. Interior Penetrations of Non-Fire-Rated Walls and Floors:

a. Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Section 079200 "Joint Sealants."
b. Seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect material while curing.

2. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
3. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway or cable unless sleeve seal is to be installed or unless seismic criteria require different clearance.
4. Install sleeves for wall penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of walls. Cut sleeves to length for mounting flush with both surfaces of walls. Deburr after cutting.
5. Install sleeves for floor penetrations. Extend sleeves installed in floors 2 inches above finished floor level. Install sleeves during erection of floors.

D. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies:

1. Use circular metal sleeves unless penetration arrangement requires rectangular sleeved opening.

2. Seal space outside of sleeves with approved joint compound for gypsum board assemblies.

3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at raceway entries into building.

B. Install 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.

3.3 SLEEVE-SEAL-FITTING INSTALLATION

A. Install sleeve-seal fittings in new walls and slabs as they are constructed.

B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.

C. Secure nailing flanges to concrete forms.

D. Using grout, seal the space around outside of sleeve-seal fittings.

END OF SECTION 26 05 44

PART 1 - GENERAL

1.1 WORK INLCUDES

A. Base Bid:

1. Electrical Contractor to Provide:

a. Identification for raceways.
b. Identification of power and control cables.
c. Identification for conductors.
d. Underground-line warning tape.
e. Warning labels and signs.
f. Instruction signs.
g. Equipment identification labels, including arc-flash warning labels.
h. Miscellaneous identification products.

B. Alternates Bid: None

1.2 SUMMARY

A. Section Includes:

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Delegated-Design Submittal: For arc-flash hazard study.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Comply with ASME 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.

2.2 COLOR AND LEGEND REQUIREMENTS

A. Raceways and Cables Carrying Circuits at 600 V or Less:

1. Black letters on an orange field.
2. Legend: Indicate voltage.

B. Warning labels and signs shall include, 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 LABELS

A. Vinyl Labels for Raceways Carrying Circuits at 600 V or Less: Preprinted, flexible labels laminated with a clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing label ends.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Brady Corporation.
b. Champion America.
c. emedco.
d. Grafoplast Wire Markers.
e. HellermannTyton.
f. LEM Products Inc.
g. Marking Services, Inc.
h. Panduit Corp.
i. Seton Identification Products.

B. Self-Adhesive Labels:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. A'n D Cable Products.
b. Brady Corporation.
c. Brother International Corporation.
d. emedco.
e. Grafoplast Wire Markers.
f. Ideal Industries, Inc.
g. LEM Products Inc.
h. Marking Services, Inc.
i. Panduit Corp.
j. Seton Identification Products.

2. Preprinted, 3-mil-thick, polyester flexible label with acrylic pressure-sensitive adhesive.

3. Polyester, thermal, transfer-printed, 3-mil-thick, multicolor, weather- and UV-resistant, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment unless otherwise indicated.

    a. Nominal Size: 3.5-by-5-inch.

2.4 TAPES AND STENCILS:

A. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Carlton Industries, LP.
    b. Champion America.
    c. HellermannTyton.
    d. Ideal Industries, Inc.
    e. Marking Services, Inc.
    f. Panduit Corp.

B. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; not less than 3 mils thick by 1 to 2 inches wide; compounded for outdoor use.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Brady Corporation.
    b. Carlton Industries, LP.
    c. emedco.
    d. Marking Services, Inc.

C. Floor Marking Tape: 2-inch-wide, 5-mil pressure-sensitive vinyl tape, with black and white stripes and clear vinyl overlay.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Carlton Industries, LP.
    b. Seton Identification Products.

D. Underground-Line Warning Tape

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Brady Corporation.
    b. Ideal Industries, Inc.
    c. LEM Products Inc.
    d. Marking Services, Inc.
    e. Reef Industries, Inc.
    f. Seton Identification Products.

2. Tape:

   a. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical and communications utility lines.
   b. Printing on tape shall be permanent and shall not be damaged by burial operations.
   c. Tape material and ink shall be chemically inert and not subject to degradation when exposed to acids, alkalis, and other destructive substances commonly found in soils.

3. Color and Printing:

   a. Comply with ANSI Z535.1, ANSI Z535.2, ANSI Z535.3, ANSI Z535.4, and ANSI Z535.5.
   b. Inscriptions for Red-Colored Tapes: "ELECTRIC LINE, HIGH VOLTAGE".
   c. Inscriptions for Orange-Colored Tapes: "TELEPHONE CABLE, CATV CABLE, COMMUNICATIONS CABLE, OPTICAL FIBER CABLE".

4. Tag: Type I:

   a. Pigmented polyolefin, bright colored, compounded for direct-burial service.
   b. Width: 3 inches.
   c. Thickness: 4 mils.Weight: 18.5 lb/1000 sq. ft..
   d. Tensile according to ASTM D 882: 30 lbf and 2500 psi.

5. Tag: Type ID:

   a. Detectable three-layer laminate, consisting of a printed pigmented polyolefin film, a solid aluminum-foil core, and a clear protective film that allows inspection of the continuity of the conductive core; bright colored, compounded for direct-burial service.
   b. Width: 3 inches.
   c. Overall Thickness: 5 mils.
   d. Foil Core Thickness: 0.35 mil.
   e. Weight: 28 lb/1000 sq. ft..
   f. Tensile according to ASTM D 882: 70 lbf and 4600 psi.

6. Tag: Type IID:

   a. Reinforced, detectable three-layer laminate, consisting of a printed pigmented woven scrim, a solid aluminum-foil core, and a clear protective film that allows inspection of the continuity of the conductive core; bright-colored, compounded for direct-burial service.
   b. Width: 3 inches
   c. Overall Thickness: 8 mils.
   d. Foil Core Thickness: 0.35 mil.
   e. Weight: 34 lb/1000 sq. ft..
   f. Tensile according to ASTM D 882: 300 lbf and 12,500 psi.

2.5 Tags

A. Metal Tags: Brass or aluminum, 2 by 2 by 0.05 inch, with stamped legend, punched for use with self-locking cable tie fastener.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Brady Corporation.
    b. Carlton Industries, LP.
    c. emedco.
    d. Marking Services, Inc.
    e. Seton Identification Products.

B. Nonmetallic Preprinted Tags: Polyethylene tags, 0.015 inch thick, color-coded for phase and voltage level, with factory screened permanent designations; punched for use with self-locking cable tie fastener.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Brady Corporation.
    b. Carlton Industries, LP.
    c. emedco.
    d. Grafoplast Wire Markers.
    e. LEM Products Inc.
    f. Marking Services, Inc.
    g. Panduit Corp.
    h. Seton Identification Products.

C. Write-On Tags:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Carlton Industries, LP.
    b. LEM Products Inc.
    c. Seton Identification Products.

2. Polyester Tags: 0.010 inch thick, with corrosion-resistant grommet and cable tie for attachment to raceway, conductor, or cable.
3. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.
4. Marker for Tags: Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.

2.6 Signs

A. Baked-Enamel 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.

4. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Carlton Industries, LP.
    b. Champion America.

c. emedco.
d. Marking Services, Inc.

B. Metal-Backed Butyrate 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.

4. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Brady Corporation.
b. Champion America.
c. emedco.
d. Marking Services, Inc.

C. Laminated Acrylic or Melamine Plastic Signs:

1. Engraved legend.
2. Thickness:

a. For signs up to 20 sq. inches, minimum 1/16-inch-.
b. For signs larger than 20 sq. inches, 1/8 inch thick.
c. Engraved legend with black letters on white face.
d. Self-adhesive.
e. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

3. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Brady Corporation.
b. Carlton Industries, LP.
c. emedco.
d. Marking Services, Inc.

2.7 CABLE TIES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. HellermannTyton.
2. Ideal Industries, Inc.
3. Marking Services, Inc.
4. Panduit Corp.

B. General-Purpose Cable Ties: Fungus inert, self-extinguishing, one piece, self-locking, Type 6/6 nylon.

1. Minimum Width: 3/16 inch.
2. Tensile Strength at 73 deg F according to ASTM D 638: 12,000 psi.
3. Temperature Range: Minus 40 to plus 185 deg F.

4. Color: Black, except where used for color-coding.

C. UV-Stabilized Cable Ties: Fungus inert, designed for continuous exposure to exterior sunlight, self-extinguishing, one piece, self-locking, Type 6/6 nylon.

1. Minimum Width: 3/16 inch.
2. Tensile Strength at 73 deg F according to ASTM D 638: 12,000 psi.
3. Temperature Range: Minus 40 to plus 185 deg F.
4. Color: Black.

D. Plenum-Rated Cable Ties: Self-extinguishing, UV stabilized, one piece, self-locking.

1. Minimum Width: 3/16 inch.
2. Tensile Strength at 73 deg F according to ASTM D 638: 7000 psi.
3. UL 94 Flame Rating: 94V-0.
4. Temperature Range: Minus 50 to plus 284 deg F.
5. Color: Black.

2.8 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. 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. 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. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.

D. Attach plastic raceway and cable labels that are not self-adhesive type with clear vinyl tape, with adhesive appropriate to the location and substrate.

E. Cable Ties: For attaching tags. Use general-purpose type, except as listed below:

1. Outdoors: UV-stabilized nylon.
2. In Spaces Handling Environmental Air: Plenum rated.

F. During backfilling of trenches, install continuous underground-line warning tape directly above cable or raceway 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.

3.2 IDENTIFICATION SCHEDULE

A. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits, More Than 30 A and 120 V to Ground: Identify with self-adhesive vinyl label. Install labels at 10-foot maximum intervals.

B. Accessible Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive vinyl labels containing the wiring system legend and system voltage. System legends shall be as follows:

1. "EMERGENCY POWER."
2. "POWER."

C. 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- and Voltage-Level Identification, 600 V or Less: Use industry standard colors for ungrounded feeder and branch-circuit conductors.

a. 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.

D. Control-Circuit Conductor Identification: For conductors and cables in pull and junction boxes, manholes, and handholes, use write-on tags with the conductor or cable designation, origin, and destination.

E. Control-Circuit Conductor Termination Identification: For identification at terminations, provide self-adhesive, self-laminating polyester labels with the conductor designation.

F. Conductors to Be Extended in the Future: Attach write-on tags to conductors and list source.

G. 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 operation and maintenance manual.

H. 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 direct-buried cables and cables in raceways.

I. Workspace Indication: Install floor marking tape to show working clearances in the direction of access to live parts. Workspace shall comply with NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces.

J. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Self-adhesive warning labels.

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.

K. Arc Flash Warning Labeling: Self-adhesive thermal transfer vinyl labels.

1. Comply with NFPA 70E and ANSI Z535.4.
2. Comply with Section 260574 "Overcurrent Protective Device Arc-Flash Study" requirements for arc-flash warning labels.

L. 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.

M. 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.

N. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and operation and maintenance manual.

1. Labeling Instructions:

a. Indoor Equipment: Self-adhesive, engraved, laminated acrylic or melamine plastic 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 labels are provided with self-adhesive means of attachment, fasten them with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.

END OF SECTION 26 05 53

PART 1 - GENERAL

1.1 WORK INLCUDES

A. Base Bid:

1. Electrical Contractor to Provide:

a. Fusible switches.
b. Nonfusible switches.
c. Molded-case circuit breakers (MCCBs).
d. Molded-case switches.
e. Enclosures.

B. Alternates Bid: None

1.2 ACTION SUBMITTALS

A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include nameplate ratings, dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.

1.3 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.4 WARRANTY

A. Manufacturer's Warranty: Manufacturer and Installer agree to repair or replace components that fail in materials or workmanship within specified warranty period.

1. Warranty Period: One year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Enclosed switches and circuit breakers shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

2.2 GENERAL REQUIREMENTS

A. Source Limitations: Obtain enclosed switches and circuit breakers, overcurrent protective devices, components, and accessories, within same product category, from single manufacturer.

B. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.

D. Comply with NFPA 70.

2.3 FUSIBLE SWITCHES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. ABB Inc.
2. Eaton.
3. General Electric Company.
4. Siemens Industry, Inc.
5. Square D; by Schneider Electric.

B. Type HD, Heavy Duty:

1. Single throw.
2. Three pole.
3. 240 600-V ac.
4. 200 A and smaller.
5. UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate specified fuses.
6. Lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

C. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
3. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.
4. Service-Rated Switches: Labeled for use as service equipment.

2.4 NONFUSIBLE SWITCHES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eaton.
2. General Electric Company.
3. Siemens Industry, Inc.
4. Square D; by Schneider Electric.

B. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
3. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.
4. Service-Rated Switches: Labeled for use as service equipment.

2.5 MOLDED-CASE CIRCUIT BREAKERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eaton.
2. General Electric Company.
3. Siemens Industry, Inc.
4. Square D; by Schneider Electric.

B. Circuit breakers shall be constructed using glass-reinforced insulating material. Current carrying components shall be completely isolated from the handle and the accessory mounting area.

C. Circuit breakers shall have a toggle operating mechanism with common tripping of all poles, which provides quick-make, quick-break contact action. The circuit-breaker handle shall be over center, be trip free, and reside in a tripped position between on and off to provide local trip indication. Circuit-breaker escutcheon shall be clearly marked on and off in addition to providing international I/O markings. Equip circuit breaker with a push-to-trip button, located on the face of the circuit breaker to mechanically operate the circuit-breaker tripping mechanism for maintenance and testing purposes.

D. The maximum ampere rating and UL, IEC, or other certification standards with applicable voltage systems and corresponding interrupting ratings shall be clearly marked on face of circuit breaker. Circuit breakers shall be 100 percent rated. Circuit breaker/circuit breaker combinations for series connected interrupting ratings shall be listed by UL as recognized component combinations. Any series rated combination used shall be marked on the end-use equipment along with the statement "Caution - Series Rated System. _____ Amps Available. Identical Replacement Component Required."

E. MCCBs shall be equipped with a device for locking in the isolated position.

F. Lugs shall be suitable for 140 deg F rated wire on 125-A circuit breakers and below.

G. Standards: Comply with UL 489 and NEMA AB 3, with interrupting capacity to comply with available fault currents.

H. Thermal-Magnetic Circuit Breakers: Inverse time-current thermal element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.

I. Enclosed Switches and Circuit Breakers: UL 489, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.

J. Enclosure Finish: The enclosure shall be gray baked enamel paint, electrodeposited on cleaned, phosphatized steel (NEMA 250 Type 1).

K. Conduit Entry: NEMA 250 Types 4, 4X, and 12 enclosures shall contain no knockouts. NEMA 250 Types 7 and 9 enclosures shall be provided with threaded conduit openings in both endwalls.

L. Operating Mechanism: The circuit-breaker operating handle shall be directly operable through the front cover of the enclosure (NEMA 250 Type 1). The cover interlock mechanism shall have an externally operated override. The override shall not permanently disable the interlock mechanism, which shall return to the locked position once the override is released. The tool used to override the cover interlock mechanism shall not be required to enter the enclosure in order to override the interlock.

PART 3 - EXECUTION

3.1 ENCLOSURE ENVIRONMENTAL RATING APPLICATIONS

A. Enclosed Switches and Circuit Breakers: Provide enclosures at installed locations with the following environmental ratings.

1. Indoor, Dry and Clean Locations: NEMA 250, Type 1.
2. Outdoor Locations: NEMA 250, Type 4X.
3. Other Wet or Damp, Indoor Locations: NEMA 250, Type 4.

3.2 INSTALLATION

A. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:

1. Notify Construction Manager no fewer than 24 days in advance of proposed interruption of electric service.
2. Indicate method of providing temporary electric service.
3. Do not proceed with interruption of electric service without Construction Manager's written permission.
4. Comply with NFPA 70E.

B. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

C. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.

D. Comply with mounting and anchoring requirements specified in Section 260548.16 "Seismic Controls for Electrical Systems."

E. Temporary Lifting Provisions: Remove temporary lifting of eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

F. Install fuses in fusible devices.

G. Comply with NFPA 70 and NECA 1.

3.3 IDENTIFICATION

A. Comply with requirements in Section 260553 "Identification for Electrical Systems."

1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
2. Label each enclosure with engraved metal or laminated-plastic nameplate.

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

C. Perform tests and inspections.

D. Tests and Inspections for Switches:

1. Visual and Mechanical Inspection:

a. Inspect physical and mechanical condition.
b. Inspect anchorage, alignment, grounding, and clearances.
c. Verify that the unit is clean.
d. Verify blade alignment, blade penetration, travel stops, and mechanical operation.
e. Verify that fuse sizes and types match the Specifications and Drawings.
f. Verify that each fuse has adequate mechanical support and contact integrity.
g. Inspect bolted electrical connections for high resistance using one of the two following methods:

1) Use a low-resistance ohmmeter.

a) Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from those of similar bolted connections by more than 50 percent of the lowest value.

2) Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer's published data or NETA ATS Table 100.12.

a) Bolt-torque levels shall be in accordance with manufacturer's published data. In the absence of manufacturer's published data, use NETA ATS Table 100.12.

h. Verify that operation and sequencing of interlocking systems is as described in the Specifications and shown on the Drawings.
i. Verify correct phase barrier installation.
j. Verify lubrication of moving current-carrying parts and moving and sliding surfaces.

2. Electrical Tests:

a. Perform resistance measurements through bolted connections with a low-resistance ohmmeter. Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from adjacent poles or similar switches by more than 50 percent of the lowest value.
b. Measure contact resistance across each switchblade fuseholder. Drop values shall not exceed the high level of the manufacturer's published data. If manufacturer's published data are not available, investigate values that deviate from adjacent poles or similar switches by more than 50 percent of the lowest value.
c. Perform insulation-resistance tests for one minute on each pole, phase-to-phase and phase-to-ground with switch closed, and across each open pole. Apply voltage in accordance with manufacturer's published data. In the absence of manufacturer's published data, use Table 100.1 from the NETA ATS. Investigate values of insulation resistance less than those published in Table 100.1 or as recommended in manufacturer's published data.
d. Measure fuse resistance. Investigate fuse-resistance values that deviate from each other by more than 15 percent.
e. Perform ground fault test according to NETA ATS 7.14 "Ground Fault Protection Systems, Low-Voltage."

E. Tests and Inspections for Molded Case Circuit Breakers:

1. Visual and Mechanical Inspection:

a. Verify that equipment nameplate data are as described in the Specifications and shown on the Drawings.
b. Inspect physical and mechanical condition.
c. Inspect anchorage, alignment, grounding, and clearances.
d. Verify that the unit is clean.
e. Operate the circuit breaker to ensure smooth operation.
f. Inspect bolted electrical connections for high resistance using one of the two following methods:

1) Use a low-resistance ohmmeter.

a) Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from those of similar bolted connections by more than 50 percent of the lowest value.

2) Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer's published data or NETA ATS Table 100.12.

a) Bolt-torque levels shall be in accordance with manufacturer's published data. In the absence of manufacturer's published data, use NETA ATS Table 100.12.

g. Inspect operating mechanism, contacts, and chutes in unsealed units.
h. Perform adjustments for final protective device settings in accordance with the coordination study.

2. Electrical Tests:

a. Perform resistance measurements through bolted connections with a low-resistance ohmmeter. Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from adjacent poles or similar switches by more than 50 percent of the lowest value.
b. Perform insulation-resistance tests for one minute on each pole, phase-to-phase and phase-to-ground with circuit breaker closed, and across each open pole. Apply voltage in accordance with manufacturer's published data. In the absence of manufacturer's published data, use Table 100.1 from the NETA ATS. Investigate values of insulation resistance less than those published in Table 100.1 or as recommended in manufacturer's published data.
c. Perform a contact/pole resistance test. Drop values shall not exceed the high level of the manufacturer's published data. If manufacturer's published data are not available, investigate values that deviate from adjacent poles or similar switches by more than 50 percent of the lowest value.
d. Perform insulation resistance tests on all control wiring with respect to ground. Applied potential shall be 500-V dc for 300-V rated cable and 1000-V dc for 600-V rated cable. Test duration shall be one minute. For units with solid state components, follow manufacturer's recommendation. Insulation resistance values shall be no less than two megohms.
e. Determine the following by primary current injection:

1) Long-time pickup and delay. Pickup values shall be as specified. Trip characteristics shall not exceed manufacturer's published time-current characteristic tolerance band, including adjustment factors.
2) Short-time pickup and delay. Short-time pickup values shall be as specified. Trip characteristics shall not exceed manufacturer's published time-current characteristic tolerance band, including adjustment factors.
3) Ground-fault pickup and time delay. Ground-fault pickup values shall be as specified. Trip characteristics shall not exceed manufacturer's published time-current characteristic tolerance band, including adjustment factors.
4) Instantaneous pickup. Instantaneous pickup values shall be as specified and within manufacturer's published tolerances.

f. Test functionality of the trip unit by means of primary current injection. Pickup values and trip characteristics shall be as specified and within manufacturer's published tolerances.
g. Perform minimum pickup voltage tests on shunt trip and close coils in accordance with manufacturer's published data. Minimum pickup voltage of the shunt trip and close coils shall be as indicated by manufacturer.
h. Verify correct operation of auxiliary features such as trip and pickup indicators; zone interlocking; electrical close and trip operation; trip-free, anti-pump function; and trip unit battery condition. Reset all trip logs and indicators. Investigate units that do not function as designed.
i. Verify operation of charging mechanism. Investigate units that do not function as designed.

3. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
4. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.

F. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.

G. Prepare test and inspection reports.

1. Test procedures used.
2. Include identification of each enclosed switch and circuit breaker tested and describe test results.
3. List deficiencies detected, remedial action taken, and observations after remedial action.

END OF SECTION 26 28 16

EXHIBIT D - Sample Small Projects Agreement

SAMPLE

COLLEGE OF DUPAGE
SMALL PROJECTS AGREEMENT (HSC CADAVER LAB SUPPLEMENTAL HVAC)
BETWEEN COMMUNITY COLLEGE DISTRICT 502 AND CONTRACTOR

THIS AGREEMENT ("**Agreement**") is made as of _____ by and among COMMUNITY COLLEGE DISTRICT 502 (College of DuPage), ("**COD**") and _____ ("**Contractor**").

COD and Contractor desire to enter into this Agreement, pursuant to which Contractor shall perform certain work in connection with the Project, as hereinafter provided. In consideration of the performance of work by Contractor and the payment for such work by COD, the parties agree as follows:

1. Scope of Project. Contractor shall perform work for COD in connection with the Project, including specifically, the matters set forth on Exhibit 1. Contractor shall perform all work with the highest standards of workmanship and materials. Contractor shall maintain a sufficient staff to perform all work in the most expeditious manner consistent with the interests of COD. Contractor shall promptly notify COD immediately in writing: (i) of any information required from COD so Contractor can complete its work in a timely manner; and (ii) of any work requested by COD that is not included in the scope of work provided in Exhibit 1.

The Contractor understands that COD may engage other Contractors or COD personnel to work in areas near the Contractor's work. Contractor shall cooperate with such others so that work is not disrupted or delayed.

The Contractor shall be solely responsible for means and methods selected in performing the Work. Contractor shall supervise all work so that it is performed in a safe and expeditious manner. Contractor shall be solely responsible for the safe work of its employees and its subcontractor's employees.

The work shall be completed in _____ calendar days. Time is of the essence under this Agreement.

2. Payment to Contractor. COD shall pay Contractor for Contractor's work properly performed under this Agreement. Contractor's work shall be billed as set forth in Exhibit 2 and in no event shall the total amount due to Contractor under this Agreement exceed the total contract sum following, without COD's prior written approval:

Total Contract Sum: $_____ (numbers and words)

3. Defective Work and Guarantee. Contractor shall promptly correct any defective work. Payment by COD for any work otherwise determined to be defective shall not relieve Contractor of its obligation to correct. Contractor shall warrant and guarantee all work to be free from defect for one year following substantial completion of the work.

4. Indemnification and Insurance. Contractor hereby agrees to indemnify and hold COD, its trustees, officers, agents, employees and any other parties designated by COD (COD, its trustees, officers, agents, employees any other parties designated by COD hereinafter collectively called the "**Indemnitees**") harmless from all losses, claims, liabilities, injuries, damages and expenses, including but not limited to, all attorneys' fees, defense and court costs and expenses, that the Indemnitees may incur arising out of, or occurring in connection with, the acts, omissions, or breaches by Contractor of its duties and obligations under or pursuant to this Agreement. This indemnification obligation shall not be limited by a limitation on amount or type of damages, compensation or benefits payable by or for the Contractor or a Subcontractor under workers' or workmen's compensation acts, disability benefit acts or other employee benefit acts.

Contractor shall procure, at no expense to COD, the insurance coverages set forth in Exhibit 3. Contractor shall adhere to all provisions of Exhibit 3.

5. Performance and Payment Bond. For every Small Project greater than Five Thousand Dollars ($5,000), Contractor shall procure, a performance and payment bond with a surety with a Best Rating of A, VI. Prior to commencement of any work on the Project, Contractor shall submit insurance and bonds. Any provisions contained within the bonds abrogating COD's rights or remedies, otherwise available in contract or law, are void.

6. Termination. COD may terminate this Agreement at any time, in whole or in part, with or without cause, upon written notice to Contractor. In the event this Agreement is terminated for convenience, Contractor shall be compensated for work properly rendered through the date of termination, as can be documented to the reasonable satisfaction of COD. COD shall have no liability to Contractor beyond the date of termination. In no event shall contractor be compensated for anticipated profit or lost opportunity.

7. Liens. Upon COD's request, contractor shall submit mechanics' lien waivers in form acceptable to COD with each statement for work rendered or request for payment. Should liens be placed on the project by any subcontractor, contractor shall indemnify COD for all costs, expenses and attorneys fees incurred in the defense of such lien.

8. Materials. All materials incorporated into the work shall be new and of high quality. Contractor shall adhere to all manufacturer's recommendations. If requested by COD or otherwise set out in the contract documents, Contractor shall, before purchase of such material, submit to COD for COD's review, and in a format acceptable to COD, all product data and literature. All manufacturer's warranties shall be forwarded to COD prior to substantial completion of the work.

9. Changes in Scope of Work. COD may, without invalidating this Agreement, request changes in the scope of the work, whether taking the form of additions, deletions, or other revisions. No such work shall be performed unless and until such change is agreed in writing by COD and Contractor. If the change in work will result in a change in contract price, the change in price shall be calculated by 1) lump sum, 2) agreed unit rates, or 3) time and material reimbursable plus mark-up. COD shall solely select the method of pricing.

10. Successors and Assigns. Contractor shall not assign any rights under or interest in this Agreement without the prior written consent of the COD. This Agreement shall be binding upon and inure to the benefit of the parties hereto and their respective successors and assigns.

11. Controlling Law. This Agreement is to be governed by the laws of the State of Illinois. Each party has reviewed and approved this Agreement and the rule of construction that resolves ambiguities against the drafting party shall not be employed in the interpretation of this Agreement.

12. Entire Agreement; Conflict. This Agreement incorporates COD's bid instruction and request documents and Contractor's bid. This Agreement represents the entire agreement between Contractor and COD and supersedes all prior negotiations or agreements, written or oral, which are not included herein. This Agreement may only be amended by written instrument executed by COD and Contractor. In the event of a conflict between this Agreement and a proposal from Contractor or any exhibits hereto, this Agreement shall control, followed by COD's bid instruction and request documents, and finally, by Contractor's bid.

13. Prevailing Wage Act. To the extent required by law, contractor shall not pay less than the prevailing wage as established pursuant to an Act Regulating The Wages of Laborers, Mechanics, and Other Workman employed under Contract for Public Workers 820 ILCS 130/1 *et seq*.

14. Human Rights Act. To the extent required by law, contractor shall abide by the Illinois Human Right Act, 775 ILCS 10/0.01 *et seq*.

15. Drug Free Workplace. To the extent required by law, contractor shall abide with the requirements of the Drug Free Workplace Act 30 ILCS 580.1 *er seq*.

16. Sexual Harassment Policy. Contractor represents by the signing of this Agreement that it has a written sexual harassment policy that is in accordance with 775 ILCS 5/2-105 (A)(4).

This Agreement has been executed the day and year provided above.

COLLEGE OF DUPAGE	Contractor:
By: _____	By: _____
Name: Dr. Brian Caputo	Name: _____
Title: VP Administration, CFO	Title: _____

EXHIBIT 1

SCOPE OF WORK

[List Drawings and Specifications if any and addenda if any related to BID 2018-0012 and identify whether alternates are accepted, at what specific amount, which is included in Total Contract Sum]

EXHIBIT 2

Contractor shall submit monthly statements for work rendered. The statements will be based upon Contractor's work completed at the time of billing on the basis of actual work performed. COD shall make payments to Contractor sixty (60) days after receipt of Contractor's statements properly submitted. Monthly statements shall detail Amount Currently Due, Previous Amount Billed, and Balance of Contract Outstanding. In the event of termination for convenience by COD as herein provided, Contractor shall be paid for work properly rendered prior to termination, or as otherwise provided herein.

Requests for Payment shall be submitted no more than once per month in a format acceptable to COD.

Any terms or payment provisions, such as penalties or interest, contained on Contractor's invoices shall be of no effect.

COD may withhold payment from monies otherwise due to the Contractor to compensate the COD for the cost of repairing defective work or completing incomplete work in case of Contractor default.

If COD selects agreed unit rates as the method of payment for base scope work or change order work, the agreed unit rates are as set forth below:

UNIT RATE SCHEDULE

Description	Unit	Rate ($)

Contractor shall be allowed 10% mark-up on change order work when time and material reimbursable method of pricing is selected.

EXHIBIT 3

CONTRACTOR'S LIABILITY INSURANCE

The Contractor shall not commence work under this contract until all insurance required herein is obtained and approved by the Owner. Nor shall the Contractor allow any subcontractor to commence work until all similar insurance required of the subcontractor has been so obtained.

The Contractor shall furnish COD with two (2) original Certificates of Insurance, with Community College District 502 named as an additional insured for Commercial General and Automobile Liability, showing the following minimum coverage with an insurance company acceptable to the College. Further, the Certificate of Insurance shall state that coverage provided is primary to any other coverage available to College of DuPage. The foregoing Certificates shall contain a provision that coverage afforded under the policies will not be cancelled or non-renewed until at least thirty (30) days prior written notice has been given to College of DuPage.

TYPE OF INSURANCE	**MINIMUM INSURANCE COVERAGE** Combined Single Limit Per Occurrence/Aggregate
Commercial General Liability including: 1. Premises - Operations 2. Explosion, Underground and Collapse Hazard 3. Products/Completed Operations 4. Contractual Insurance 5. Broad Form Property Damage 6. Independent Contractors 7. Bodily Injury	$1,000,000/$2,000,000
Automobile Liability Owned, Non-owned, or Rented	$1,000,000/$2,000,000
Workers' Compensation and Occupational Diseases	As Required by Applicable Laws
Employer's Liability	$1,000,000
Professional Liability (if performance specifications)	$3,000,000/$3,000,000

EXHIBIT E - Prevailing Wage Form

College of DuPage

Prevailing Wage Form

In an effort to meet the Prevailing Wage Survey requirements of the State of Illinois, the College of DuPage has established the Prevailing Wage Form that will assist in reporting Prevailing Wage information. Please complete the information below and return to the College of DuPage Project Manager.

Project Name: _____

Project Bid/RFP#: _____

Contractor Information:

Company Name _____

Address: _____ Suite/Floor _____

City: _____ ST ___ Zip Code _____

Phone: _____ Fax: _____

Contractor Contact Information:

First Name _____ MI ___ Last Name _____

Title _____ Email _____

City _____ ST ___ Zip _____

Primary Phone: _____

College of DuPage Project Manager: _____ Date: _____