



ADDENDUM NO. 3 TO PROJECT NO. 44220

**Construction Work
Provide Conversion of 4th Floor to Wet Lab, Building No. 4
New York Psychiatric Institute
1051 Riverside Drive
New York, NY 10032**

January 29, 2014

NOTE: This Addendum forms a part of the Contract Documents. Insert it in the Project Manual.
Acknowledge receipt of this Addendum in the space provided on the Bid Form.

SPECIFICATION GROUP

1. Page 055000-1, 1.02, Add line:
“B. Suspended Services Grid: Section 095453”

Page 055000-2, Add paragraph:
“**1.04 PERFORMANCE REQUIREMENTS**

- A. Where drip pans are indicated design suspension system below drip pans for support of suspended ceiling, lighting, and suspended services grid. Include comprehensive engineering analysis by a qualified professional engineer, using design criteria indicated.”

Page 055000-2, 1.05, Add sub-paragraph:

- “C. Delegated-Design Submittal: For installed products indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation. Include details of construction including location of connections to services and connections to building structure.”

Page 05500-4, 2.02, Add sub-paragraph:

- “B. Slotted Channel Framing: Cold-formed metal box channels (struts) complying with MFMA-4.
1. Size of Channels: 1-5/8 by 1-5/8 inches (41 by 41 mm).
 2. Material: Galvanized steel, ASTM A 653/A 653M, structural steel, Grade 33 (Grade 230); 0.108-inch (2.8-mm)] nominal thickness.”

2. Page 070150-1, Delete paragraph 1.01 RELATED WORK SPECIFIED ELSEWHERE in its entirety.
3. Page 081516-2, 2.02, A., Add line:

“1. Door comes equipped with all operable hardware.”
4. Page 085113-1, Delete line 1.01, A. 1.
Page 085113-1, Delete line 1.01, B.2.
Page 085113-1, 1.02, A., Delete “fabrication”
Page 085113-1, 1.02, B., Delete “for each type of unit”
Page 085113-1, Delete line 1.01, C.1.
Page 085113-1, 1.03 A.:

Change “glass and glazing and window specifications to demonstrate aesthetic effects and” to “weatherstrip gaskets to”.

Page 085113-2, Delete paragraph 2.01 ALUMINUM WINDOWS AND DOOR FRAMES in its entirety.
Page 085113-2, change paragraph 2.02 MATERIALS to read:

“A. Neoprene Gaskets: ASTM D 2000.
B. PVC Gaskets: ASTM D 2287.
C. Expanded Neoprene Gaskets: ASTM C 509”

Page 085113-2, Delete paragraph 2.03 FINISHES in its entirety.
Page 085113-3, 3.02, Delete subparagraphs B. and C.
Page 085113-3, 3.04, Delete “Lubricate hardware and other moving parts, except parts in contact with weatherstripping.”
5. Page 087100-9, change paragraph 2.03, F., group 6 to read:

“1. All operable hardware will be furnished by manufacturer. Refer to Section 081516 “FRP doors and Frames.”
6. Page 096516-1, Delete line 1.01, B.
7. Page 096519-1, Delete line 1.02, B.
Page 096519-3, 2.02, subparagraph A, 1.a:
Change “[]” to “Environcare Ed 2944 Lotus Flower”
8. Page 101423-2, 2.01, A., Add line:

“1. Match institution’s standard graphics.”
9. Page 102110-1, 1.01 RELATED WORK SPECIFIED ELSEWHERE: Delete line B.
Page 102110-1, 1 change paragraph.02 DESCRIPTION to read:

“A. The following types of compartments are specified under this Section:
1. Toilet Compartments: Floor mounted door and partition panels, pilasters, hardware, fittings, and other appurtenances.”

Page 102110-1, Delete paragraph 1.03 OPTION in its entirety.
Page 102110-1, Delete line 1.04, B.3.
Page 102110-2, Delete line 1.04, C.3.and 1.04, C.7.
Page 102110-2, Add paragraph:

“1.07 QUALITY ASSURANCE

- A. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84, or another standard acceptable to authorities having jurisdiction, by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Flame-Spread Index: 50 or less.
 - 2. Smoke-Developed Index: 450 or less.
- B. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA) and Architectural Barriers Act (ABA) Accessibility Guidelines for Buildings and Facilities" for toilet compartments designated as accessible.”

Page 102110-2, Delete subparagraph 2.01, A. Solid Phenolic Core Panels

Page 102110-3: Delete 2.01, G. lines 4, 5 and 6.b.

Add paragraph:

“2.01 MANUFACTURERS

- A. Subject to compliance with requirements products of the following manufacturers may be incorporated into the work:
 - 1. American Sanitary Partition Corp.
 - 2. Accurate Partitions Corp.
 - 3. Weis/Robart Partitions Inc.”

Page 102110-4, Delete line 3.01, A.3. and 3.01, B.2.

Page 102110-5, Delete line 3.01, C.

- 10. Page 115213-1, 2.01, A.1., Change “16:9” to “16:10”
Page 115213-1, 2.01, A.2., Change “glass beaded” to “High Power”.
- 11. Page 115300-1, 1.02, D., Add line:
“1. EQ07: Biosafety Cabinet Class II, Type A2”

Page 115300-16, add paragraph:

“2.08 EQ07: BIOSAFETY CABINET CLASS II, TYPE A2

- A. PRODUCT DESCRIPTION:
 - 1. Provide a certified copy of the Personnel, Product and Cross-contamination (Biological) Tests, equivalent to or more severe than as specified in NSF Standard #49, performed on one unit from each production run from which cabinets have been manufactured. All units must meet NSF #49 performance requirements and have NSF #49 label attached.
 - 2. Cabinet will have zoned or uniform down flow velocity profile relative to down flow velocity over the work surface. All biologically contaminated ducts and plenums maintained under negative pressure or enclosed within a negative pressure zone.
 - 3. Sliding view screen of 1/4" tempered glass capable of moving to a fully closed or open (20") position during shut down periods. Audible alarm to indicate when view screen is in unsafe position. Calculated intake

velocity through front 12" access opening maintained between 100-110 fpm.

4. Both exhaust and supply filters to be front loading and meet the zero-probed HEPA 99.99% efficient on all particles 0.3 micron by DOP test. Minihelic pressure gauge (up to 2" W.G.) to monitor filter loading.
5. Cabinet constructed of #18 gauge cold-rolled steel, with #16 gauge stainless steel work surface and radius (rounded) corners on the work surface. Side walls and rear wall one-piece or welded construction. Stainless steel air diffuser and filter protector provided in work area. Stainless steel fixed or adjustable leg assembly will provide a work surface height of 30". Units must pass through an 84" high door opening.
6. Work area provided with two (2) internally mounted GFI duplex 120V outlets with drip-proof covers and circuit breakers. Provide fluorescent light (100 foot-candles of illumination at work surface) and a germicidal ultra-violet (UV) light.
7. Unit capable of automatically handling a 60% minimum increase in filter loading without a decrease in total air delivery of more than 10%. Provide a voltage compensating motor speed controller that automatically compensates for voltage changes to maintain constant voltage to motor. Speed controller will permit manual adjustment to handle a 150% increase in filter loading and maintain total air delivery at or above 90%..
8. Unit completely factory pre-wired with 6' power cord. Supply a 0.1 Amp form "C" contact on the blower switch to interact with a potential room control package. Complete units, including flow alarm, listed as certified by UL or ETL, for electrical safety and integrity.
9. Unit to carry a three (3) year warranty.

B. UTILITY REQUIREMENTS:

1. E 1/60/115V.
2. V 3/8" NPT (Drawings determine service requirement).
3. EXH N/A

C. BASIS OF DESIGN: NuAire, Model No. NU-425-400

D. EQUIPMENT ITEM(S) SHALL BE CFCI.

E. WARRANTY

1. Minimum five (5) year parts and labor.

F. ACCEPTABLE MANUFACTURERS

1. Baker www.bakerco.com
2. Labconco www.labconco.com "

12. Page 123553-25, change paragraph 2.16 to read:

“2.16 CYLINDER RACKS:

- A. General: Furnish and install wall mounted cylinder racks, in locations indicated on the Drawings.
- B. Cylinder racks shall be fabricated of 11 gauge steel, powder paint finish bracket including polypropylene strap (length min. 54") and cinch buckle similar to US Safety Model #GB100FS or equal for single cylinder. For two cylinder arrangement, use Model #GB200FS.

C. Cylinder rack inside Cylinder Closet, #418

1. Provide product similar to Unistrut P1000 series, 12 gauge, length extent of closet width along with associated accessories, including but not limited to bolts and spring nuts.
 2. Channels and parts shall be finished in their standard acid resistant epoxy powder coat finish.
 3. Accessories- Cylinder strap holders angle fittings, two per cylinder column, with one inch nylon strapping, safety buckle and quick disconnect similar to Model #29695T56/ 29695T66as manufactured by McMaster-Carr Supply Company (New Brunswick, NJ).”
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13. SECTION 230719 INSULATION: ADD THE ACCOMPANYING SECTION (PAGES 230719 – 1 THROUGH 230719 – 17) TO THE PROJECT MANUAL.”
 14. HVAC – TABLE OF CONTENTS: ADD SECTION 230719 INSULATION.
 15. SECTION 265110 INTERIOR LIGHTING: REMOVE FROM THE PROJECT MANUAL
 16. SECTION 265100 INTERIOR LIGHTING: ADD THE ACCOMPANYING SECTION (PAGES 265100 – 1 THROUGH 265100 – 7) TO THE PROJECT MANUAL.”
 17. ELECTRICAL – TABLE OF CONTENTS: REMOVE SECTION 265110 INTERIOR LIGHTING
 18. ELECTRICAL – TABLE OF CONTENTS: ADD SECTION 265100 INTERIOR LIGHTING
 19. PAGE 230000 – 1, ARTICLE 1.2.1: DELETE THIS ARTICLE IN ITS ENTIRETY.
 20. PAGE 230593 – 2, CHANGE PARAGRAPH 2.01.D.1 TO READ:
1. PERCENTAGE OF PROPYLENE GLYCOL: 30 PERCENT
 21. PAGE 230993 – 4, CHANGE PARAGRAPH 1.7.C TO READ:
C. PROVIDE ALL AVAILABLE SOFTWARE POINTS FROM VFD DRIVE VIA BACNET COMMUNICATION INTERFACE.
 22. PAGE 230993 – 6, CHANGE PARAGRAPH 1.8.C TO READ:
C. PROVIDE ALL AVAILABLE SOFTWARE POINTS FROM VFD DRIVE VIA BACNET COMMUNICATION INTERFACE.
 23. PAGE 230993 – 9, CHANGE PARAGRAPH 1.9.G TO READ:
G. PROVIDE ALL AVAILABLE SOFTWARE POINTS FROM VFD DRIVE VIA BACNET COMMUNICATION INTERFACE.
 24. PAGE 230993 – 11, CHANGE PARAGRAPH 1.10.E TO READ:
E. PROVIDE ALL AVAILABLE SOFTWARE POINTS FROM VFD DRIVE VIA BACNET COMMUNICATION INTERFACE.
 25. PAGE 230993 – 12, CHANGE PARAGRAPH 1.11.D TO READ:

- D. PROVIDE ALL AVAILABLE SOFTWARE POINTS FROM VFD DRIVE VIA BACNET COMMUNICATION INTERFACE.
- 26. PAGE 230993 – 13, CHANGE PARAGRAPH 1.13.D TO READ:
D. PROVIDE ALL AVAILABLE SOFTWARE POINTS FROM VFD DRIVE VIA BACNET COMMUNICATION INTERFACE.
- 27. PAGE 230993 – 16, CHANGE PARAGRAPH 1.15.D TO READ:
D. PROVIDE ALL AVAILABLE SOFTWARE POINTS FROM VFD DRIVE VIA BACNET COMMUNICATION INTERFACE.

DRAWINGS

- 28. Drawing No. AR-101:
GENERAL REMOVAL NOTES, Add note:
“6. FLOORS 2, 3, 5, 6, 7, 9 & 10: REPAIR AND PATCH FLOORS, CEILINGS AND WALLS TO MATCH EXISTING UPON COMPLETION OF WORK.”
- 29. Drawing No. A-400:
2/A-400, Delete shelves WS18PL at EQ21 (total of two).
6/A400, Change note “GWB SOFFIT” to “PTD ALUM TRANISTION TRIM”.
- 30. Drawing No. A-401:
6/A-401and 7/A-401, Change “V4” to “V3”
9/A-401, Equipment tags to read “EQ-01”
10/A-401, Equipment tags to read “EQ-01”
12/A-401, Equipment tag to read “EQ-14”
15/A-401, Equipment tags to read “EQ-01”
17/A-401, Equipment tags to read “EQ-01”
19/A-401, Change “CO2-2” to “CO2-1”
- 31. Drawing No. A-402:
6/A-402, Add 5’-0”x2’-0” stainless steel countertop over BC30DDAC & BC30DD-FL
7/A-402, Add WS30SS as per SK-A-01 attached.
9/A-402, Change “CO2-2” to “CO2-1”
19/A-402, Change “V4” to “V3”
Add 21/A-402 as per SK-A-01 attached.
- 32. Drawing No. A-600:
Revise as follows:

BASE CABINET – ACID STORAGE

TAG	WIDTH	DEPTH
BC30DD-AC	2’-6”	1’-9”

BASE CABINET SINK

USED W/ S3 SINK

TAG	WIDTH	DEPTH
BCS30-SS	2’-6”	1’-9”

BASE CABINET SINK

USED W/ S1 & S2 SINKS

TAG	WIDTH	DEPTH
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BCS30-A	2'-6"	1'-9"
BCS30-B	2'-6"	1'-9"
BCS36-A	3'-0"	1'-9"

BASE CABINET – DOUBLE DOOR

TAG	WIDTH	DEPTH
BC30DD-A	2'-6"	1'-9"
BC30DD-B	2'-6"	1'-9"

BASE CABINET – SINGLE DOOR

TAG	WIDTH	DEPTH
BC18SD-B	1'-6"	1'-9"

HUNG CABINET DOUBLE DOOR: Change dimension “2'-4” to “2'-0 3/4”

HUNG CABINET SINGLE DOOR: Change dimension “2'-4” to “2'-0 3/4”

HUNG CABINET THREE DRAWERS: Change dimension “2'-4” to “2'-0 3/4”

**BASE CABINET – FLAMMABLES
STOR.**

TAG	WIDTH	DEPTH
BC30DD-FL	2'-6"	1'-9"

Add note with leader: “STEEL CABINET”

**BASE CABINET – FLAMMABLES
STOR.**

TAG	WIDTH	DEPTH
BC18SD-FL	1'-6"	1'-9"

WALL SHELVES

TAG	WIDTH	DEPTH
WS18PL	1'-6"	1'-0" – 1'-3"
WS24PL	2'-0"	1'-0" – 1'-3"
WS30PL	2'-6"	1'-0" – 1'-3"
WS30SS	2'-6"	1'-0" – 1'-3"
WS36PL	3'-0"	1'-0" – 1'-3"

PARTIAL DETAIL SECTION @ LAB TABLE SYSTEM TS60: Change “1” THICK PAINTED STEEL SHELF” to “1” PL. LAM SHELF”

- 33. Drawing No. A-502:
2/A-502, Change as per SK-A-02 (attached).
- 34. Drawing No. A-601:
DOOR SCHEDULE FOURTH FLOOR: Change note “A-603” to “A-404”
Change hardware set for door D412A from “6” to “15”.
DOOR TYPES: Change dimension at H/FG Door to read: “SEE SCHEDULE (3'-6”/4'-0”)”
- 35. Drawing No. Q-100:
EQUIPMENT LEGEND

PROVIDE (FURNISH AND INSTALL), Add:

EQ-07	BIO-SAFETY CABINET CLASS II, A2 - RECIRCULATING
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INSTALL (FURNISH BY OTHERS), Delete:

EQ07	BIO-SAFETY CABINET CLASS II, A2 - RECIRCULATING
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36. Drawing No. Q-101:

Revise equipment schedule to read:

EQ#	Equipment Description	Furnished and installed by others	Install (Furnished by others)	Provide and install (See Specs)
EQ-07	Bio Safety cabinet - Class II, A2, recirculating			4

Change “Autoclave” to “Small Steam Sterilizer”.

Change “Glasswasher” to “Glassware Washer w/ Dryer”.

37. Drawing No. ER-101

- a. Sheet Title renamed to “REMOVAL LL1, 4TH & 8TH FLOORS”

38. Drawing No. M-001

- a. Under General Notes, Remove note 21.

39. Drawing No. M-601

- a. Under Existing Fan Schedule Note 1, Change (10) to (9).

40. Drawing No. M-101

- a. Modify Coded Notes #2 as follows: “PROVIDE GLAVANIZED DRIP PAN WITH LEAK DETECTOR WHICH COVERS ENTIRE ROOM. THE DRIP PAN SHALL BE INSTALLED DIRECTLY BELOW THE 5TH FLOOR SLAB AND SHALL BE SUPPORTED BY STRUCTURAL ANGLE CHANNEL AS REQUIRED. ALL LIGHTING, DUCTWORK, ETC SHALL BE INSTALLED DIRECTLY BELOW THE DRAIN PAN AND SUPPORTED BY THE STRUCTURAL ANGLE CHANNEL. MECHANICAL CONTRACTOR TO SUBMIT A SHOP DRAWING OF STRUCTURAL ANGLE CHANNEL DESIGN TO THE STRUCTURAL ENGINEER FOR REVIEW. PITCH DRIP PAN TOWARDS LEAK DETECTOR.”

41. Drawing No. M-103

- a. "8TH FLOOR RCP" to "8TH FLOOR PIPING PART PLAN"
 - i. Drawing revised to show chilled water and condensate drain piping to AC unit.
Refer SK-M-01
- b. "L1 LEVEL RCP" to "L1 LEVEL PIPING PART PLAN"
 - i. Drawing revised to show condensate drain piping. Refer SK-M-02
- c. "8TH FLOOR RCP" to "8TH FLOOR DUCTWORK PART PLAN"

END OF ADDENDUM

James Dirolf, P.E.
Director of Design

SECTION 230719

INSULATION

PART 1 GENERAL

1.01 RELATED WORK SPECIFIED ELSEWHERE

- A. Through Penetration Firestops: Section 078400.
- B. Painting: Section 099103.
- C. Pipe Hangers and Supports: Section 230529.

1.02 ABBREVIATIONS

- A. FS: Federal Specification.
- B. K: Thermal Conductivity, i.e., maximum Btu per inch thickness per hour per square foot.
- C. pcf: Pounds per cubic foot.
- D. PVC: Polyvinylchloride.

1.03 SUBMITTALS

- A. Product Data:
 - 1. Manufacturer's catalog sheets, specifications and installation instructions for insulation materials and jacket materials.
 - 2. Materials Schedule: Itemize insulation materials and thicknesses for each specified application in Insulation Material Schedules in Part 3 of this Section. Where optional materials are specified, indicate option selected.
- B. Quality Control Submittals:
 - 1. Installers Qualification Data:
 - a. Name of each person who will be performing the Work, and their employer's name, business address and telephone number.
 - b. Furnish names and addresses of the required number of similar projects that each person has worked on which meet the qualifications.

1.04 QUALITY ASSURANCE

- A. Qualifications: The persons installing the Work of this Section and their Supervisor shall be personally experienced in mechanical insulation work and shall have been regularly employed by a company installing mechanical insulation for a minimum of 5 years.

- B. Regulatory Requirements:
 - 1. Insulation installed inside buildings, including duct lining materials, laminated jackets, mastics, sealants and adhesives shall have a Fire Spread/Smoke Developed Rating of 25/50 or less based on ASTM E 84.

PART 2 PRODUCTS

2.01 INSULATION

- A. Fibrous Glass (Mineral Fiber) Insulation: Composed principally of fibers manufactured from rock, slag, or glass, with or without binders, and asbestos free.
 - 1. Preformed Pipe Insulation: Minimum density 3 pcf; ASTM C 547:
 - a. Class 1 (Suitable for Temperatures Up to 450 degrees F): K of 0.26 at 75 degrees F.
 - b. Class 2 (Suitable for Temperatures 451 to 650 degrees F): K of 0.46 at 300 degrees F.
 - c. Class 3 (Suitable for Temperatures 651 to 1200 degrees F): K of 0.56 at 300 degrees F.
 - 2. Premolded Fitting Insulation: Minimum density 4.0 pcf, K of 0.26 at 75 degrees F; ASTM C 547, Class 1.
 - 3. Insulation Inserts for PVC Fitting Jackets: Minimum density 1.5 pcf, K of 0.28 at 75 degrees F; ASTM C 553, Type III.
 - a. Suitable for temperatures up to 450 degrees F.
 - 4. Block or Board Insulation: Minimum density 3.0 pcf and 6.0 pcf as specified; ASTM C 612:
 - a. Type IA or IB (Suitable for Temperatures Up to 450 degrees F): K of 0.26 at 75 degrees F.
 - b. Type II (Suitable for Temperatures 451 to 850 degrees F): K of 0.44 at 300 degrees F.
 - c. Type III (Suitable for Temperatures 851 to 1000 degrees F): K of 0.44 at 300 degrees F.
 - d. Type IV (Suitable for Temperatures 1001 to 1200 degrees F): K of 0.37 at 300 degrees F.
 - e. Type V (Suitable for Temperatures 1201 to 1800 degrees F): K of 0.42 at 300 degrees F.
 - 5. Thermal and Acoustic Board Insulation: Minimum density 3.0 pcf, K of 0.27 at 75 degrees F; ASTM C 1071, Type II.
 - a. Air Stream Side: Erosion, temperature, and fire resistant type; NFPA 90-A and 90-B.
 - 6. Blanket Insulation:
 - a. For Ductwork (Suitable for Temperatures Up to 450 Degrees F): Minimum density 1.0 pcf, K of 0.31 at 75 degrees F; ASTM C 553, Type II.
 - b. For Breeching (Suitable for Temperatures up to 1200 degrees F): Minimum density 8 pcf, K of 0.55 at 400 degrees F, metal mesh faced one side; ASTM C 553, Type VII.
- B. Flexible Elastomeric Foam Insulation:
 - 1. FM tested and approved, meeting the following:

- a. Maximum Water Vapor Transmission: 0.10 perm - inch based on ASTM E 96, Procedure A.
 - b. K of 0.27 at 75 degrees F based on ASTM C 518 or C 177.
 - c. Fire Spread/Smoke Developed Rating: 25/50 or less based on ASTM E 84.
 - 2. Pipe Insulation: ASTM C 534, Type I.
 - 3. Sheet Insulation for Ductwork and Equipment: ASTM C 534, Type II, smooth skin one side.
 - 4. Polyethylene and polyolefin insulation is not acceptable.
- C. High Density Jacketed Insulation Inserts for Hangers and Supports:
- 1. For Use with Fibrous Glass Insulation:
 - a. Cold Service Piping:
 - 1) Polyurethane Foam: Minimum density 4 pcf, K of 0.13 at 75 degrees F, minimum compressive strength of 125 psi.
 - b. Hot Service Piping:
 - 1) Calcium Silicate: Minimum density 15 pcf, K of 0.50 at 300 degrees F; ASTM C 533.
 - 2) Perlite: Minimum density 12 pcf, K of 0.60 at 300 degrees F; ASTM C 610.
 - c. Ductwork: Fibrous glass board, minimum density 6 pcf, K of 0.26 at 75 degrees F, conforming to ASTM C 612, Type IA or IB.
 - 2. For Use with Flexible Elastomeric Foam Insulation:
 - a. Ductwork and Piping: Hardwood dowels and blocks, length or thickness equal to insulation thickness, other dimensions as specified or required.
- D. Cements:
- 1. Fibrous Glass Thermal Insulating Cement: Asbestos free; ASTM C 195.
 - 2. Fibrous Glass Hydraulic Setting Thermal Insulating and Finishing Cement: ASTM C 449/C 449M.

2.02 JACKETS

- A. Laminated Vapor Barrier Jackets for Piping and Ductwork: Factory applied by insulation manufacturer, conforming to ASTM C 1136, Types I and II.
 - 1. Type I: Reinforced white kraft and aluminum foil laminate with kraft facing out.
 - a. Pipe Jackets: Furnished with integral 1-1/2 inch self sealing longitudinal lap, and separate 3 inch wide adhesive backed butt strips.
 - 2. Type II: Reinforced aluminum foil and kraft laminate with foil facing out.
 - 3. Laminated vapor barrier jackets are not required for flexible elastomeric foam insulation.
- B. Canvas Jackets: Cotton duck, fire retardant, complying with NFPA 701, 4 oz or 6 oz per sq yd as specified.

- C. Premolded PVC Fitting Jackets:
 - 1. Constructed of high impact, UV resistant PVC.
 - a. ASTM D 1784, Class 14253-C.
 - b. Working Temperature: 0-150 degrees F.

- D. Metal Jacketing:
 - 1. Aluminum: ASTM B 209, Alloys 1100, 30003, 3105 or 5005, Temper H14, 0.016 inch thick.
 - a. Factory Pre-formed Sectional Pipe Jacketing:
 - 1) Smooth outer finish with integral bonded laminated polyethylene film - kraft paper moisture barrier underside.
 - 2) Pittsburg or modified Pittsburg longitudinal lock seams.
 - 3) 2 inch overlapping circumferential joints with integral locking clips, or butt joints sealed with 2 inch wide mastic backed aluminum snap bands.
 - b. Roll Jacketing: Smooth outer finish with integral bonded laminated polyethylene film - kraft paper moisture barrier underside.
 - c. Sheet Jacketing: Corrugated 1-1/4 inch x 1/4 inch deep with integral bonded laminated polyethylene film - kraft paper moisture barrier underside.
 - d. Fastening Devices:
 - 1) Strapping: Type 18-8 stainless steel, 0.020 inch thick, 1/2 and 3/4 inch wide as specified.
 - 2) Wing Seals: Type 18-8 stainless steel, 0.032 inch thick.
 - 3) Sheet Metal Screws: Panhead, Type A, hardened aluminum, and stainless steel.
 - 2. Circumferentially Corrugated Aluminum Jacketing: Childers' Corrolon.
 - a. Construction: 3/16 inch circumferentially corrugated embossed aluminum, ASTM B 209, Types 1100, 3003, 3105, or 505, H-14 temper, 0.016 inch thick.
 - b. Moisture Barrier: Integrally bonded to jacket over entire surface in contact with insulation.
 - c. Fastening Devices:
 - 1) Strapping: 0.020 inch thick by 1/2 inch wide, Type 3003, 3105, 5005, H-14 temper.
 - 2) Wing Seals: 0.032 inch thick Type 5005, H-14 temper aluminum.

2.03 ADHESIVES, MASTICS, AND SEALERS

- A. Lagging Adhesive (Canvas Jackets): Childers' CP-50A, Epolux's Cadalag 336, Foster's 30-36.

- B. Vapor Seal Adhesive (Fibrous Glass Insulation): Childers' CP-82, Epolux's Cadoprene 400, Foster's 85-75 or 85-20.

- C. Vapor Barrier Mastic/Joint Sealer (Fibrous Glass Insulation): Childers' CP-30, Epolux's Cadalar 670, Foster's 95-44 or 30-35.

- D. Adhesive (Flexible Elastomeric Foam): Armstrong's 520, Childers' CP-80, Epolux's Cadoprene 488, Foster's 82-40.
- E. Adhesive (Reinforcing Membrane): Childers' Chil-Spray WB CP-56.
- F. Mastic (Reinforcing Membrane): Childers' AK-CRYL CP-9.
- G. Sealant (Metal Pipe Jacket): One-part silicone sealant for high temperatures; Dow Corning's Silastic 736 RTV or General Electric's RTV 106.

2.04 MISCELLANEOUS MATERIALS

- A. Insulation Fasteners for Ductwork and Equipment:
 - 1. Acceptable Manufacturers: Duro-Dyne Corp.; Erico Fastening Systems, Inc.
 - 2. Type: Weld pins, complete with self-locking insulation retaining washers.
- B. Pressure Sensitive Tape for Sealing Laminated Jackets:
 - 1. Acceptable Manufacturers: Alpha Associates, Childers, Ideal Tape, Morgan Adhesive.
 - 2. Type: Same construction as jacket.
- C. Wire, Bands, and Wire Mesh:
 - 1. Binding and Lacing Wire: Nickel copper alloy or copper clad steel, gage as specified.
 - 2. Bands: Galvanized steel, 1/2 inch wide x 0.015 inch thick, with 0.032 inch thick galvanized wing seals.
 - 3. Wire Mesh: Woven 20 gage steel wire with 1 inch hexagonal openings, galvanized after weaving.
- D. Metal Corner Angles: Galvanized steel, 2 x 2 inch 28 gage.
- E. Reinforcing Membrane: Glass or Polyester, 10 x 10 mesh. Alpha Associates Style 59, Childers' Chil-Glas, Foster's MAST-A-FAB.

PART 3 EXECUTION

3.01 PREPARATION

- A. Perform the following before starting insulation Work:
 - 1. Install hangers, supports and appurtenances in their permanent locations.
 - 2. Complete testing of piping, ductwork, and equipment.
 - 3. Clean and dry surfaces to be insulated.

3.02 INSTALLATION, GENERAL

- A. Install the Work of this Section in accordance with the manufacturer's printed installation instructions unless otherwise specified.

- B. Piping Insulation: Provide continuous insulation and jacketing when passing thru interior wall, floor, and ceiling construction.
 - 1. At Through Penetration Firestops: Coordinate insulation densities with the requirements of approved firestop system being installed. See Section 078400.
 - a. Insulation densities required by approved firestop system may vary with the densities specified in this Section. When this occurs use the higher density insulation.
- C. Do not intermix different insulation materials on individual runs of piping.

3.03 INSTALLATION AT HANGERS AND SUPPORTS

- A. Reset and realign hangers and supports if they are displaced while installing insulation.
- B. Install high density jacketed insulation inserts at hangers and supports for insulated ductwork, piping, and equipment.
- C. Insulation Inserts For Use with Fibrous Glass Insulation:
 - 1. Ductwork: Install 6 pcf density jacketed fibrous glass board, same thickness as adjoining insulation, sized for full bearing on supporting trapeze member, and as required to enable abutting to adjoining insulation and overlapping of jacketing.
 - 2. Piping: Where clevis hangers are used, install insulation shields and high density jacketed insulation inserts between shield and pipe.
 - a. Where insulation is subject to compression at points over 180 degrees apart, e.g. riser clamps, U-bolts, trapezes, etc.; fully encircle pipe with 2 protection shields and 2 high density jacketed fibrous glass insulation inserts within supporting members.
 - 1) Exception: Locations where pipe covering protection saddles are specified for hot service piping, 6 inch and larger.
- D. Insulation Inserts For Use with Flexible Elastomeric Foam Insulation:
 - 1. Ductwork: Install hardwood block, same thickness as adjoining insulation, sized for full bearing on supporting trapeze member and as required to abutt and seal vapor tight with adjoining insulation.
 - 2. Piping:
 - a. Where clevis hangers are used, install insulation shields with hardwood filler pieces, same thickness as adjoining insulation, inserted in undersized die cut or slotted holes in insulation at support points.
 - b. Contour hardwood blocks to match the curvature of pipe, and shield.
 - c. Coat dowels and blocks with insulation adhesive, and insert while still wet.
 - d. Vapor seal outer surfaces of dowels and blocks with adhesive after insertion.

e. Install filler pieces as follows:

PIPE/TUBING SIZE	FILLER PIECES	POSITION
Thru 1-1/2"	2 dowel plugs	6 o'clock; in tandem
2" thru 4"	1 block 2 dowel plugs	6 o'clock, and 4 & 8 o'clock respectively
6" thru 8"	2 blocks 4 dowel plugs	6 o'clock; in tandem and 4 & 8 o'clock; in tandem

3.04 INSTALLATION OF FIBROUS GLASS COLD SERVICE INSULATION

- A. Install insulation materials with a field or factory applied ASTM C 1136 Type I laminated vapor barrier jacket, unless otherwise specified.
- B. Piping:
 - 1. Butt insulation joints together, continuously seal minimum 1-1/2 inch wide self sealing longitudinal jacket laps and 3 inch wide butt adhesive backed strips.
 - a. Substitution: 3 inch wide pressure sensitive sealing tape, of same material as jacket, may be used in lieu of butt strips.
 - 2. Bed insulation in a 2 inch wide band of vapor barrier mastic, and vapor seal exposed ends of insulation with vapor barrier mastic at each butt joint between pipe insulation and equipment, fittings or flanges at the following intervals:
 - a. Horizontal Pipe Runs: 21 ft.
 - b. Vertical Pipe Runs: 9 ft.
- C. Fittings, Valves, Flanges and Irregular Surfaces:
 - 1. Insulate with mitre cut or premolded fitting insulation of same material and thickness as pipe insulation.
 - 2. Secure insulation in place with 16 gage wire, with ends twisted and turned down into insulation.
 - 3. Butt insulation against pipe insulation and bond with joint sealer.
 - 4. Insulate valves up to and including bonnets, without interfering with packing nuts.
 - 5. Apply leveling coat of insulating cement to smooth out insulation and cover wiring.
 - 6. When insulating cement has dried, seal fitting, valve and flange insulation, by imbedding a layer of reinforcing membrane or 4 oz. canvas jacket between 2 flood coats of vapor barrier mastic, each 1/8 inch thick wet.
 - 7. Lap reinforcing membrane or canvas on itself and adjoining pipe insulation at least 2 inches.
 - 8. Trowel, brush or rubber glove outside coat over entire insulated surface.
 - 9. Exceptions:
 - a. In Mechanical Equipment Rooms, Steam Service Rooms, Machine Rooms, Boiler Rooms, Penthouses, Finished Rooms and Finished Spaces: Cover fittings, valves and flanges insulated with fibrous glass with an additional 6 oz canvas

jacket, lapped on adjoining insulation and pasted with lagging adhesive.

- b. Type C and D Piping Systems: Valves, fittings and flanges may be insulated with premolded PVC fitting jackets, with fibrous glass insulation inserts.
 - 1) Additional insulation inserts are required for services with operating temperatures under 45 degrees F or where insulation thickness exceeds 1-1/2 inches. The surface temperature of PVC fitting jacket must not go below 45 degrees F.

3.05 INSTALLATION OF FIBROUS GLASS HOT SERVICE INSULATION

- A. Install insulation materials with field or factory applied ASTM C 1136 Type I laminated vapor barrier jacket unless otherwise specified.
- B. Canvas Jackets on Piping, Fittings, Valves, Flanges, Unions, and Irregular Surfaces:
 - 1. For Piping 2 inch Size and Smaller: 4 oz per sq yd unless otherwise specified.
 - 2. For Piping Over 2 inch Size: 6 oz per sq yd unless otherwise specified.
- C. Piping:
 - 1. Butt insulation joints together, continuously seal minimum 1-1/2 inch wide self sealing longitudinal jacket laps and 3 inch wide adhesive backed butt strips.
 - a. Substitution: 3 inch wide pressure sensitive sealing tape, of same material as the jacket, may be used in lieu of butt strips.
 - 2. Fill voids in insulation at hanger with insulating cement.
 - 3. Exceptions:
 - a. Piping in Accessible Shafts, Attic Spaces, Crawl Spaces, Unfinished Spaces and Concealed Piping: Butt insulation joints together and secure minimum 1-1/2 inch wide longitudinal jacket laps and 3 inch wide butt strips of same material as jacket, with outward clinching staples on maximum 4 inch centers. Fill voids in insulation at hangers with insulating cement.
 - b. Piping in Tunnels: Butt insulation joints together and secure minimum 1-1/2 inch wide longitudinal jacket laps and 3 inch wide butt strips, of same material as jacket, with outward clinching staples on maximum 4 inch centers and 16 gage wires a minimum of 4 loops per section. Fill voids in insulation with insulating cement.
- D. Fittings, Valves, Flanges and Irregular Surfaces:
 - 1. Insulate with mitre cut or premolded fitting insulation of same material and thickness as insulation.
 - 2. Secure in place with 16 gage wire, with ends twisted and turned down into insulation.
 - 3. Butt fitting, valve and flange insulation against pipe insulation, and fill voids with insulating cement.

4. Insulate valves up to and including bonnets, without interfering with packing nuts.
5. Apply leveling coat of insulating cement to smooth out insulation and cover wiring.
6. After insulating cement has dried, coat insulated surface with lagging adhesive, and apply 4 oz or 6 oz canvas jacket as required by pipe size.
 - a. Lap canvas jacket on itself and adjoining pipe insulation at least 2 inches.
 - b. Size entire canvas jacket with lagging adhesive.
7. Exceptions:
 - a. In Types E, F and G Service Piping Systems: Valves, fittings and flanges may be insulated with premolded PVC fitting jackets, with fibrous glass insulation inserts.
 - 1) Additional insulation inserts are required for services with operating temperatures over 250 degrees F or where insulation thickness exceeds 1-1/2 inches. The surface temperature of PVC fitting jacket must not exceed 150 degrees F.
 - b. In Types E, F, and G Service Piping Systems: Insulate fittings, valves, and irregular surfaces 3 inch size and smaller with insulating cement covered with 4 oz or 6 oz canvas jacket as required by pipe size.
 - 1) Terminate pipe insulation adjacent to flanges and unions with insulating cement trowelled down to pipe on a bevel.
 - c. In Type H Service Piping System: Insulate fittings, valves, flanges, unions, and irregular surfaces 3 inch size and smaller with insulating cement covered with 4 oz or 6 oz canvas jacket as required by pipe size.
 - d. Fittings, Valves, Flanges, and Irregular Surfaces In Concealed Piping, Piping in Accessible Shafts, Attic Spaces, Crawl Spaces, Unfinished Rooms, Unfinished Spaces, and Tunnels: Sizing of canvas surface is not required.

E. Equipment:

1. Secure fibrous glass block or board insulation in place with wire or galvanized steel bands.
 - a. Small Areas: Secure insulation with 16 gage wire on maximum 6 inch centers.
 - b. Large Areas: Secure insulation with 14 gage wire or .015 inch thick by 1/2 inch wide galvanized steel bands on maximum 10 inch centers. Stagger insulation joints.
 - c. Irregular Surfaces: Where application of block or board insulation is not practical, insulate with insulating cement built-up to same thickness as adjoining insulation.
2. Fill joints, voids and irregular surfaces with insulating cement, to a uniform thickness.
3. Stretch wire mesh over entire insulated surface and secure to anchors, with wire edges laced together.
4. Apply finishing cement, total of 1/2 inch thick, in 1/4 inch thick coats.
 - a. Trowel second coat to a smooth hard finish.

5. Neatly bevel insulation around manholes, handholes, cleanouts, ASME stamp, boiler manufacturer's name and catalog number.

3.06 INSTALLATION OF FLEXIBLE ELASTOMERIC FOAM INSULATION

- A. Where possible, slip insulation over the pipe, and seal butt joints with adhesive.
 1. Where the slip-on technique is not possible, slit the insulation and install.
 2. Re-seal with adhesive, making sure the mating surfaces are completely joined.
- B. Insulate fittings and valves with miter cut sections. Use templates provided by the manufacturer, and assemble the cut sections in accordance with the manufacturer's printed instructions.
 1. Insulate threaded fittings and valves with sleeved fitting covers. Over lap and seal the covers to the adjoining pipe insulation with adhesive.
- C. Carefully mate and seal with adhesive all contact surfaces to maintain the integrity of the vapor barrier of the system.
- D. Insulated Covers for Pumps:
 1. Do not extend pump insulation beyond or interfere with stuffing boxes, or interfere with adjustment and servicing of parts requiring regular maintenance or operating attention.
- E. Piping Exposed Exterior to a Building, Totally Exposed to the Elements:
 1. Apply flexible elastomeric foam insulation to piping with adhesive.
 2. Apply reinforcing membrane around piping insulation with adhesive or mastic.
 3. Adhesive Applied System: Apply 2 coats of finish. See Section 099103.
 4. Mastic Applied System: Apply another coat of mastic over reinforcing membrane.

3.07 INSTALLATION OF SHEET METAL JACKETING ON PIPING

- A. Secure jacketing to insulated piping with preformed aluminum snap straps and stainless steel strapping installed with special banding wrench.
- B. Jacket exposed insulated fittings, valves and flanges with mitred sections of aluminum jacketing.
 1. Seal joints with sealant and secure with preformed aluminum bands.
 2. Substitution: Factory fabricated, preformed, sectional aluminum fitting covers may be used in lieu of mitred sections of aluminum jacketing for covering fittings, valves and flanges.
 3. Substitution: Factory fabricated, preformed, sectional aluminum fitting covers or premolded polyvinylchloride fitting covers may be used in lieu of mitred sections of aluminum jacketing for covering fittings, valves and flanges.

3.08 INSTALLATION OF DUCTWORK INSULATION

- A. Fibrous Glass Board Insulation Application:

1. Secure insulation to ductwork, with duct insulation fasteners spaced 3 inch in from all corners of ducts, with intermediate fasteners on maximum 16 inch centers in all directions.
2. Butt edges of insulation and fill voids with similar insulation.
3. Seal minimum 1-1/2 inch wide longitudinal jacket laps continuously with vapor seal adhesive.
4. Lap circumferential joints with 4 inch wide jacket material and seal laps continuously with vapor barrier lap adhesive, or seal continuously with minimum 3 inch wide pressure sensitive sealing tape, of same material as jacket.
5. Install metal corner angles over the jacketed insulated corners. Seal exposed ends of insulation with vapor barrier mastic.
6. Vapor seal breaks in vapor barrier jacketing, exposed surfaces of duct insulation fasteners and metal corner angles, with pressure sensitive sealing tape of same material as jacket or coat with vapor barrier mastic.
7. Field apply 6 oz canvas jacket over the vapor barrier jacketed insulation where indicated on Ductwork Service Insulation Material Schedule in Part 3 of this Section.
 - a. Apply canvas jacket with lagging adhesive, with a 2 inch lap on circumferential and longitudinal seams.
 - b. Outward clinching staples may be utilized for additional securement of canvas to bottom of ducts in excess of 48 inch in width.
 - c. Apply heavy coat of lagging adhesive to entire canvas surface.
8. Place trapeze hangers, fabricated of steel rods and structural steel channels or angles, outside of jacketed insulated ducts.
 - a. Install high density insulation inserts, of thickness equal to insulation, minimum of 4 inch in width by the bottom dimension of the duct, at points of support.
 - b. Continuously jacket insulated ducts and filler pieces through supports.

B. Fibrous Glass Blanket Insulation Application:

1. Cut insulation to stretch-out dimensions as recommended by insulation manufacturer.
2. Remove 2 inch wide strip of insulation material from the jacketing on the longitudinal and circumferential joint edges to form an overlapping staple/tape flap.
3. Install insulation with jacketing outside so staple/tape flap overlaps insulation and jacketing on other end.
4. Butt ends of insulation tightly together.
 - a. Rectangular and Square Ductwork: Do not compress insulation at duct corners.
5. Staple longitudinal and circumferential joints with outward clinching staples minimum 6 inches on center, and seal with pressure sensitive sealing tape.
6. Cut off pretruding ends of fasteners flush with insulation surface and seal with pressure sensitive sealing tape.
7. Install duct insulation fasteners on bottom side of horizontal duct runs, when bottom dimension of the duct is in excess of 24 inches in width.

8. Install duct insulation fasteners on sides of duct risers having a dimension over 24 inches in size.
9. Seal tears, punctures, and penetrations of insulation jacketing with sealing tape.
10. Secure insulation to ductwork with fasteners spaced in accordance with the following schedule:

DUCT DIMENSION	SPACING OF FASTENERS (MINIMUM)
Up to 24 inches	None required.
24 inches to 48 inches	Horizontal Runs: 2 rows - 16 inches on center. Risers: 16 inches on center, all directions.
49 inches to 60 inches	Horizontal Runs: 3 rows - 16 inches on center. Risers: 16 inches on center, all directions.
61 inches and over	Horizontal Runs: 16 inches on center, all directions. Risers: 16 inches on center, all directions.

- C. Bench Insulated Ductwork:
 1. Insulate ducts prior to erection in place when ducts are required to be installed proximate to walls, ceilings, equipment or other ductwork, which will not permit adequate space for installation of insulation after ducts are installed.
 2. Line interior surfaces of ducts with thermal and acoustic board insulation, when the specified application of exterior insulation is impractical.
 - a. Written permission from the Director must be received, prior to the substitution of lined ducts for exterior insulated ducts.
 - b. Maintain interior cross-sectional areas of ducts, as noted on drawings.

- D. Flexible Elastomeric Foam Insulation on Ductwork Exposed to the Elements, Exterior to a Building:
 1. Apply 2 inch thick flexible elastomeric foam sheet insulation to ductwork with adhesive.
 - a. Insulate sheet metal duct seams, angle bracing, and reinforcing with same insulation thickness specified for ductwork.
 2. Apply reinforcing membrane around ductwork insulation with adhesive or mastic.
 3. Adhesive Applied System: Apply 2 coats of finish. See Section 099103.
 4. Mastic Applied System: Apply another coat of mastic over reinforcing membrane.

3.10 FIELD QUALITY CONTROL

- A. Field Samples: The Director's Representative, may at his discretion, take field samples of installed insulation for the purpose of checking materials and application. Reinsulate sample cut areas.

3.11 PIPING AND EQUIPMENT INSULATION SCHEDULE

- A. Insulate all cold service and hot service piping, equipment, and appurtenances except where otherwise specified.

- B. Schedule of Items Not to be Insulated:
 - 1. Do not insulate the following cold service items:
 - a. Actual heat transfer surfaces.
 - b. Cold water piping buried in direct contact with ground.
 - c. Chromium plated piping, unless otherwise specified.
 - d. Flexible vibration eliminators.

 - 2. Do not insulate the following hot service piping:
 - a. Plated or white metal piping.
 - b. Condenser water piping, unless otherwise indicated.
 - c. Exposed risers (hot water, low pressure steam and condensate return) in finished rooms.
 - d. Piping inside convector and finned tube radiation enclosures.
 - e. Short vertical and horizontal piping connections (less than 24 inches in length):
 - 1) Located exposed above floors in finished rooms or finished spaces.
 - 2) Serving one fixture, or one piece of equipment.
 - 3) Connected to horizontal mains, branch mains or riser mains.
 - 4) Conveying liquids or vapors at temperatures from 75 degrees F to 215 degrees F, unless otherwise specified.
 - f. Drains from heating equipment and appurtenances that flow to waste.
 - g. Water and other fluids 81 degrees F to 104 degrees F.
 - h. Branch blow-down piping connections, from continuous blow-down piping to boiler sample water coolers.
 - i. Boiler blow-off and blow-down piping.
 - j. Discharge piping from steam safety and water relief valves.
 - 3. Do not insulate the following hot service fittings, valves, flanges and irregular surfaces:
 - a. Flanges and unions in Type E, F and G service piping systems.
 - b. Hydronic Specialties:
 - 1) Flow indicators.
 - 2) Zone control valves.
 - 3) Air vents.
 - 4) Air control fittings.
 - c. Steam traps and cooling legs of steam traps.
 - d. Pressure reducing valves and pilot lines.
 - e. Safety and relief valves.
 - f. Back pressure valves.
 - g. Float chambers and level controllers.
 - h. Boiler water columns.
 - i. Soot blower heads.
 - j. Steam turbine drives.
 - k. Venturi tubes and orifice plates.
 - 4. Do not insulate the following hot service equipment:
 - a. Actual heat transfer surfaces.

- b. ASME stamps, nameplates with manufacturer's name and model number.
- 5. Do not insulate items installed under other Contracts.
- 6. Do not insulate mechanical equipment with a factory applied insulated steel jacket.

3.12 COLD SERVICE INSULATION MATERIAL SCHEDULE

TYPE	SERVICE AND TEMPERATURES	INSULATION MATERIAL	PIPE SIZES (INCHES)	MINIMUM (NOMINAL) INSULATION THICKNESS (INCHES)
C	Chilled Water and other fluids (except domestic cold water) 40 F to 80 F.	Flex. Elastomeric Foam or Fibrous Glass	1-1/2 & less	1
			Over 1-1/2	1-1/2
D	Domestic cold water, and as specified. 33 F to 80 F.	Flex. Elastomeric Foam or Fibrous Glass	All Sizes	1/2

A. NOTES:

- 1. Double the insulation thickness above for piping, installed in tunnels and conduits.
- 2. Equipment Insulation: Insulation thicknesses above also apply for flat, curved and irregular equipment surfaces.
 - a. Insulate equipment with fibrous glass board insulation with minimum density 6 pcf.
 - b. Insulate base mounted and unitary type pumps and other equipment specified, installed in potable water, ice water, chilled water and dual temperature water systems, with 3/4 inch thick sheet flexible elastomeric foam.
 - c. Exceptions: Minimum insulation thickness for Type A service shall be a minimum of 1 inch thick for flat, curved and equipment irregular surfaces.
- 3. Type D Insulation Materials: In addition to the services shown on the schedule above, use Type D materials and thicknesses for the following:
 - a. Condensate Drain Piping:
 - 1) Piping connected to drain pans under cooling coils within unit enclosure, except where over drain pans.
 - 2) Horizontal condensate drain piping outside unit enclosures.
 - 3) Vertical condensate drain piping of less than one story immediately following horizontal run.

3.13 HOT SERVICE INSULATION MATERIAL SCHEDULE

	SERVICE AND TEMPERATURES	INSULATION MATERIAL	PIPE SIZES (INCHES)	MINIMUM (NOMINAL) INSULATION THICKNESS (INCHES)
E	Water and other fluids 105 F to 140 F.	Flex. Elastomeric Foam or Fibrous Glass	1-1/2 & Less	1
			Over 1-1/2	2
F	Water and other fluids 141 F to 250 F.	Fibrous Glass	6 & Less	2
			8 & Up	2-1/2
F	Steam (LPS) to 15 psig	Fibrous Glass	1-1/2 & Less	1-1/2
			2 & Up	3
G	Steam (MPS) to 16 to 125 psig	Fibrous Glass	1 & less	2
			1-1/4 to 4	3
			5 & Up	3-1/2
H	Steam (HPS) to 126 psig and Above	Fibrous Glass	1-1/2 & less	2-1/2
			2 to 4	3
			5 & Up	3-1/2

A. NOTES:

1. Insulate piping in tunnels and conduits with insulation of thickness as follows:
 - a. Types E, F, and G Service: Minimum 2 inch thick unless greater thickness is specified in Hot Service Insulation material Schedule above.
 - b. Type H Service: Minimum 4 inch thickness.
2. Equipment Insulation:
 - a. Insulate the following with fibrous glass block or board insulation:
 - 1) Low pressure steam and heating hot water boilers.
 - b. Insulate equipment with fibrous glass board insulation with minimum density 6 pcf.
 - c. Minimum thickness for flat, curved and irregular equipment surfaces:
 - 1) 1-1/2 inch for E and F service.
 - 2) 3 inch for G service.
 - 3) 5 inch for H service.

3.14 SCHEDULE OF METAL JACKETING FOR INSULATED PIPE

- A. Jacket exposed insulated risers with preformed sectional aluminum metal jacketing, in Types E to H service piping systems, installed in finished rooms or finished spaces above Basement Floor Level.
 - 1. Exception: Preformed sectional aluminum metal jacketing is not required on piping in Mechanical Equipment Rooms, Steam Service Rooms, Penthouse, Mechanical Equipment Rooms and Machine Rooms.

- B. Install jacketing from floor to ceiling or from floor to first change of direction in riser, when such change in direction is a minimum of 9'-0" above finished floor, whichever is applicable.
 - 1. The aforementioned also applies to down feed piping systems.

- C. Piping in Tunnel Manholes: Jacket insulated piping with circumferentially corrugated aluminum jacketing.
 - 1. Lap longitudinal and circumferential joints a minimum of 2 inches.
 - 2. Secure jacketing in place with 1/2 inch x 0.020 inch thick aluminum bands secured with aluminum wing type seals, on maximum 12 inch centers.
 - 3. Jacketing is not required on fittings, valves, flanges, and irregular surfaces.
 - 4. Install jacketing so as to avoid trapping condensation and precipitation.
 - 5. Extend jacketing a minimum of 10 feet inside tunnels in all directions.

- D. Piping Exterior to Building: Jacket insulated piping with circumferentially corrugated aluminum jacketing.
 - 1. Lap longitudinal and circumferential joints a minimum of 2 inches.
 - 2. Secure jacketing in place with 1/2 inch x 0.020 inch thick aluminum bands secured with aluminum wing type seals, on maximum 12 inch centers.
 - 3. Cover insulated fittings, valves, and offsets with mitered sections of jacketing. Seal joints with mastic, and secure with aluminum strapping and wing seals.
 - 4. Factory fabricated, preformed fitting covers of same material as jacketing may be used instead of mitered jacketing.
 - 5. Install jacketing so as to avoid trapping condensation and precipitation.

3.16 DUCTWORK SERVICE INSULATION SCHEDULE

- A. Insulate all ductwork service except where otherwise specified.

- B. Do not insulate the following ductwork service items:
 - 1. Exhaust ductwork, unless otherwise shown.
 - 2. Return fans.
 - 3. Exhaust fans.
 - 4. Interior lined ductwork.
 - 5. Flexible ductwork connections.
 - 6. Interior lined air terminal units.

7. Sound absorbers.
8. Ductwork located within equipment.
9. Ductwork where design temperature difference between interior and exterior of duct or plenum does not exceed 15 degrees F.

3.17 DUCTWORK SERVICE INSULATION MATERIAL SCHEDULE

LOCATION	SERVICE	INSUL. MATERIAL	MINIMUM INSUL. THICKNESS	JACKET TYPE	MINIMUM REQUIRED R VALUE
Concealed, inside building insul. envelope in unconditioned spaces (in shafts, ceilings, walls, and floors)	Air Conditioning Supply and Returns Under 65 F, 100% Outside Air, Heating Supply Over 85 F.	Fibrous Glass Blanket	2	I or II	R-5
	Returns with Temp. Diff. With Ambient Greater than 15 degrees F	Fibrous Glass Board	1-1/2	I or II	
Exposed, inside building insul. envelope.	Air Conditioning Supply Under 65 F, 100% Outside Air, Heating Supply Over 85 F.	Fibrous Glass Board	1-1/2	I with Canvas Outer Jacket	R-5
Inside building but exposed to outside air temp., e.g., ventilated attic.	Air Conditioning Supply, Heating Supply, All Returns including returns mixed with outside air.	Fibrous Glass Blanket	2-1/2	I or II	R-8
		Fibrous Glass Board	2	I or II	

A. NOTES:

1. Equipment: Insulate air handling equipment, not furnished with factory applied insulated jacket or internal insulation, with minimum 1-1/2 inch thick fibrous glass board with an ASTM C 1136 Type I jacket, installed and finished as specified for exposed ductwork in finished spaces.

END OF SECTION

SECTION 265100

INTERIOR LIGHTING

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Interior lighting fixtures, lamps, and ballasts.
 - 2. Exit signs.
 - 3. Lighting fixture supports.

1.02 SUBMITTALS

- A. Waiver of Submittals: The “Waiver of Certain Submittal Requirements” in Section 013300 does not apply to this Section.
- B. Product Data: For each type of lighting fixture, arranged in order of fixture designation. Include data on features, accessories, finishes, and the following:
 - 1. Physical description of lighting fixture including dimensions.
 - 2. Ballast, including BF.
 - 3. Life, output (lumens, CCT, and CRI), and energy-efficiency data for lamps.
 - 4. Photometric data and adjustment factors based on laboratory tests, complying with IESNA Lighting Measurements Testing & Calculation Guides, of each lighting fixture type. The adjustment factors shall be for lamps, ballasts, and accessories identical to those indicated for the lighting fixture as applied in this Project.
 - a. Testing Agency Certified Data: Photometric data shall be certified by a qualified independent testing agency. Photometric data for remaining fixtures shall be certified by manufacturer.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- D. Comply with NFPA 70.

1.03 COORDINATION

- A. Coordinate layout and installation of lighting fixtures and suspension system with other construction that penetrates ceilings or is supported by them, including HVAC equipment, fire-suppression system, and partition assemblies.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Products: Subject to compliance with requirements, provide product indicated on Drawings.

2.02 GENERAL REQUIREMENTS FOR LIGHTING FIXTURES AND COMPONENTS

- A. Recessed Fixtures: Comply with NEMA LE 4 for ceiling compatibility for recessed fixtures.
- B. Fluorescent Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE 5 and NEMA LE 5A as applicable.
- C. Metal Parts: Free of burrs and sharp corners and edges.
- D. Sheet Metal Components: Steel unless otherwise indicated. Form and support to prevent warping and sagging.
- E. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.
- F. Diffusers and Globes:
 - 1. Acrylic Lighting Diffusers: 100 percent virgin acrylic plastic. High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
 - a. Lens Thickness: At least 0.125 inch (3.175 mm) minimum unless otherwise indicated.
 - b. UV stabilized.
 - 2. Glass: Annealed crystal glass unless otherwise indicated.
- G. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps and ballasts. Labels shall be located where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.
 - 1. Label shall include the following lamp and ballast characteristics:
 - a. "USE ONLY" and include specific lamp type.
 - b. Lamp diameter code (T-4, T-5, T-8, T-12, etc.), tube configuration (twin, quad, triple, etc.), base type, and nominal wattage for fluorescent and compact fluorescent luminaires.
 - c. Lamp type, wattage, bulb type (ED17, BD56, etc.) and coating (clear or coated) for HID luminaires.
 - d. Start type (preheat, rapid start, instant start, etc.) for fluorescent and compact fluorescent luminaires.
 - e. ANSI ballast type (M98, M57, etc.) for HID luminaires.

- f. CCT and CRI for all luminaires.
- H. Electromagnetic-Interference Filters: Factory installed to suppress conducted electromagnetic interference as required by MIL-STD-461E. Fabricate lighting fixtures with one filter on each ballast indicated to require a filter.

2.03 BALLASTS FOR LINEAR FLUORESCENT LAMPS

- A. General Requirements for Electronic Ballasts:
 - 1. Comply with UL 935 and with ANSI C82.11.
 - 2. Designed for type and quantity of lamps served.
 - 3. Ballasts shall be designed for full light output unless another BF, dimmer, or bi-level control is indicated.
 - 4. Total Harmonic Distortion Rating: Less than 20 percent.
 - 5. Transient Voltage Protection: IEEE C62.41.1 and IEEE C62.41.2, Category A or better.
 - 6. Operating Frequency: 42 kHz or higher.
 - 7. Lamp Current Crest Factor: 1.7 or less.
 - 8. BF: 0.88 or higher.
 - 9. Power Factor: 0.95 or higher.
 - 10. Parallel Lamp Circuits: Multiple lamp ballasts shall comply with ANSI C82.11 and shall be connected to maintain full light output on surviving lamps if one or more lamps fail.
- B. Luminaires controlled by occupancy sensors shall have programmed-start ballasts.
- C. Electronic Programmed-Start Ballasts for T5 Lamps: Comply with ANSI C82.11 and the following:
 - 1. Lamp end-of-life detection and shutdown circuit for T5 diameter lamps.
 - 2. Automatic lamp starting after lamp replacement.
- D. Ballasts for Low Electromagnetic-Interference Environments: Comply with 47 CFR 18, Ch. 1, Subpart C, for limitations on electromagnetic and radio-frequency interference for consumer equipment.
- E. Ballasts for Dimmer-Controlled Lighting Fixtures: Electronic type.
 - 1. Dimming Range: 100 to 1 percent of rated lamp lumens.
 - 2. Ballast Input Watts: Can be reduced to 20 percent of normal.
 - 3. Compatibility: Certified by manufacturer for use with specific dimming control system and lamp type indicated.
 - 4. Control: Coordinate wiring from ballast to control device to ensure that the ballast, controller, and connecting wiring are compatible.
- F. Ballasts for Bi-Level Controlled Lighting Fixtures: Electronic type.
 - 1. Operating Modes: Ballast circuit and leads provide for remote control of the light output of the associated lamp between high- and low-level and off.
 - a. High-Level Operation: 100 percent of rated lamp lumens.

- b. Low-Level Operation: 30 percent of rated lamp lumens.
- 2. Ballast shall provide equal current to each lamp in each operating mode.
- 3. Compatibility: Certified by manufacturer for use with specific bi-level control system and lamp type indicated.

2.04 BALLASTS FOR COMPACT FLUORESCENT LAMPS

- A. Description: Electronic-programmed rapid-start type, complying with UL 935 and with ANSI C 82.11, designed for type and quantity of lamps indicated. Ballast shall be designed for full light output unless dimmer or bi-level control is indicated:
 - 1. Lamp end-of-life detection and shutdown circuit.
 - 2. Automatic lamp starting after lamp replacement.
 - 3. Sound Rating: Class A.
 - 4. Total Harmonic Distortion Rating: Less than 20 percent.
 - 5. Transient Voltage Protection: IEEE C62.41.1 and IEEE C62.41.2, Category A or better.
 - 6. Operating Frequency: 20 kHz or higher.
 - 7. Lamp Current Crest Factor: 1.7 or less.
 - 8. BF: 0.95 or higher unless otherwise indicated.
 - 9. Power Factor: 0.95 or higher.
 - 10. Interference: Comply with 47 CFR 18, Ch. 1, Subpart C, for limitations on electromagnetic and radio-frequency interference for nonconsumer equipment.

2.05 EMERGENCY FLUORESCENT POWER UNIT

- A. Internal Type: Self-contained, modular, battery-inverter unit, factory mounted within lighting fixture body and compatible with ballast. Comply with UL 924.
 - 1. Emergency Connection: Operate one fluorescent lamp(s) continuously at an output of 1100 lumens each.
 - 2. Nightlight Connection: Operate one fluorescent lamp continuously.
 - 3. Test Push Button and Indicator Light: Visible and accessible without opening fixture or entering ceiling space.
 - a. Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
 - b. Indicator Light: LED indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
 - 4. Battery: Sealed, maintenance-free, nickel-cadmium type.
 - 5. Charger: Fully automatic, solid-state, constant-current type with sealed power transfer relay.
 - 6. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing red LED.
- B. External Type: Self-contained, modular, battery-inverter unit, suitable for powering one or more fluorescent lamps, remote mounted from lighting fixture. Comply with UL 924.
 - 1. Emergency Connection: Operate one fluorescent lamp continuously. Connect unswitched circuit to battery-inverter unit and switched circuit to fixture ballast.

2. Nightlight Connection: Operate one fluorescent lamp in a remote fixture continuously.
3. Battery: Sealed, maintenance-free, nickel-cadmium type.
4. Charger: Fully automatic, solid-state, constant-current type.
5. Housing: NEMA 250, Type 1 enclosure.
6. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
7. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
8. Remote Test: Switch in hand-held remote device aimed in direction of tested unit initiates coded infrared signal. Signal reception by factory-installed infrared receiver in tested unit triggers simulation of loss of its normal power supply, providing visual confirmation of either proper or failed emergency response.
9. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing red LED.

2.06 EXIT SIGNS

- A. General Requirements for Exit Signs: Comply with UL 924; for sign colors, visibility, luminance, and lettering size, comply with authorities having jurisdiction.
- B. Internally Lighted Signs:
 1. Lamps for AC Operation: LEDs, 50,000 hours minimum rated lamp life.
 2. Self-Powered Exit Signs (Battery Type): Integral automatic charger in a self-contained power pack.
 - a. Battery: Sealed, maintenance-free, nickel-cadmium type.
 - b. Charger: Fully automatic, solid-state type with sealed transfer relay.
 - c. Operation: Relay automatically energizes lamp from battery when circuit voltage drops to 80 percent of nominal voltage or below. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
 - d. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
 - e. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
 - f. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing red LED.

2.07 FLUORESCENT LAMPS

- A. T5 rapid-start lamps, rated 28 W maximum, nominal length of 45.2 inches (1150 mm), 2950 initial lumens (minimum), CRI 85 (minimum), color temperature 3500 K, and average rated life of 20,000 hours unless otherwise indicated.
- B. Compact Fluorescent Lamps: 4-Pin, CRI 80 (minimum), color temperature 3500 K, average rated life of 10,000 hours at three hours operation per start, and suitable for use with dimming

ballasts unless otherwise indicated.

1. 18 W: T4, double or triple tube, rated 1200 initial lumens (minimum).
2. 26 W: T4, double or triple tube, rated 1800 initial lumens (minimum).
3. 32 W: T4, triple tube, rated 2400 initial lumens (minimum).

2.08 LIGHTING FIXTURE SUPPORT COMPONENTS

- A. Single-Stem Hangers: 1/2-inch (13-mm) steel tubing with swivel ball fittings and ceiling canopy. Finish same as fixture.
- B. Twin-Stem Hangers: Two, 1/2-inch (13-mm) steel tubes with single canopy designed to mount a single fixture. Finish same as fixture.
- C. Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated steel, 12 gage (2.68 m).
- D. Rod Hangers: 3/16-inch (5-mm) minimum diameter, cadmium-plated, threaded steel rod.
- E. Hook Hangers: Integrated assembly matched to fixture and line voltage and equipped with threaded attachment, cord, and locking-type plug.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Lighting fixtures:
 1. Set level, plumb, and square with ceilings and walls unless otherwise indicated.
 2. Install lamps in each luminaire.
- B. Temporary Lighting: If it is necessary, and approved by Architect, to use permanent luminaires for temporary lighting, install and energize the minimum number of luminaires necessary. When construction is sufficiently complete, remove the temporary luminaires, disassemble, clean thoroughly, install new lamps, and reinstall.
- C. Remote Mounting of Ballasts: Distance between the ballast and fixture shall not exceed that recommended by ballast manufacturer. Verify, with ballast manufacturers, maximum distance between ballast and luminaire.
- D. Lay-in Ceiling Lighting Fixtures Supports:
 1. Install ceiling support system rods or wires, independent of the ceiling suspension devices, for each fixture. Locate not more than 6 inches (150 mm) from lighting fixture corners.
 2. Support Clips: Fasten to lighting fixtures and to ceiling grid members at or near each fixture corner with clips that are UL listed for the application.

3. Fixtures of Sizes Less Than Ceiling Grid: Install as indicated on reflected ceiling plans or center in acoustical panel, and support fixtures independently with at least two 3/4-inch (20-mm) metal channels spanning and secured to ceiling tees.
4. Install at least one independent support rod or wire from structure to a tab on lighting fixture. Wire or rod shall have breaking strength of the weight of fixture at a safety factor of 3.

E. Suspended Lighting Fixture Support:

1. Pendants and Rods: Where longer than 48 inches (1200 mm), brace to limit swinging.
2. Stem-Mounted, Single-Unit Fixtures: Suspend with twin-stem hangers.
3. Continuous Rows: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of fixture chassis, including one at each end.
4. Do not use grid as support for pendant luminaires. Connect support wires or rods to building structure.

3.02 IDENTIFICATION

- A. Install labels with panel and circuit numbers on concealed junction and outlet boxes. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

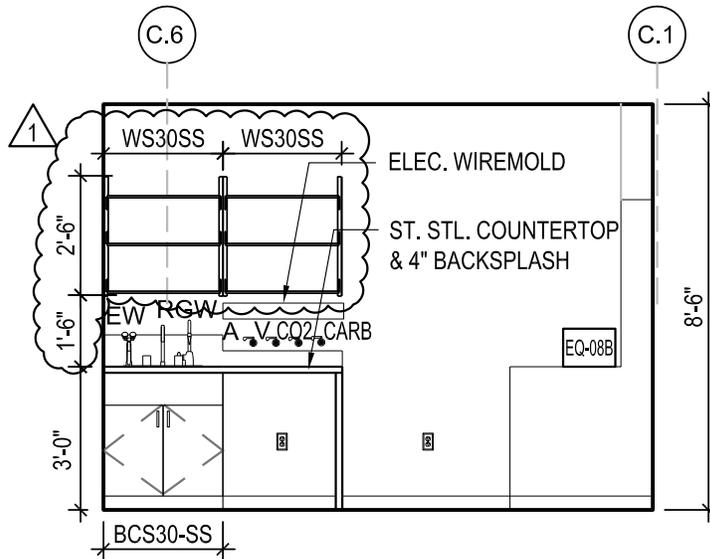
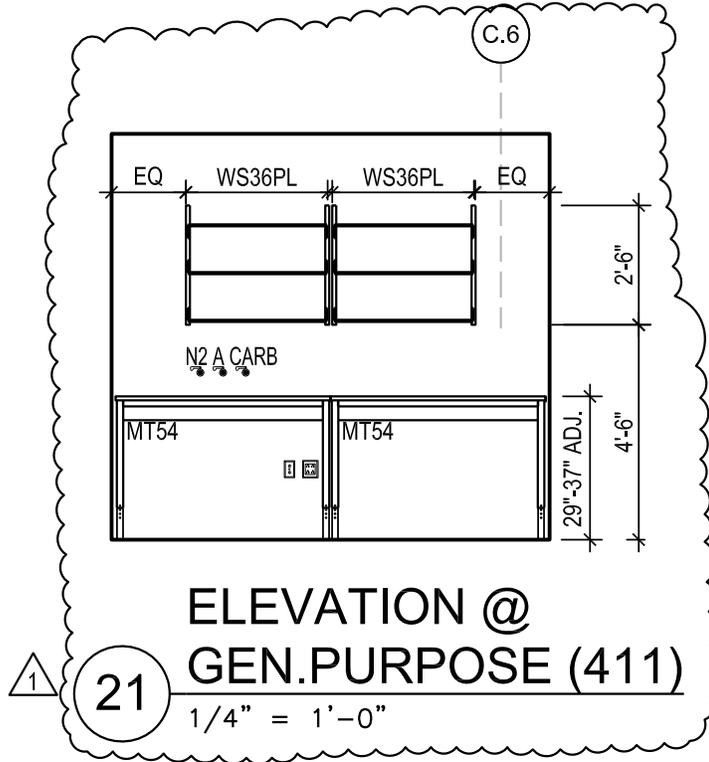
3.03 FIELD QUALITY CONTROL

- A. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery and retransfer to normal.
- B. Verify that self-luminous exit signs are installed according to their listing and the requirements in NFPA 101.
- C. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

3.04 STARTUP SERVICE

- A. Burn-in all lamps that require specific aging period to operate properly, prior to occupancy by Owner. Burn-in fluorescent and compact fluorescent lamps intended to be dimmed, for at least 100 hours at full voltage.

END OF SECTION



CONTRACT: CONSTRUCTION
PROJ. NO: 44220-C
DATE:
DRAWN:
APPROVED:

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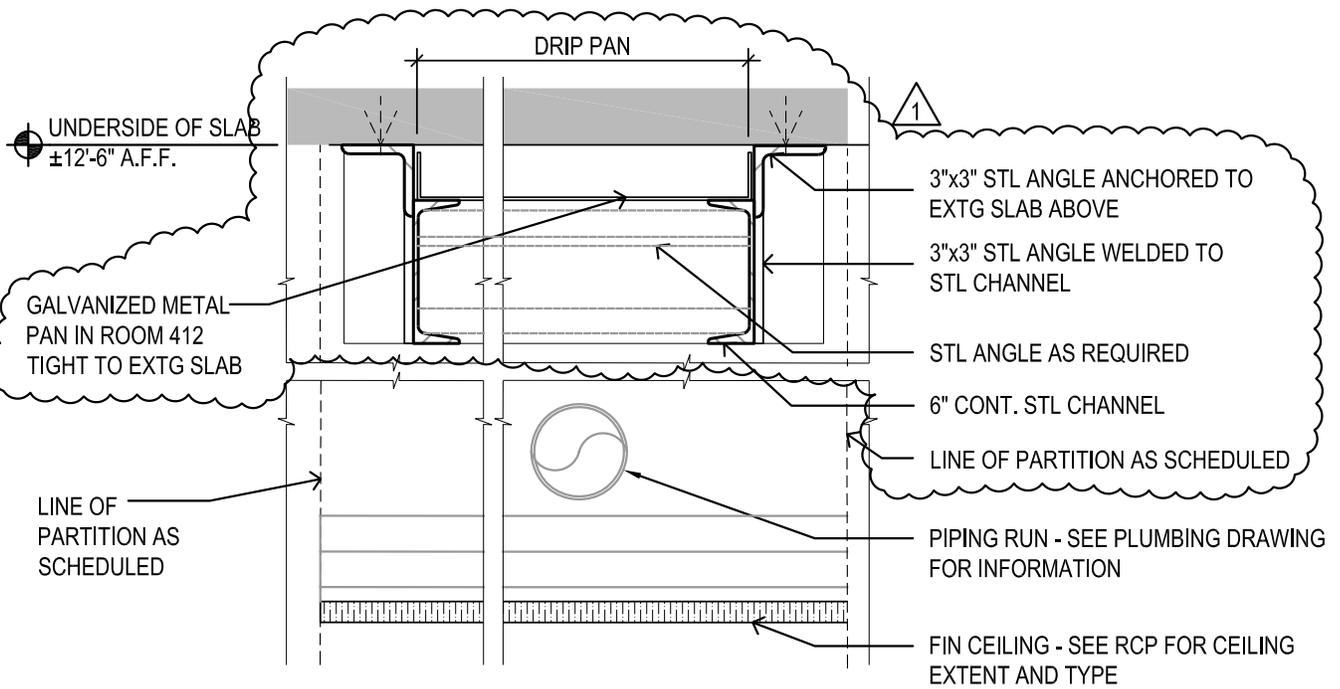
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ADDENDUM #3	REFERENCE DRAWING: A-402
SHEET TITLE:	LAB CASEWORK ELEVATIONS
PROJECT:	PROVIDE CONVERSION OF 4TH FLOOR TO WET LAB BUILDING NO. 4
<small>WARNING: THE ALTERATION OF THIS MATERIAL IN ANY WAY, UNLESS DONE UNDER THE DIRECTION OF A COMPARABLE PROFESSIONAL, I.E. ARCHITECT FOR AN ARCHITECT, ENGINEER FOR AN ENGINEER OR LANDSCAPE ARCHITECT FOR A LANDSCAPE ARCHITECT, IS A VIOLATION OF THE NEW YORK STATE EDUCATION LAW AND/OR REGULATIONS AND IS A CLASS 'A' MISDEMEANOR.</small>	
	DWG NO: SK-A-01



2 **DETAIL @ DRIP PAN IN RM 412**
 SCALE: 1-1/2"=1'-0"



NYS OFFICE OF GENERAL SERVICES
Serving New York

CONTRACT: CONSTRUCTION
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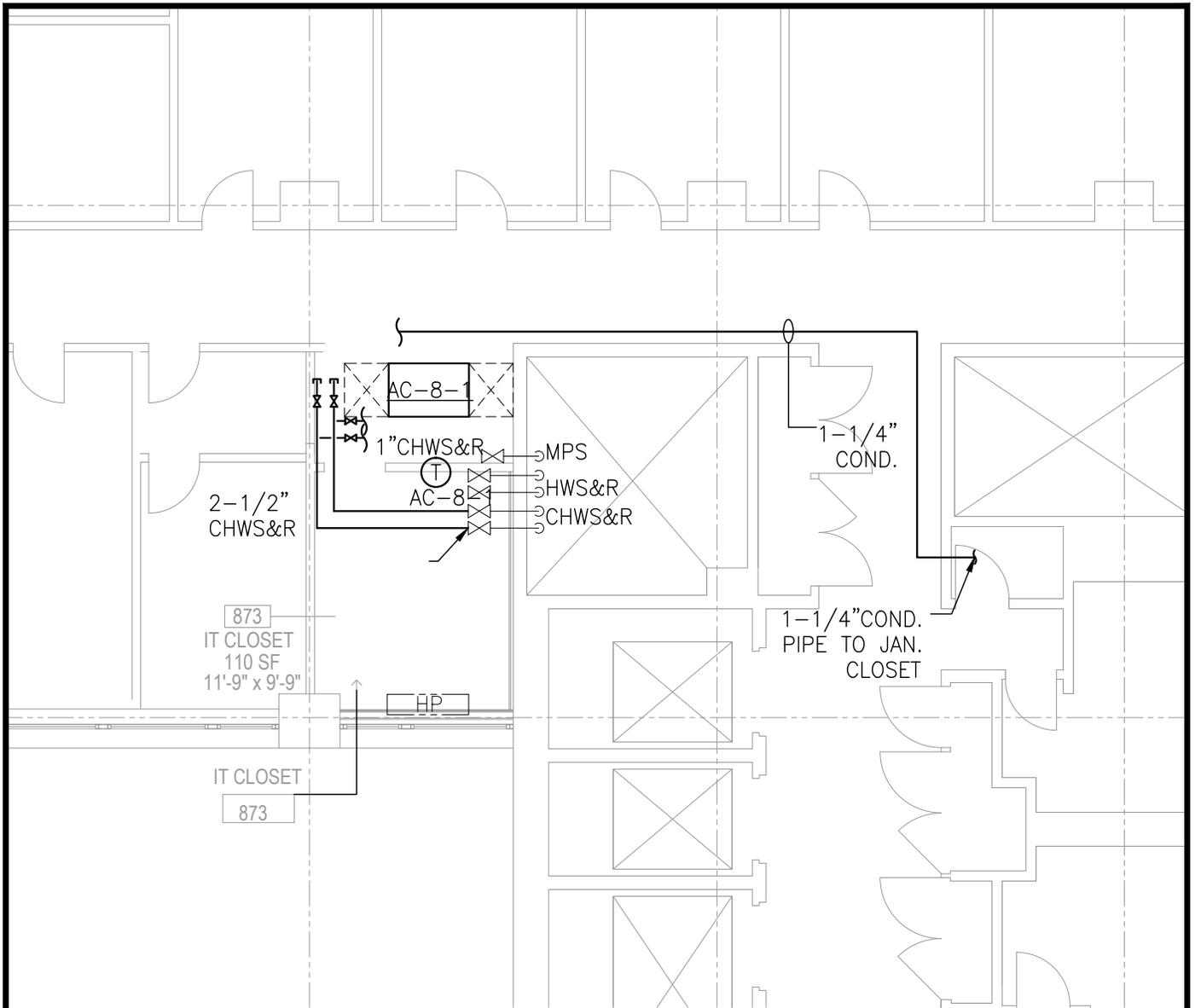
ADDENDUM #3 REFERENCE DRAWING: A-502

SHEET TITLE: CEILING DETAILS
 DETAIL @ DRIP PAN IN RM 412

PROJECT: PROVIDE CONVERSION OF
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DWG NO:
 SK-A-02



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



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ADDENDUM #3

REFERENCE DRAWING: M-103

SHEET TITLE:

8TH FLOOR PIPING PART
PLAN

PROJECT:

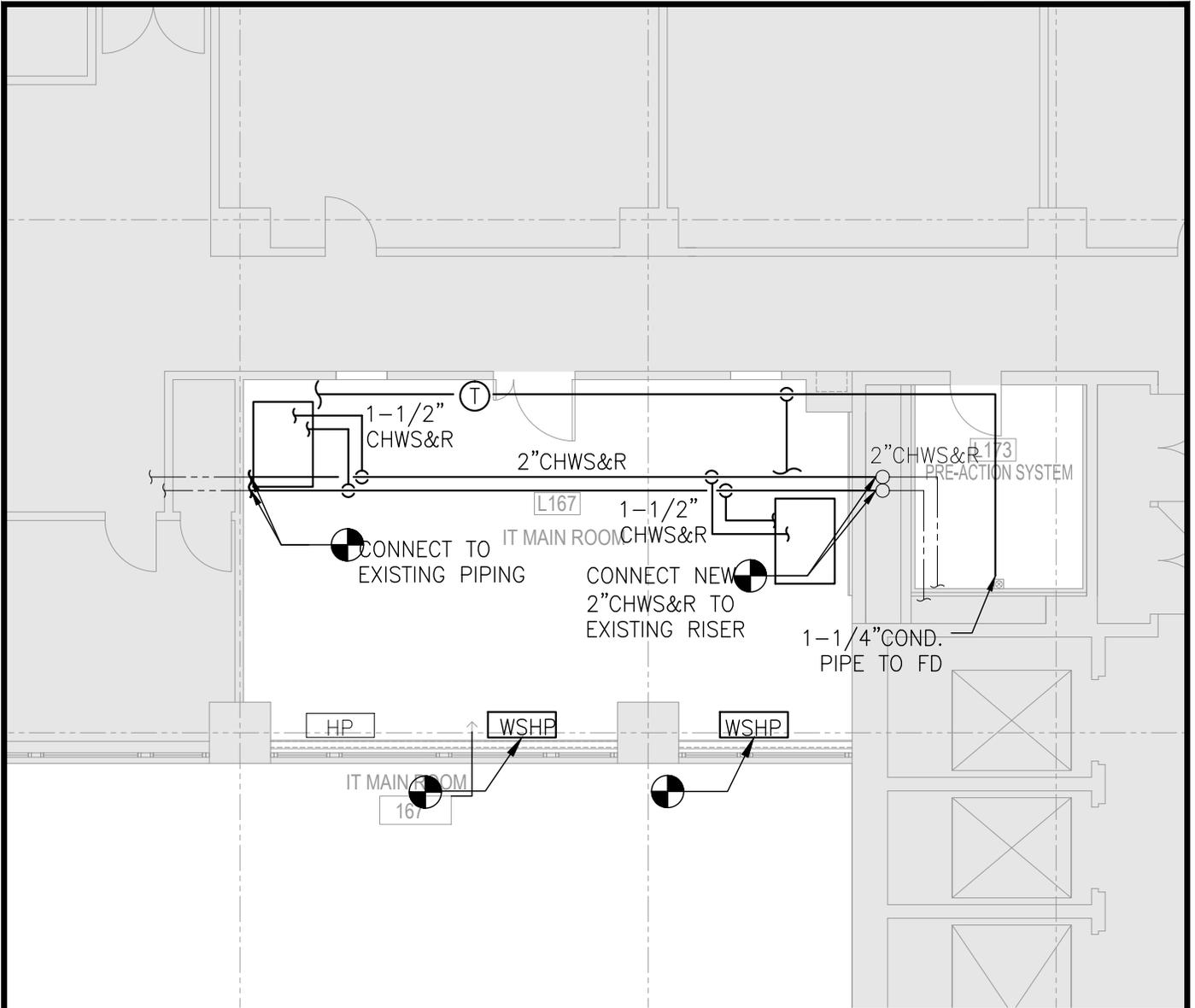
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BUILDING NO. 4

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SK-M-01

CONTRACT: CONSTRUCTION
PROJ. NO: Y110805-000
DATE: 01/27/14
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SCALE: 1/8" = 1'-0"



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ADDENDUM #3

REFERENCE DRAWING: M-103

SHEET TITLE:

L1 LEVEL PIPING PART
 PLAN

PROJECT:

PROVIDE CONVERSION OF
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 BUILDING NO. 4

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