#### ADDENDUM #001 DATE: 06.20.2024

#### TO CONTRACT DOCUMENTS ENTITLED: University of Missouri Columbia, Molecular Imaging and Theranostic Center Rooms 106 & 114A Lab Renovation

PROJECT NUMBER: CP241201

ADVERTISEMENT DATE: June 5, 2024

PREPARED FOR:

The Curators of the University of Missouri Teaching Hospital

CONSULTANT:

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Drawings and Specifications for the above noted project and the work covered thereby are herein modified as follows, and except as set forth herein, otherwise remain unchanged and in full force and effect:

#### **SPECIFICATION CHANGES:**

- 1. SECTION 12 24 00 Mecho Shades
  - a. At Part 2 Product, 2.01 Manufacturer, B. Other Acceptable Manufacturers: Added SWF Contract Manual Roller Shades.
- 2. SECTION 12 35 53.13
  - a. At Part 2 Products: 2.01 Manufacturers A. Manufacturers: Added Institutional Casework:www.ociscientific.com/#sle.
- 3. SECTION 22 10 00 Plumbing Piping
  - a. Replaced Section 2.1 A Cast Iron; Standard Weight; No-Hub Sleeve Gaskets with Cast Iron; Standard Weight Epoxy Coated; No-Hub Sleeve Gaskets.
  - b. Added Section 2.3 A PVC-DWV; Schedule 40; Solvent Weld Joints.
  - c. Revised Section 3.3 B2. and 3.3 C.1 System Piping and Valve Schedule.
- 4. SECTION 23 31 00 Ductwork
  - a. Revised Section 3.2 D and 3.2 E Ductwork Application Schedule

#### DRAWING CHANGES:

- 1. A-100 Demolition Plan Level 01
  - a. Added keynote X19 and X20 in room 114A.
  - b. Added General flooring demolition note for room 114A:
    - A. Remove the existing coatings by methods in accordance with NACE no. 6/SSPC-SP13. Joint surface preparation standards and ICRI technical guidelines. Shot blast or diamond grind to mechanically abrade concrete surfaces to remove laitance, curing compounds, hardeners, sealers, all existing coatings and other contaminants and to provide an ICRI-CSP 3 surface profile.

- B. Verify concrete dryness and prepare concrete surfaces in accordance with NACE no. 6/SSPC-SP13. joint surface preparation standards and ICRI technical guidelines. moisture vapor transmission should not exceed three lbs per 1000 sq. ft. in a 24 hour period (reference ASTM F 1869 standard test method for measuring moisture vapor emission rate of concrete subfloor using anhydrous calcium chloride)". Relative humidity should not exceed 80%. (reference ASTM F2170 standard test method for determining relative humidity in concrete using in situ probes). For moisture content up to 15 lbs per 1000 sq ft in a 24 hour period or relative humidity up to 95% series 208 may be substituted for the primer. Refer to the series 208 product data sheet for more information.
- C. After mechanically abrading, verify that all surfaces are clean, dry, and free of any contaminants, which could adversely affect the adhesion of the flooring system.
- c. At keynote legend:
  - i. Added keynote 19: Remove existing epoxy floor coating (Armorseal water based epoxy) see general note for additional information.
  - ii. Added keynote 20: Existing floor drain to be removed. in fill area with concrete after removal.
- 2. I-100: Interior Finish Plan:
  - a. At Lab 114A, eliminated "a" from ERF1 flooring.
  - b. At Finish Remarks: change note "a" to read: Not Used
- 1. M-111 Mechanical HVAC Plan Level 01
  - a. Removed keynote 1.
  - b. Added general note 2 for exhaust ductwork materials.
- 2. P-100 Plumbing Demolition Plan Underfloor
  - a. Added demolition scope for existing floor drain piping in room 114A.
- 3. P-101 Plumbing Demolition Plan Level 01
  - a. Added demolition scope for existing floor drain in room 114A.
- 4. E-101 Electrical Demolition Plan Level 01
  - a. Revised keynote 1.
  - b. Revised to show existing to remain smoke detectors in lab 106.
  - c. Revised to show existing to remain smoke detector in lab 114A.
- 5. ES-111 Electrical Systems Plan Level 01
  - a. Revised keynote on plan for two smoke detectors in lab 106.
  - b. Revised keynote on plan for one smoke detectors in lab 114A.
  - c. Added keynote 3.

END OF ADDENDUM #1

#### SECTION 12 2400 WINDOW SHADES - MECHOSHADE SYSTEMS

### PART 1 GENERAL

#### **1.01 SECTION INCLUDES**

A. Manual roller shades and accessories.

#### 1.02 RELATED REQUIREMENTS

A. Section 06 1000 - Rough Carpentry: Concealed wood blocking for attachment of shade brackets and accessories.

#### 1.03 REFERENCE STANDARDS

- A. ASTM G21 Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.
- B. BIFMA HCF 8.1 Health Care Furniture Design Guidelines for Cleanability.
- C. NFPA 70 National Electrical Code.
- D. NFPA 701 Standard Methods of Fire Tests for Flame Propagation of Textiles and Films.
- E. WCMA A100.1 Standard for Safety of Window Covering Products.

#### 1.04 ADMINISTRATIVE REQUIREMENTS

- A. Sequencing:
  - 1. Do not fabricate shades until field dimensions for each opening have been taken with finished conditions in place. "Hold to" dimensions are not acceptable.
  - 2. Do not install shades until final surface finishes and painting are complete.

#### 1.05 SUBMITTALS

- A. See Section 01 3000 Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product to be used including materials, finishes, fabrication details, dimensions, profiles, mounting requirements, and accessories.
- C. Shop Drawings: Include shade schedule indicating size, location and keys to details.
- D. Source Quality Control Submittals: Provide test reports indicating compliance with specified fabric properties.
- E. Selection Samples: Include fabric samples in full range of available colors and patterns.
- F. Verification Samples: Minimum size 6 inches square, representing actual materials, color and pattern.

#### 1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than ten years of documented experience.
- B. Installer Qualifications: Company specializing in performing work of this type with minimum ten years of documented experience with shading systems of similar size, type, and complexity; manufacturer's authorized representative.

#### 1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver shades in manufacturer's unopened packaging, labeled to identify each shade for each opening.
- B. Handle and store shades in accordance with manufacturer's recommendations.

#### 1.08 FIELD CONDITIONS

A. Do not install products under environmental conditions outside manufacturer's absolute limits.

#### 1.09 WARRANTY

- A. See Section 01 7800 Closeout Submittals, for additional warranty requirements.
- B. Provide manufacturer's standard, non-depreciating warranty, for interior shading only, covering the following:
  - 1. Shade Hardware: 10 years unless otherwise indicated.
  - 2. Shade Fabric: 10 years unless otherwise indicated.

#### PART 2 PRODUCTS

#### 2.01 MANUFACTURERS

- A. Basis of Design: MechoShade Systems LLC: www.mechoshade.com/#sle.
- B. Other Acceptable Manufacturers:
  - 1. SWF Contract Manual Roller Shades.
  - 2. Products by listed manufacturers are subject to compliance with specified requirements.

#### 2.02 ROLLER SHADES

- A. General:
  - 1. Provide shade system components that are capable of being removed or adjusted without removing mounted shade brackets or cassette support channel.
  - 2. Provide shade system that operates smoothly when shades are raised or lowered.
- B. Basis of Design Roller Shades: MechoShade Systems LLC; Mecho/5 System: www.mechoshade.com/#sle.
  - 1. Description: Single roller, manually operated fabric window shades.
  - 2. Brackets and Mounting Hardware: As recommended by manufacturer for mounting indicated and to accommodate shade fabric roll-up size and weight.
  - 3. Roller Tubes:
    - a. Material: Extruded aluminum.
    - b. Size: As recommended by manufacturer; selected for suitability for installation conditions, span, and weight of shades.
    - c. Fabric Attachment: Utilize extruded channel in tube to accept vinyl spline welded to fabric edge. Shade band to be removable and replaceable without removing roller tube from brackets or inserting spline from the side of the roller tube.
    - d. Roller tubes to be capable of being removed and reinstalled without affecting roller shade limit adjustments.
  - 4. Hembars: Designed to maintain bottom of shade straight and flat.
  - 5. Clutch Operator: Manufacturer's standard material and design integrated with bracket/brake assembly.
    - a. Provide a permanently lubricated brake assembly mounted on a oil-impregnated hub with wrapped spring clutch.
    - b. Brake must withstand minimum pull force of 50 pounds in the stopped position.
    - c. Mount clutch/brake assembly on the support brackets, fully independent of the roller tube components.
  - 6. Drive Chain: Continuous loop stainless steel beaded ball chain, 95 pound minimum breaking strength. Provide upper and lower limit stops.
    - a. Chain Retainer: Chain tensioning device complying with WCMA A100.1.

#### 2.03 SHADE FABRIC

- A. Fabric: Non-flammable, color-fast, impervious to heat and moisture, and able to retain its shape under normal operation.
  - 1. Material Composition:
    - a. vinyl jacketed polyester fabric 3% openness.
  - 2. Performance Requirements:
    - a. Flammability: Pass NFPA 701 large or small scale test.
  - 3. Openness Factor: 3%, nominal.
  - 4. Color: As selected by Architect from manufacturer's full range of colors.
  - 5. Products:
    - a. MechoShade Systems LLC Inc; Soho 1100 Series (1% open): www.mechoshade.com/#sle.

#### 2.04 ROLLER SHADE FABRICATION

- A. Field measure finished openings prior to ordering or fabrication.
- B. Dimensional Tolerances: Fabricate shades to fit openings within specified tolerances.
  - 1. Vertical Dimensions: Fill openings from head to sill with 1/2 inch space between bottom bar and window stool.

#### PART 3 EXECUTION

#### 3.01 EXAMINATION

- A. Examine finished openings for deficiencies that may preclude satisfactory installation.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- C. Start of installation shall be considered acceptance of substrates.

#### 3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions and approved shop drawings, using mounting devices as indicated.
- B. Adjust level, projection, and shade centering from mounting bracket. Verify there is no telescoping of shade fabric. Ensure smooth shade operation.

#### 3.03 PROTECTION

- A. Protect installed products from subsequent construction operations.
- B. Touch-up, repair or replace damaged products before Substantial Completion.

#### END OF SECTION

#### SECTION 12 3553.13 METAL LABORATORY CASEWORK

### PART 1 GENERAL

#### 1.01 SECTION INCLUDES

- A. Standard and custom metal cabinets and cabinet hardware.
- B. Reagent shelving.
- C. Tables.
- D. Service enclosures.
- E. Acid storage cabinets.
- F. Solvent storage cabinets.
- G. Vacuum pump cabinets.
- H. Countertops.
- I. Laboratory sinks.
- J. Pegboards.
- K. Laboratory emergency equipment plumbing fixtures.
- L. Service fittings and outlets.

#### 1.02 RELATED REQUIREMENTS

- A. Section 06 1000 Rough Carpentry: Blocking and nailers for anchoring casework.
- B. Section 07 9200 Joint Sealants: Sealing joints between casework and countertops and adjacent walls, floors, and ceilings.
- C. Section 09 2116 Gypsum Board Assemblies: Reinforcements in metal-framed partitions for anchoring casework.
- D. Section 09 6500 Resilient Flooring: Resilient wall base.
- E. Section 26 0533.23 Surface Raceways for Electrical Systems: Surface raceway systems.

#### 1.03 REFERENCE STANDARDS

- A. ADA Standards 2010 ADA Standards for Accessible Design.
- B. ANSI Z97.1 American National Standard for Safety Glazing Materials Used in Buildings -Safety Performance Specifications and Methods of Test.
- C. ANSI Z358.1 American National Standard for Emergency Eyewash and Shower Equipment.
- D. ASTM A513/A513M Standard Specification for Electric-Resistance-Welded Carbon and Alloy Steel Mechanical Tubing.
- E. ASTM A1008/A1008M Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable.
- F. ASTM C1036 Standard Specification for Flat Glass.
- G. ASTM C1048 Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass.
- H. ASTM C920 Standard Specification for Elastomeric Joint Sealants.
- I. ASTM D522/D522M Standard Test Methods for Mandrel Bend Test of Attached Organic Coatings.
- J. ASTM E119 Standard Test Methods for Fire Tests of Building Construction and Materials.

- K. ASTM E84 Standard Test Method for Surface Burning Characteristics of Building Materials.
- L. ICC (IFC) International Fire Code.
- M. NFPA 1 Fire Code.
- N. NFPA 30 Flammable and Combustible Liquids Code.
- O. SEFA 1 Laboratory Fume Hoods.
- P. SEFA 2 Installations.
- Q. SEFA 3 Laboratory Work Surfaces.
- R. SEFA 7 Laboratory Fixtures.
- S. SEFA 8M Laboratory Grade Metal Casework.

#### **1.04 ADMINISTRATIVE REQUIREMENTS**

- A. Coordination: Coordinate installation of casework with related items.
  - 1. Service Fixtures: Coordinate location and characteristics of service connections.
- B. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section; require attendance by all affected installers.

#### 1.05 SUBMITTALS

- A. See Section 01 3000 Administrative Requirements for submittal procedures.
- B. Product Data: Details of materials, component dimensions and configurations, construction details, joint details, attachments; manufacturer's catalog literature on hardware and keying, accessories, and service fittings, if any.
- C. Shop Drawings: Indicate casework types, sizes, and locations, using large scale plans, elevations, and cross sections. Include rough-in and anchors and reinforcements placement dimensions and tolerances, clearances required, and utility locations, if any. Include coordinated information for laboratory equipment specified in another section and/or furnished by Owner.
- D. Samples For Color Selection: Submit two samples of metal casework and work top finish surfaces, illustrating color and finish.
- E. Test Reports: Independent laboratory reports showing compliance with chemical and physical resistance requirements for casework finish and countertops.
- F. Manufacturer's qualification statement.
- G. Installer's qualification statement.
- H. Maintenance Data: Manufacturer's recommendations for care and cleaning.
- I. Finish touch-up kit for each type and color of materials provided.

#### 1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.
- B. Installer Qualifications: Company specializing in performing work of the type specified in this section, with not less than three years of documented experience and approved by manufacturer.

#### 1.07 DELIVERY, STORAGE, AND HANDLING

A. Protect items provided by this section, including finished surfaces and hardware items during handling and installation. For metal surfaces, use polyethylene film or other protective material standard with the manufacturer.

#### 1.08 WARRANTY

- A. See Section 01 7800 Closeout Submittals for additional warranty requirements.
- B. Manufacturer Warranty: Provide 5-year warranty against defects. Complete forms in Owner's name and register with manufacturer. Covered defects include, but are not limited to:
  - 1. Ruptured, cracked, or stained finish coating.
  - 2. Discoloration, or lack of finish integrity.
  - 3. Cracking or peeling of finish.
  - 4. Weld or any other structural failure.
  - 5. Failure of hardware.

#### PART 2 PRODUCTS

#### 2.01 MANUFACTURERS

- A. Metal Laboratory Casework:
  - 1. Institutional Casework Inc: www.iciscientific.com/#sle.
  - 2. Kewaunee Scientific Corp: www.kewaunee.com/#sle.
  - 3. Labcrafters, Inc: www.lab-crafters.com/#sle.
  - 4. Mott Manufacturing Ltd: www.mott.ca/#sle.
  - 5. Substitutions: See Section 01 6000 Product Requirements.
- B. Countertops:
  - 1. Durcon (Epoxy resin): www.durcon.com/#sle.
  - 2. Kewaunee Scientific Corp (Epoxy resin); www.kewaunee.com/#sle.
  - American Epoxy Scientific LLC. (Epoxy resin): https://www.epoxysci.com/
    a. Substitutions: See Section 01 6000 Product Requirements.
- C. Sinks and Cup Sinks:
  - 1. Durcon (Epoxy resin): www.durcon.com/#sle.
  - 2. Simmon North America (Epoxy resin): https://www.simmonsnorthamerica.com/
  - 3. American Epoxy Scientific LLC (Epoxy resin). (Epoxy resin): https://www.epoxysci.com/
  - 4. Kewaunee Scientific Corp (Epoxy resin); www.kewaunee.com/#sle.
    - a. Substitutions: See Section 01 6000 Product Requirements.
- D. Water and Gas Service Fittings:
  - 1. Broen-Lab A/S: www.broen-lab.com/#sle.
  - 2. Chicago Faucets, a Geberit company: www.chicagofaucets.com/#sle.
  - 3. WaterSaver Faucet Co: www.wsflab.com/#sle.
  - 4. Substitutions: See Section 01 6000 Product Requirements.
- E. Obtain casework from single source and manufacturer, unless otherwise indicated.

#### 2.02 METAL LABORATORY CASEWORK

- A. Casework: Die-formed metal sheet; each unit self-contained and not dependent on adjacent units or building structure for rigidity; factory-fabricated, factory-assembled, and factory-finished.
  - 1. Style: Flush overlay square edge.
  - 2. Primary Cabinet Material: Cold-rolled steel.
  - 3. Cabinet Nominal Dimensions: Unless otherwise indicated, provide cabinets of widths and heights indicated on drawings, and with following front-to-back dimensions.
    - a. Base Cabinets: 22 inch.
    - b. Tall Cabinets: 18 inch.
    - c. Upper Cabinets: 14 inch.
  - 4. Steel Sheet Metal:

- a. Gables, Front and Back Panels, Gusset Plates, Aprons, and Rails: 18 gauge, 0.0478 inch minimum thickness.
- b. Drawers, Cabinet Floors, Shelves, Filler Panels and Drawer Dividers: 20 gauge, 0.0359 inch minimum thickness.
- c. Backing Sheet to Door and Door Fronts: 22 gauge, 0.0299 inch minimum thickness.
- Structural Performance: In addition to the requirements of SEFA 3, SEFA 7 and SEFA 8M, provide components that safely support the following minimum loads, without deformation or damage:
  - a. Base Units: 500 pounds per linear foot across the cabinet ends.
  - b. Tables: 300 pounds on four legs.
  - c. Drawers: 125 pounds.
  - d. Hanging Upper Cases: 300 pounds.
  - e. Shelves: 100 pounds.
- 6. Corners and Joints: Without gaps or inaccessible spaces or areas where dirt or moisture could accumulate.
- 7. Edges and Seams: Smooth. Form counter tops, shelves, and drain boards from continuous sheets.
- 8. Shelf Edges: Turned down 3/4 inch on each side and returned 3/4 inch front and back.
- 9. Ends: Close open ends with matching construction.
- 10. Welding: Electric spot welded; joints ground smooth and flush.
- 11. Drawers and Doors: Fabricate drawer and door fronts of sandwiched sheets of sheet steel welded together and reinforced for hardware.
  - a. Fill with sound-deadening core.
- 12. Shelves: Adjustable and fixed shelves formed down 3/4 inch, returned back 7/8 inch, and up 1/4 inch into a channel shape, front and rear; formed down 3/4 inch at each end. Shelves over 42 inches long reinforced with a channel welded to underside of shelf.
- 13. Glazing: Type and thickness standard with manufacturer.
  - a. Framed Doors: Float glass, with gaskets and removable stops; minimize rattling and vibration.
- 14. Fittings and Fixture Locations: Cut and drill countertops, backs, and other casework components for service outlets and fixtures.
- 15. Access Panels: Where indicated, for maintenance of utility service fixtures and fittings and mechanical and electrical components.
- 16. Removable panels at backs of open spaces between base cabinets and at ends of utility spaces not otherwise enclosed.
  - a. Cutouts for power receptacles where indicated on drawings.
- 17. Filler Panels: Flanged on both sides, of matching construction and finish, for locations where cabinets do not fit tight to adjacent construction.
- 18. Scribe Panels: Similar to filler panels, except flanges on one side and flat on the other, of matching construction and finish.
- 19. Stainless Steel Finish: No.4, brushed finish.
- 20. Separation: Use bituminous paint or non-conductive tape to coat metal surfaces in contact with cementitious materials, and to separate dissimilar metals.
- B. Reagent Shelving and Supports.
  - 1. Shelves: epoxy resin shelves in lengths indicated.
    - a. Depth: As indicated on drawings.
  - 2. Supports: Manufacturer's standard metal support pedestal assemblies.
- C. Acid Storage Cabinets: Construction identical to other cabinets, with following exceptions:
  - 1. Completely lined with corrosion-resistant liner material; stainless steel fasteners for all connections and hardware inside cabinet.

- 2. Shelves: Perforated or vented, rigid polypropylene.
- 3. Bottom Pan: Liquid tight, polypropylene liner covering entire bottom of acid storage cabinet.
- 4. Vents: Comply with SEFA 1.
  - a. Vent base cabinets through work surface behind baffle in hood with manufacturer's vent kit.
- D. Solvent (Flammable and Combustible Liquids) Storage Cabinets: Construction identical to other cabinets, with following exceptions:
  - 1. Construct to NFPA 30 and applicable OSHA requirements.
  - 2. Fire Resistance: Maximum internal temperature of 325 degrees F at the center, and 1 inch from top of the cabinet when cabinet is subjected to a ten minute fire test that simulates fire exposure of a standard time-temperature curve specified in ASTM E119.
  - 3. Steel sheet, 18 gauge, 0.0478 inch minimum thickness, double panel construction with 1-1/2 inch space between panels and electrical grounding connection.
  - 4. Shelves: Full depth, adjustable sloped metal shelf.
  - 5. Bottom Pan: 2 inches deep liquid-tight pan covering entire bottom of cabinet.
  - 6. Cabinet Hardware: UL-listed.
    - a. Hinges: Full-length stainless steel continuous (piano) hinges.
    - b. Self-closing Doors: Comply with requirements of NFPA 1 and ICC (IFC). Minimum 90 degree opening. Three-point latch arrangement, door(s) shutting and latching automatically when hold-open device's fusible link melts at 165 degrees F under fire conditions outside the cabinet. At pair of doors, synchronize latching so that both doors always fully close.
    - c. Door Handles: Manufacturer's standard, with slip-resistant grip.
    - d. Grounding screw-lug.
  - 7. Signage: Provide manufacturer's standard signage reading "FLAMMABLE KEEP FIRE AWAY" or similar message in bright red color.
- E. Vacuum Pump Cabinets: Construction identical to other cabinets, with following exceptions:
  - 1. No cabinet bottom but with integral toe space, removable back panels, and precut 2-1/2 inch vent hole for separate vent assembly.
  - 2. Insulation: Manufacturer's standard acoustical insulation on interior of door panels, interior side of back and panels as well as underside of top panel.
  - 3. Motor Platform: Separate from cabinet, capable of supporting 300 pounds, two of four casters to be lockable, swivel-type; 2 inch lip and liquid tight pan covering entire bottom of cabinet.
  - 4. Pump On/Off Switch: Integral, 120V, 20A, with pilot light indicating availability of power and mode of vacuum pump operation.
    - a. Conduit Stub: 20 foot, 1/2 inch flexible metal conduit connected to switch, for connection to building power.
  - 5. Convenience Outlet: Integral electrical duplex outlet located in rear of cabinet, accessible from inside cabinet and pre-wired to pump on/off switch.
- F. Tables: Include adjustable height units.
  - 1. Adjustable Height Table Construction: Manufacturer's standard, with countertop worksurfaces, unless noted otherwise.
    - a. Cantilevered Base Frame: Each base equipped with a pair of glides.
    - b. Worksurface Support Frame: Telescoping from base frame.
    - c. Worksurface: As indicated on drawings.
      - 1) Lift Capacity: 1,000 lb, evenly distributed on worksurface.
      - 2) Adjustability:
        - (a) Total Range: 14 inches.

- (b) Manual Operation: Threaded fastener pins inserted into holes on 1 inch centers.
- 3) Finish, Surface Color, and Texture: As indicated on drawings.
- 2. Primary Materials: Manufacturer's standard for each component.
  - a. Tubing: Hot-rolled steel, ASTM A513/A513M.
  - b. Sheet Metal: Cold-rolled steel, ASTM A1008/A1008M.
  - c. Metal Finish Color: As indicated on drawings..
- G. Countertop Panel-Type Supports: Materials similar to adjacent casework, 1-1/2 inch in width, with front-to-back and toe space dimensions matching base cabinet. Designed to be secured in a concealed fashion to countertop material. Include two leveling devices per support panel.
- H. Vertical Service Drop Enclosures: Where indicated on drawings, for service drops to metal casework.
  - 1. Frames: Unless otherwise standard with the manufacturer, channel strut frames, with members at all corners, bottom, mid-height, and top of enclosure. Designed for anchorages at the bottom to countertop, and at top to miscellaneous metal support framing.
  - 2. Enclosures: Consisting of fixed and removable (access) panels, in configuration standard with the manufacturer.
    - a. Extent: Top at 4 inches above bottom of ceiling.
    - b. Rear Panel: Fixed panel, constructed like other casework closure panels.
    - c. Side Panels: Fixed panels, constructed like other casework closure panels.
    - d. Front Panels:
      - 1) Removable (Access) Panel: Metal panel, constructed like other casework closure panels.
    - e. Attachment: Use corrosion-resistant metal mounting hardware and fasteners.

#### 2.03 CABINET HARDWARE

- A. Manufacturer's standard styles, and as indicated below.
- B. Finish of exposed stainless steel components: No.4 finish.
- C. Locks: On casework drawers and doors, where indicated. Lock with 5 pin cylinder and 2 keys per lock.
- D. Shelves in Cabinets:
  - 1. Shelf Standards and Rests: Vertical standards with rubber button fitted rests, satin chromium plated over nickel on base material.
- E. Swinging Doors:
  - 1. Hinges: Offset pin, number as required by referenced standards for width, height, and weight of door.
    - a. Butt Hinges for Overlay Doors: five-knuckle, projecting barrel, minimum 2-1/2 inches long. Stainless steel with No.4 finish.
  - 2. Catches: Mechanical catch.
  - 3. Pulls: Stainless steel wire pulls, 4 inches wide.
- F. Drawers:
  - 1. Pulls: Stainless steel wire pulls, 4 inches wide.
  - 2. Slides: Steel, full extension arms, ball bearings; self-closing; capacity as recommended by manufacturer for drawer height and width.

#### 2.04 COUNTERTOPS

A. Countertops:

- 1. Epoxy Resin Countertops: Filled epoxy resin molded into homogenous, non-porous sheets; no surface coating and color and pattern consistent throughout thickness; with integral or adhesively seamed components.
  - a. Flat Surface Thickness: 1 inch, nominal.
  - b. Surface Finish: Smooth, non-glare.
  - c. Color: As indicated on drawings..
  - d. Exposed Edge Shape: 1/8 inch bevel chamfer.
  - e. Drip Edge: Drip groove 1/8 inch wide and deep, located 1/2 inch back from edge on underside of each exposed edge.
  - f. Back and End Splashes: Same material, same thickness; separate for field attachment.

#### 2.05 SINKS

- A. Laboratory sinks.
  - 1. General: Sinks with perimeter lip for drop-in installation.
  - 2. Sink types and sizes are indicated on drawings.
  - 3. Splash Guards: Provide guards made of colored acrylic sheet set into aluminum channel adjacent to sink areas. See drawings for locations and configurations required.

#### 2.06 PEGBOARDS

1.

- A. Acrylic pegboards with pre-drilled or punched holes in a staggered pattern, designed to accept removable white polypropylene pegs. With each pegboard include a stainless steel drip-trough with drain outlet and matching diameter 36 inch long PVC drain hose.
  - 1. Size: As indicated on drawings.
  - 2. Accessories: Screen insert.

#### 2.07 LABORATORY EMERGENCY EQUIPMENT PLUMBING FIXTURES

- A. General: Provide emergency equipment products complying with requirements of ANSI Z358.1.
- B. Eye/Face Wash Units: Deck-mounted units.
  - Type EW-1: 90-Degree swing-down, designed for mounting behind the sink.
  - a. Plug-type valve designed to open orifice and activate water flow only when unit is swung down into operational position.
  - 2. Sign: Manufacturer's standard ANSI-compliant identification sign.
- C. Eyewash/Safety Shower Combination Units: Recessed into wall construction.
  - 1. Cover/Eyewash Drain Pan: Combination fixture, with projecting activation handle requiring grasping and pulling down into operating position for activation.
    - a. Plug-type valve designed to open orifice and activate water flow only when unit is swung down into operational position
    - b. Twin eyewash heads mounted on supply arms, with internal flow control, and filter.
  - Shower Head: 10 inch diameter stainless steel, with 20 gallons per minute flow control.
    a. Mounting: Below finished ceiling. Include vertical supply pipe and ceiling
    - escutcheon.
  - 3. Cabinet: Designed for recess into 3-5/8 inch minimum depth metal-framed wall construction.
    - a. Mounting: Mount at height complying with ADA Standards.
  - 4. Activation Handle: Recessed into cabinet, projecting 1-7/8 inches maximum beyond face of wall, and requiring pushing down for activation.
    - a. Grip: Manufacturer's standard vinyl grip.
  - 5. Water Supply: 1 inch NPS FPT; 35 psi, minimum pressure.
  - 6. Drain Outlet: 2 inch NPS FPT.

#### 2.08 SERVICE FITTINGS

- A. General: Comply with requirements of SEFA 7.
- B. Gas Service Fittings and Fixtures.1. As indicated on drawings.
- C. Water Service Fittings and Fixtures.
  - 1. As indicated on drawings.
- D. Electrical Fittings and Fixtures:
  - 1. Electrical Fittings, General: Types indicated, for mounting on laboratory casework, including, as appropriate, grounding screws, and mounting accessories and fasteners.
  - 2. See Section 26 0533.23 for surface raceway systems.
  - 3. Pedestal Boxes: Cast aluminum.
    - a. Finish: Satin, brushed.

#### 2.09 MATERIALS

- A. Sheet Steel: High-strength low-alloy, cold rolled and leveled unfinished steel sheet, ASTM A1008/A1008M, Class 1 (matte) finish.
- B. Solid Epoxy Resin: Modified epoxy resin and non-asbestos inert fillers cast into sheets.
- C. Glass: Fully tempered float; ASTM C1036, Type 1, Quality Q3; ASTM C1048, tempered using horizontal tempering and complying with ANSI Z97.1; 3/16 inch thick minimum; exposed edges ground, and cut or drilled to receive hardware; clear.
- D. Solvent-Resistant Liner Material: High density, asbestos free, non-combustible, calciumsilicate-based panel consisting of autoclaved Portland cement, mineral fillers and synthetic fibers.
- E. Sealant For Use in Casework Construction: Manufacturer's recommended type.
- F. Sealant For Use in Casework Installation:
  - 1. One component, clear silicone base sealant, chemical curing complying with ASTM C920, Type S, Grade NS, Class 25, Use NT, when tested to glass and aluminum, anti-fungus composition.

#### 2.10 FINISHES

- A. Sheet Steel Finish: Having chemical resistance equal to Level 0 (no change) or Level 1 (slight change of gloss or slight discoloration) according to SEFA 8M. Test applied finishes using procedures specified in ASTM D522/D522M.
  - 1. Coating Type, New Casework: Baked on epoxy; minimum two coats.
  - 2. Color: As indicated on drawings..
  - 3. Preparation: Degrease and phosphate etch, and prime.
- B. Stainless Steel Finish: No.4, brushed finish.

#### 2.11 ACCESSORIES

- A. Gas Cylinder Brackets: Restraint safety assemblies for laboratory gas cylinders.
  - 1. Regulatory Compliance: OSHA and NFPA.
  - 2. Bracket Mounting: Wall, with fasteners.
  - 3. Cylinder Capacity: Two
  - 4. Cylinder Diameter Capability: 4 to 12 inches.
  - 5. Bracket Construction: 11 gauge, 0.119 inch hot-rolled steel.
  - 6. Steel Finish: Polyester powder-coat.
  - 7. Secondary Optional Restraint: Manufacturer's standard metal chain set.
  - 8. Manufacturers:

- a. USA Safety Solutions, Inc; https://www.usasafety.com/.
- b. Justrite; https://www.justrite.com/.
- c. Fisher Scientific; https://www.fishersci.com/.
- d. Substitutions: See Section 01 6000 Product Requirements.
- B. Glove Dispenser
  - 1. Manufacturers:
    - a. Universal Medical (Basis of Design)
    - b. American Specialties, Inc.
    - c. Fisher Scientific
    - d. Substitutions: See Section01 6000-Product Requirements.
  - 2. Construction:
    - a. Three pocket side loading pockets
    - b. Clear acrylic
    - c. Two-way keyholes for wall mounting horizontally or vertically
- C. Shelf
  - 1. Manufacturers:
    - a. Bradley Corporation (Basis of Design)
    - b. American Specialties, Inc.
    - c. AJW Architectural Products
    - d. Substitutions: See Section 01 6000-Product Requirements.
  - 2. Construction:
    - a. Shelf; 18 guage stainless steel in stain finish
    - b. Brackets; 16 guage stainless steel in stain finish
- D. Lab Coat Hooks
  - 1. Manufacturers:
    - a. Bradley Corporation (Basis of Design)
    - b. American Specialties, Inc.
    - c. Fisher Scientific
    - d. Substitutions: See Section 01 6000-Product Requirements.
  - 2. Construction:
    - a. Backplate; 22 guage stainless steel in satin finish
    - b. Hooks; 14 guage stainless steel
- E. Water Polisher
  - 1. Manufacturers:
    - a. Barnstead Water (Basis of Design)
    - b. Millipore Sigma
    - c. Elga LabWater
    - d. Substitutions: See Section 01 6000-Product Requirements.
  - 2. Description:
    - a. Tap water to Type I ultrapure water
    - b. Internal 6L tank
    - c. Built in UV oxidation chamber
  - 3. Water Specifications; Produces water that meets ASTM<sup>™</sup>, ISO 3696 and CLSI-CLRW Type I water requirements. CE, CSA
    - a. Resistivity: 18.2 MΩ·cm
    - b. Conductivity: 0.055 µS/cm
    - c. TOC:  $1 \le 5$  ppb (µg/L)
    - d. Particles: <1 µM/mL

- e. Bacteria: <0.01 CFU/mL
- f. Flow rate: 0.6 L/min.
- 4. Accessories:
  - a. Remote hand dispenser
  - b. Wall attachment kit

#### PART 3 EXECUTION

#### 3.01 EXAMINATION

- A. Verify adequacy of support framing and anchors.
- B. Verify that service connections are correctly located and of proper characteristics.

#### 3.02 INSTALLATION

- A. Perform installation in accordance with manufacturer's instructions and with SEFA 2.
- B. Use anchoring devices to suit conditions and substrate materials encountered. Use concealed fasteners to the greatest degree possible. Use exposed fasteners only where allowed by approved shop drawings, or where concealed fasteners are impracticable.
- C. Set casework items plumb and square, securely anchored to building structure, with no distortion.
  - 1. Base Cabinets: Examine floor levelness and flatness of installation space. Do not proceed with installation if encountered floor conditions required more than 3/4 inch leveling adjustment. When installation conditions are acceptable, for each space, establish the high point of the floor. Set and make level and plumb first cabinet in relation to this high point.
  - 2. Wall Cabinets: Examine wall surfaces in installation space. Do not proceed with installation if the following conditions are encountered:
- D. Align cabinets to adjoining components, install filler and/or scribe panels where necessary to close gaps.
- E. Fasten together cabinets in continuous runs, with joints flush, uniform and tight. Misalignment of adjacent units not to exceed 1/16 inch. In addition, do not exceed the following tolerances:
  - 1. Variation of Tops of Base Cabinets from Level: 1/16 inch in 10 feet.
  - 2. Variation of Bottoms of Upper Cabinets from Level: 1/8 inch in 10 feet .
  - 3. Variation of Faces of Cabinets from a True Plane: 1/8 inch in 10 feet.
  - 4. Variation of Adjacent Surfaces from a True Plane (Lippage): 1/32 inch.
  - 5. Variation in Alignment of Adjacent Door and Drawer Edges: 1/16 inch.
- F. Secure upper and floor cabinets to concealed reinforcement at gypsum board assemblies.
- G. Separate dissimilar metals to prevent galvanic action.
- H. Service Space Framing: Anchor to floor with two fasteners at each frame. Fasten to wall substrates.
- I. Base Cabinets: Fasten cabinets to service space framing and/or wall substrates, with fasteners spaced not more than 16 inches on center. Bolt adjacent cabinets together with joints flush, tight, and uniform.
  - 1. Where base cabinets are installed away from walls or service space framing, anchor to floor at toe space at not more than 24 inches on center, and at sides of cabinets with not less than two fasteners per side.
- J. Wall Cabinets: Fasten to hanging strips, and/or wall substrates. Fasten each cabinet through back, near top, at not less than 16 inches on center.
- K. Install hardware uniformly and precisely. Set hinges snug and flat in mortises.

- L. Vented Cabinets: Install in strict compliance with manufacturer's written installation instructions.
  - 1. Install vent kits and connect to exhaust system.
  - 2. Use only rigid materials for venting. No flexible materials permitted.
  - 3. Plug vent openings in unvented cabinets with manufacturer's standard closure.
- M. Replace units that are damaged, including those that have damaged finishes.
- N. Coordinate installation of work of this section with installation of fume hoods and laboratory equipment.
- O. Countertops: Install countertops in one true plane, with ends abutting at hairline joints, and no raised edges.

#### 3.03 ADJUSTING

A. Adjust operating parts, including doors, drawers, hardware, and fixtures to function smoothly.

#### 3.04 CLEANING

A. Clean casework and other installed surfaces thoroughly.

#### 3.05 PROTECTION

- A. Do not permit finished casework to be exposed to continued construction activity.
- B. Protect casework and countertops from ongoing construction activities. Prevent installers from standing on or storing tools and materials on casework or countertops.
- C. Repair damage that occurs prior to Date of Substantial Completion, including finishes, using methods prescribed by manufacturer; replace units that cannot be repaired to like-new condition.

#### END OF SECTION

#### **SECTION 22 10 00 - PLUMBING PIPING**

#### PART 1 - GENERAL

#### 1.1 SECTION INCLUDES

- A. Pipe and Pipe Fittings.
- B. Valves.
- C. Check Valves.

#### 1.2 QUALITY ASSURANCE

- A. Valves: Manufacturer's name and pressure rating marked on valve body. Remanufactured valves are not acceptable.
- B. Welding Materials and Procedures: Conform to ASME Code and applicable state labor regulations.
- C. Welders Certification: In accordance with ANSI/ASME Sec 9 or ANSI/AWS D1.1.
- D. All grooved couplings, fittings, valves, and specialties shall be the products of a single manufacturer. Grooving tools shall be of the same manufacturer as the grooved components.
  - 1. All castings used for couplings housings, fittings, or valve and specialty bodies shall be date stamped for quality assurance and traceability.
- E. Piping, Fittings, Valves, and Flux for Potable Water Systems: All components shall be lead free per Federal Act S.3874, Reduction of Lead in Drinking Water Act.

#### 1.3 SUBMITTALS

A. Submit shop drawings per Division 01.

#### 1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store valves in shipping containers with labeling in place.

#### PART 2 - PRODUCTS

#### 2.1 CAST IRON PIPE

A. Cast Iron; Standard Weight; No-Hub Sleeve Gaskets:

- 1. Pipe: Standard weight no-hub cast iron soil pipe, bituminous corrosion protective coating inside and outside, CISPI 301 or ASTM A888.
- 2. Design Pressure: Gravity Maximum Design Temperature: 180°F.
- 3. Joints: ASTM C1540, FM 1680, and ASTM C-564.

- Super Duty, Shielded Stainless Steel Couplings: Neoprene sleeve gasket, 0.015" thick 304 stainless steel shield, stainless steel 3/8" screw type clamps, minimum of four clamps for 1-1/2" to 4" and six clamps for 5" and larger pipe sizes. Clamps shall be tightened to minimum 80 inch pounds or as manufacturer requires. Husky SD-4000 or equal.
- b. Heavy Duty, Shielded Stainless Steel Couplings: Neoprene sleeve gasket, 0.010" thick 304 stainless steel shield, stainless steel 5/16" screw type clamps, minimum of four clamps for 1-1/2" to 4" and six clamps for 5" and larger pipe sizes. Clamps shall be tightened to minimum 80 inch pounds or as manufacturer requires. Husky HD-2000 or equal.
- 4. Restraints: Install pipe and fittings per the Cast Iron Soil Pipe Institute's Designation 310. Restrain pipe and fittings using an engineered and tested product manufactured for restraining no-hub cast iron soil pipe. Install per manufacturer's recommendations.
- 5. Adapters: Transitions from cast iron soil pipe to other pipe materials with manufactured adapters specifically for the application. Adapter must meet the same requirements as the joints listed above. ASTM C1460. Sticker identifying transition fitting application must be visible to view.
- A. Cast Iron; Standard Weight Epoxy Coated; No-Hub Sleeve Gaskets:
  - 1. <u>Pipe and Fittings: Standard weight no-hub cast iron soil pipe, epoxy paint corrosion protective</u> coating inside and outside, [CISPI 301 or ASTM A888][CISPI 301 and CISPI Trademark].
  - 2. Joints: ASTM C1540 and FM 1680.
    - a. <u>Super Duty, Shielded Stainless Steel Couplings: Neoprene sleeve gasket, 0.015" (0.381 mm) thick 304 stainless steel shield , stainless steel 3/8" (10 mm) screw type clamps, minimum of four clamps for 1-1/2" (38 mm) to 4" (100 mm) and six clamps for 5" (125 mm) and larger pipe sizes. Clamps shall be tightened to minimum 80 inch pounds (9 Nm) or as manufacturer requires. Husky SD-4000 or equal.</u>
  - 3. <u>Restraints: Install pipe and fittings per the Cast Iron Soil Pipe Institute's Designation 301. Restrain</u> pipe and fittings using an engineered and tested product manufactured for restraining no-hub cast iron soil pipe. Install per manufacturer's recommendations.
  - 4. <u>Adapters: Transitions from cast iron soil pipe to other pipe materials with manufactured adapters</u> <u>specifically for the application. Adapter must meet the same requirements as the joints listed</u> <u>above. ASTM C1460. Sticker identifying transition fitting application must be visible to view.</u>

#### 2.2 COPPER PIPE

- A. Copper Pipe; Type L; Solder Joints:
  - 1. Pipe: Type L hard drawn seamless copper tube, ASTM B88.
  - 2. Design Pressure: 175 psi; Maximum Design Temperature: 200°F.
  - 3. Joints: Solder with 100% lead-free solder and flux, ASTM B32.
  - 4. Fittings: Wrought copper solder joint, ANSI B16.22.

#### 2.3 PLASTIC PIPE

- A. <u>PVC-DWV; Schedule 40; Solvent Weld Joints:</u>
  - 1. <u>Pipe: Schedule 40 rigid, PVC-DWV, normal impact Type I, with plain ends, conforming to ASTM</u> Standards D2665 or D2661. Cellular core piping is not acceptable.
  - 2. Joints: Solvent-weld socket type with solvent recommended by pipe manufacturer.
  - 3. <u>Fittings: PVC-DWV, normal impact Type I, with solvent-weld socket type ends for Schedule 40</u> pipe.

- 4. <u>Limits: Schedule 40 PVC-DWV pipe must not be threaded. Do not use where exposed or in return</u> <u>air plenums.</u>
- 5. <u>Use: Use PVC only where allowed by local jurisdiction. Comply with all special requirements or limitations.</u>
- 6. <u>Special Requirements: Provide expansion loop(s) and/or expansion joints in the piping system</u> per the manufacturer's guidelines and as shown on the drawings. Refer to Section 22 05 16 for <u>expansion joint requirements.</u>

#### 2.4 NITROGEN & ARGON INSTRUMENT AIR

- A. Design Pressure: 300 psig (2070 kPa gauge).
  - 1. Maximum Design Temperature: 130F.
- B. Piping All Sizes:
  - 1. Tubing: Type K hard drawn seamless copper tube, ASTM B819, cleaned and capped for oxygen service. Tube size indicated is nominal designation.
  - 2. Joints: BCuP silver braze, AWS A5.8.
  - 3. Fittings: Wrought copper solder joint, ANSI B16.22, cleaned and bagged "for oxygen service".
- C. Shutoff Valves:
  - VS-2: 4" (100 mm) and under, MSS SP-110, three-piece body, full port, double-seal bolted union ball type, 400 psi (2760 kPa) WOG, bronze body, chrome plated brass ball, blowout proof stem, cleaned, tested, lockable, plugged and tagged at factory for required service, with type K copper tube extensions brazed to flanges. Provide a standard keyed padlock with each valve. Review padlock type with Owner prior to installation.
  - 2. Manufacturers:
    - a. Amico
    - b. Beacon/Medaes
    - c. Chemetron
    - d. Tri-Tech Medical
    - e. Pattons Medical

#### 2.5 NITROGEN AND/OR INSTRUMENT AIR MANIFOLD

- A. Duplex fully automatic nitrogen manifold with wall mounted control cabinet and necessary header connection and pigtails arranged for 2 cylinders in service and 2 cylinders in reserve.
- B. Manifold shall deliver design capacity continuously at 180 psig (1240 kPa gauge). Provide automatic changeover from primary to secondary bank and allow replacing depleted cylinders with no change in line pressure. Manual resetting of the control panel shall not be required. Provide bank regulators to reduce cylinder pressure for line regulator set at 160 psig (1105 kPa gauge) delivery pressure. Provide manifold relief valve set at 50% above design pressure.

- C. Provide bypass system between regulators to service regulator or switch over system without interrupting supply of gas. Bleed valves shall allow adjustment of pressure reducing regulators. Manifolds which cannot perform switching operations per NFPA 99 5.1.3.5.12.5 without electrical power are not acceptable.
- D. House components in lockable cabinet with baked enamel finish. Three front mounted gauges shall indicate bank and hospital line pressures. Green indicator light shall indicate service bank in use and red light shall indicate reserve bank in use. Provide terminal block connections for remote alarm.
- E. Individually secure gas cylinders to a rigid structure in accordance with the current edition of NFPA-99. Cylinder restraints shall allow removal and reinstallation of cylinders on a regular basis.
- F. Manufacturers:
  - 1. Amico
  - 2. Beacon/Medaes
  - 3. Chemetron
  - 4. Ohio Medical
  - 5. Patton's Medical
  - 6. Tri-Tech Medical
  - 7. Powerex.

#### 2.6 VALVES

- A. Shutoff Valves:
  - 1. Ball Valves:
    - a. BA-1: 3" and under, 150 psi saturated steam, 600 psi CWP, full port, screwed or solder ends (acceptable only if rated for soldering in line with 470°F melting point of lead-free solder), bronze body of a copper alloy containing less than 15% zinc, stainless steel ball and trim, Teflon seats and seals. Apollo #77C-140, Stockham #S-255-FB-P-UL, Milwaukee #BA-400, Watts, Nibco #585-70-66, National Utilities Co., RUB.
      - 1) Provide solid extended shaft for all insulated piping.
      - 2) Provide lock out trim for all valves opening to atmosphere installed in domestic water piping over 120°F, heating water piping over 120°F, steam, condensate, boiler feed water piping, and gasoline/kerosene piping, and as indicated on the drawings. Solid extended shaft is not required on valves with lock out trim.

#### 2.7 STRAINERS

A. ST-1: Bronze body, screwed ends, screwed cover, 150 psi S @ 350°F, 200 psi CWP @ 150°F. Armstrong #F4SC, Metraflex #TS, Mueller Steam Specialty Co. #351, Sarco #BT, Watts #777.

#### 2.8 CHECK VALVES

CK-1: 2" and under, 125# steam @ 406°F, 200# CWP @ 150°F, screwed, bronze, horizontal swing. Crane #37, Hammond #IB904, Stockham #B319-Y, Walworth #3406, Milwaukee #509, Watts #G-5000, Nibco T-413B.

#### 2.9 LOCK OUT TRIM

A. Provide lock out trim for all quarter turn shutoff valves opening to atmosphere and installed in domestic water piping over 120°F and as indicated on the drawings.

#### 2.10 VALVE CONNECTIONS

A. Provide all connections to match pipe joints. Valves shall be same size as pipe unless noted otherwise.

#### 2.11 CONNECTIONS BETWEEN DISSIMILAR METALS

- A. Connections between dissimilar metals shall be insulating dielectric types that provide a water gap between the connected metals, and that either allow no metal path for electron transfer or that provide a wide water gap lined with a non-conductive material to impede electron transfer through the water path.
- B. Joints shall be rated for the temperature, pressure, and other characteristics of the service in which they are used, including testing procedure.
- C. Aluminum, iron, steel, brass, copper, bronze, galvanized steel and stainless steel are commonly used and require isolation from each other with the following exceptions:
  - 1. Iron and steel connected to each other.
  - 2. Brass, copper, and bronze connected to each other.
  - 3. Brass or bronze valves and specialties connected in closed systems with steel, iron, or stainless steel on both sides of the brass or bronze valves and specialties. Where two or more brass or bronze items occur together, they shall be connected with brass nipples. Brass or bronze valves and specialties cannot be used as a dielectric separation between pipe materials.
- D. Dielectric protection is required at connections to equipment of a material different than the piping.
- E. Screwed and/or Grooved Joints (acceptable up to 4" size):
  - 1. Dielectric waterway rated for 300 psi CWP and 225°F.
  - 2. Optional: Copper-silicon casting conforming to UNS C87850 with grooved and/or threaded ends.
  - 3. UL classified in accordance with ANSI / NSF-61 for potable water service.
  - 4. Manufacturers:
    - a. Elster Group ClearFlow fittings
    - b. Victaulic Series 647
    - c. Grinnell Series 407
    - d. Matco-Norca
- F. Flanged Joints (any size):
  - 1. Use 1/8" minimum thickness, non-conductive, full-face gaskets.
  - 2. Employ one-piece molded sleeve-washer combinations to break the electrical path through the bolts.
  - 3. Sleeve-washers are required on one side only, with sleeves minimum 1/32" thick and washers minimum 1/8" thick.

- 4. Install steel washers on both sides of flanges to prevent damage to the sleeve-washer.
- 5. Separate sleeves and washers may be used only if the sleeves are manufactured to exact lengths and installed carefully so the sleeves must extend partially past each steel washer when tightened.
- 6. Manufacturers:
  - a. EPCO
  - b. Central Plastics
  - c. Pipeline Seal and Insulator
  - d. F. H. Maloney
  - e. Calpico

#### PART 3 - EXECUTION

#### 3.1 PREPARATION

- A. Install all products per manufacturer's recommendations.
- B. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
- C. Remove scale and dirt, on inside and outside, before assembly.
- D. Remove all scale, rust, dirt, oils, stickers and thoroughly clean exterior of all bare metal exposed piping, hangers, and accessories in preparation to be painted.
- E. Connect to equipment with flanges or unions. Unions or flanges for servicing and disconnect are not required in installations using grooved joint couplings.
- F. Use only piping materials rated for the maximum temperature of the application, e.g., do not use PVC for dishwasher drainage or piping that receives boiler blowdown.
- G. Existing building sewers or building drains which are shown on the documents to be reused shall be inspected and recorded by closed circuit television for their condition. Report findings back to the Architect, Engineer, and Owner before proceeding with work so any necessary rework can take place if needed.

#### 3.2 LAB GAS PIPING INSTALLATION

- A. General Installation Requirements:
  - 1. Install all systems in accordance with manufacturer's instructions and the current edition of NFPA 99.
  - 2. Braze joints in pipe and tubing. DURING BRAZING OF PIPE CONNECTIONS, PURGE INTERIOR OF PIPE CONTINUOUSLY WITH NITROGEN. Make joint without adding flux.
  - 3. Change pipe size with reducing fittings. Change direction with fittings.
  - 4. Cut pipe and tubing accurately and install without springing or forcing.
  - 5. Pitch piping down in direction of flow.
  - 6. Provide pipe sleeves per Section 22 05 29.

- 7. Refer to Division 01 for Excavation, Fill, Backfill and Compaction requirements.
- 8. Coordinate utility warning and identification tape with backfill operation and NFPA 99 requirements. Refer to Section 22 05 53 for identification.
- 9. Provide identification for all piping. Refer to Section 22 05 53.
- 10. Manufacturer shall inspect the installation and assist in startup of equipment. Manufacturer shall submit report certifying the equipment is operating properly.
- 11. Clamps in direct contact with copper pipe shall include plastic pipe insert similar to Unistrut Cush-A-Clamp, Hydra-Zorb, Erico Cushion Clamp or Cooper Vibra-Clamp.
  - a. 1/4" (6 mm) pipe or tubing: 60" (1500 mm) OC
  - b. 3/8 (10 mm) pipe or tubing: 72" (1800 mm) OC
  - c. 1/2" (15 mm) pipe or tubing: 72" (1800 mm) OC
  - d. 3/4" (20 mm) pipe or tubing: 84" (2100 mm) OC
  - e. 1" (25 mm) pipe or tubing: 96" (2440 mm) OC
  - f. 1-1/4" (32 mm) pipe or tubing: 108" (2700 mm) OC
  - g. 1-1/2" (40 mm) or larger (horizontal): 120" (3000 mm) OC
  - h. 1-1/2" (40 mm) or larger (vertical): 10' (3000 mm) at every floor not to exceed 15" (4600 mm).
- B. Valves/Fittings and Accessories:
  - 1. Install shutoff valves at base of each riser. Install shutoff valves at branch connections to risers on individual floors. Install lateral pipes feeding shut off valves:
    - a. Locate immediately adjacent to main or riser.
    - b. Ensure not accessible to unauthorized personnel.
    - c. Identify gas and function of zone valves outside cabinets.
    - d. Leave in open position with handle locked.
    - e. Provide test ports on both sides of shutoff valves.
  - 2. Install valved connections on mains for pressure switches and main pressure gauges.
  - 3. Except where indicated or in flush wall mounted cabinets, install manual shut off valves with stem vertical and accessible for operation and maintenance.
  - 4. Install pressure gauges in valve boxes on the patient service side of the shutoff valve.
  - 5. Install strainers on inlet side of pressure reducing valves. Provide main gas valves (pressure reducing or flow control) with bypasses and shutoff valves to permit maintenance without interruption of gas.
  - 6. Provide a valved bypass around all receivers.

#### 3.3 SYSTEM, PIPING AND VALVE SCHEDULE

- A. Cold Water, Hot Water, Tempered Water Potable and Non-Potable (Above Ground):
  - 1. Copper Pipe; Type L; Solder Joints: All Sizes
  - 2. Shutoff Valves: BA-1
  - 3. Check Valves: CK-1
  - 4. Strainers: ST-1
- B. Sanitary Waste and Vent, Gravity (Above Ground):

- 1. Cast Iron; Standard Weight; No-Hub Sleeve Gaskets: 1-1/2" to 15"
- 2. PVC-DWV; Schedule 40; Solvent Weld Joints: All Sizes
- C. Sanitary Waste and Vent, Gravity (Underground Inside Building):
  - 1. Cast Iron; Standard Weight; No-Hub Sleeve Gaskets: 1-1/2" to 15"
  - 1. <u>PVC-DWV; Schedule 40; Solvent Weld Joints: All Sizes</u>

#### 3.4 TESTING PIPING

- A. Sanitary Drainage, Sanitary Vent:
  - 1. Test all piping with water to prove tight.
  - 2. Test piping before insulation is applied.
  - 3. Hydrostatically test all soil, waste, and vent piping inside of building with 10 feet head of water for 15 minutes. Inspect before fixtures are connected. If leaks appear, repair them and repeat the test.
  - 4. Hydrostatically test interior downspouts with 10 feet head of water for 15 minutes with no leaks.
  - 5. A smoke/air test at the same pressure may be used in lieu of the hydrostatic water test. Exception: Smoke/air test shall not be performed on plastic piping.
  - 6. Test force mains with water at 105% of the operating pump discharge pressure for 15 minutes.
  - 7. Test pressures stated above shall be as listed or as required by the Authority Having Jurisdiction, whichever is most stringent.
- B. Hot Water Potable and Non-Potable, Cold Water Potable and Non-Potable:
  - 1. Test pipes underground or in chases and walls before piping is concealed.
  - 2. Test all pipes before the insulation is applied. If insulation is applied before the pipe is tested and a leak develops which ruins the insulation, replace damaged insulation.
  - 3. Test the pipe with 100 psig water pressure or equal inert gas such as nitrogen. Exception: Inert gas test shall not be used to test plastic piping.
  - 4. Hold test pressure for at least 2 hours.
  - 5. Test to be witnessed by the Architect/Engineer's representative, if requested by the Architect/Engineer.
- C. Fire Service:
  - 1. Hydrostatically test the entire system for two hours at 200 psig. Maximum leakage shall be:
    - a. Interior Piping: 0 quarts per hour.
    - b. Underground Piping: 2 quarts per 100 joints per hour.
- D. All Other Piping:
  - 1. Test piping at 150% of normal operating pressure.
  - 2. Piping shall hold this pressure for one hour with no drop in pressure.
  - 3. Test piping using water, nitrogen, or air as compatible with the final service of the pipe. Do not use combustible fluids.
  - 4. Drain and clean all piping after testing is complete.

#### 3.5 SYSTEMS CLEANING, TESTS, AND ANALYSIS

- A. Document all tests and submit to Owner, Architect/Engineer, and Authority Having Jurisdiction.
- B. Prior to the installation of station outlets, pressure switches, gauges, manifolds, or relief valves, blow down the piping system with oil-free dry nitrogen to clear piping of any moisture or foreign material.
- C. In system additions or remodel installations, test all new piping prior to connection to existing system.
- D. Perform the following Installer Performance Tests in accordance with the current edition of NFPA 99:
  - 1. Initial Pressure Test:
    - Prior to the installation of pressure switches, gauges, manifolds, and relief valves, before closing of walls, but after the installation of station outlets, test all piping or piping sections with oil-free dry nitrogen at 1.5 times system working pressure, 150 psig (1035 kPa gauge) minimum.
    - b. Maintain test pressure and examine each joint for leakage using soapy water or equally safe detection method.
    - c. Locate and repair all leaks. Repeat test and repairs until no leaks are evident.
  - 2. Standing Pressure Test:
    - a. Upon passing the Initial Pressure Test and installation of the remaining system components (pressure switches, gauges, manifolds, relief valves), test all piping systems with oil-free dry nitrogen for 24 hours at 20% above the normal operating system pressure. Vacuum system piping shall be tested at a pressure not less than 60 psig (415 kpa gauge).
    - b. The piping system shall remain leak free for 24 hours. Only system pressure fluctuations due to ambient temperature variations are allowed. Vacuum system pressure must be within 5 psig (35 kPa gauge) of the original test pressure.
    - c. Locate and repair all leaks. Repeat test and repairs until no leaks are evident.
  - 3. Piping Purge Test:
    - a. A high-flow purge of oil-free dry nitrogen shall be performed on each outlet utilizing the appropriate adapter to remove particulate matter from the pipelines.
    - b. Allow each outlet to flow fully until no discoloration is evident on a white cloth.
  - 4. Cross-Connection Test:
    - a. Reduce pressure to atmospheric in piping systems other than system under investigation. Verify the medical vacuum systems are in operation.
    - b. Pressurize system under investigation with 50 psig (345 kPa gauge) oil-free dry nitrogen.
    - c. Check each station outlet of every piping system to determine test gas is dispensed only from outlet of system under investigation. Measure pressure with gauge attached to specific adaptor. Do not use universal adapters.
    - d. Test medical vacuum outlets at the same time the medical gas systems are tested.
    - e. Repeat test for each gas.

- f. Verify the presence and correctness of all system component (outlets, valves, panels) labeling.
- g. Include Waste Anesthetic Gas Disposal systems in cross-connect and flow tests as required by NFPA 99.

#### 3.6 CLEANING PIPING

- A. Assembly:
  - 1. Before assembling pipe systems, remove all loose dirt, scale, oil and other foreign matter on internal or external surfaces by means consistent with good piping practice subject to approval of the Architect/Engineer's representative. Blow chips and burrs from machinery or thread cutting operation out of pipe before assembly. Wipe cutting oil from internal and external surfaces.
  - 2. During fabrication and assembly, remove slag and weld spatter from both internal and external joints by peening, chipping and wire brushing.
  - 3. Notify the Architect/Engineer's representative before starting any post erection cleaning in sufficient time to allow witnessing the operation. Consult with and obtain approval from the Architect/Engineer's representative regarding specific procedures and scheduling. Dispose of cleaning and flushing fluids properly.
  - 4. Prior to blowing or flushing erected piping systems, disconnect all instrumentation and equipment, open wide all valves, and be certain all strainer screens are in place.
- B. Air Blow:
  - 1. Blow out pipe and components with clean compressed air. Instrument air, argon, nitrogen and sulfuric acid lines shall be blown out with dry, oil free air or nitrogen gas. "Oil Free" is defined as air compressed in a centrifugal, Teflon ring, carbon ring or water pumped air compressor. Where air supply is judged to be inadequate to continually attain cleaning velocity, alternate pressurization and sudden relief procedure may be used until discharge at all blow out points is clean. Use 80-90 psig pressure unless otherwise indicated.
  - 2. Air blow applies to the following systems:
    - a. Acetylene
    - b. Carbon Dioxide
    - c. Nitrogen (use oil free air or nitrogen gas)
    - d. Argon (use oil free air or nitrogen gas)
    - e. Instrument Air (use oil free air or nitrogen gas)
    - f. Distilled Water (use maximum of 50 psig pressure)
    - g. Chemical Feed
    - h. Air Compressor Intakes
    - i. Sulfuric Acid (use oil free air or nitrogen gas)
- C. All Water Piping:
  - 1. Flush all piping using faucets, flush valves, etc. until the flow is clean.
  - 2. After flushing, thoroughly clean all inlet strainers, aerators, and other such devices.
  - 3. If necessary, remove valves to clean out all foreign material.

#### 3.7 INSTALLATION

- A. General Installation Requirements:
  - 1. Provide dielectric connections between dissimilar metals.
  - 2. Route piping in orderly manner and maintain gradient. Install to conserve building space.
  - 3. Group piping whenever practical at common elevations.
  - 4. Install piping to allow for expansion and contraction without stressing pipe, joints, or equipment.
  - 5. Slope water piping and arrange to drain at low points.
  - 6. Install bell and spigot piping with bells upstream.
  - 7. Where pipe supports are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welds.
  - Seal pipes passing through exterior walls with a wall seal per Section 22 05 29. Provide Schedule
    40 galvanized sleeve at least 2 pipe sizes larger than the pipe.
  - 9. All non-potable outlets shall be clearly marked with a permanently affixed laminated sign with 3/8" high lettering saying "Non-Potable Water Not for Human Consumption." Sign shall have black lettering on a yellow background.
  - 10. All vertical pipe drops to sinks or other equipment installed below the ceiling shall be routed within a wall cavity, unless specifically noted otherwise to be surface mounted. For renovation projects, this Contractor is responsible for opening and patching existing walls for installation of piping. Wall patching shall match existing condition.
- B. Valves/Fittings and Accessories:
  - 1. Install shutoff valves that permit the isolation of equipment/fixtures in each room without isolating any other room or portion of the building. Individual fixture angle stops do not meet this requirement. Exception: Back-to-back rooms in no more than two adjacent rooms.
  - 2. Provide clearance for installation of insulation and access to valves and fittings.
  - 3. Provide access doors for concealed valves and fittings.
  - 4. Install valve stems upright or horizontal, not inverted.
  - 5. Provide one plug valve wrench for every ten plug valves 2" and smaller, minimum of one. Provide each plug valve 2-1/2" and larger with a wrench with set screw.
  - Install corrugated, stainless steel tubing system according to manufacturer's written instructions. Include striker plates to protect tubing from puncture where tubing is restrained and cannot move.
- C. Underground Piping:
  - 1. Refer to Division 01 for Excavation, Fill, Backfill and Compaction requirements
  - 2. As an option, the Contractor may provide factory applied protective coatings consisting of a polyethylene plastic film bonded to the pipe surface by a hot applied thermo-plastic adhesive.
    - a. Manufacturers:
      - 1) Republic Steel Corp. "X-Tru-Coat"
  - 3. Exercise care in handling, storing and laying pipe to avoid damaging factory applied coatings. If any damage occurs, repair the coating to a condition equal to the original.

- 4. Field application of protective coatings to joints, fittings and to any damaged factory applied coatings shall be similar to factory applied coatings specified above and shall be done in strict accordance with recommendations of the supplier of pipe coatings.
- 5. After completion of the fabrication, laying and field coating of the joints and fittings, but prior to backfilling, inspect the entire line in the presence of the Architect/Engineer's representative with an electronic holiday detector. Any defects in the protective coatings shall be repaired in accordance with requirements for original coatings.
- 6. Coat flange bolts and nuts in pits and below ground at the time of installation with a corrosion protective coating.
- D. Sanitary and Storm Piping:
  - 1. Install all sanitary and storm piping inside the building with a slope as shown on the drawings.
  - 2. Install horizontal offset at all connections to roof drains to allow for pipe expansion.
  - 3. Slope sanitary and storm piping outside the building to meet invert elevations shown on drawings and to maintain a minimum velocity of 2 feet per second.
  - 4. Sway Bracing: Where horizontal sanitary and/or storm pipes 4 inches and larger change flow direction greater than 45°, rigid bracing or thrust restraints shall be installed to resist movement of the upstream pipe in the direction of pipe flow. The rigid bracing or thrust restraint shall be connected to structure. A change of flow direction from horizontal into a vertical pipe does not require the upstream pipe to be braced.
  - 5. All sanitary and storm piping shall have at least 42" of cover when leaving the building.
  - 6. Starter fittings with internal baffles are not permitted.

#### 3.8 PIPE ERECTION AND LAYING

- A. Carefully inspect all pipe, fittings, valves, equipment and accessories before installation. Any items that are unsuitable, cracked or otherwise defective shall be removed from the job immediately.
- B. All pipe, fittings, valves, equipment and accessories shall have factory applied markings, stampings, or nameplates with sufficient data to determine their conformance with specified requirements.
- C. Exercise care at every stage of storage, handling, laying and erecting to prevent entry of foreign matter into piping, fittings, valves, equipment and accessories. Do not install any item that is not clean.
- D. Until system is fully operational, all openings in piping and equipment shall be kept closed except when actual work is being performed on that item or system. Closures shall be plugs, caps, blind flanges or other items specifically designed and intended for this purpose.
- E. Run pipes straight and true, parallel to building lines with minimum use of offsets and couplings. Provide only offsets required to provide needed headroom or clearance and to provide needed flexibility in pipe lines.
- F. Make changes in direction of pipes only with fittings or pipe bends. Changes in size only with fittings. Do not use miter fittings, face or flush bushings, or street elbows. All fittings shall be of the long radius type, unless otherwise shown on the drawings or specified.
- G. Provide flanges or unions at all final connections to equipment, traps and valves.

- H. Arrange piping and connections so equipment served may be totally removed without disturbing piping beyond final connections and associated shutoff valves.
- I. Use full and double lengths of pipe wherever possible.
- J. Unless otherwise indicated, install all piping, including shutoff valves and strainers, to coils, pumps and other equipment at line size with reduction in size being made only at control valve or equipment.
- K. Cut all pipe to exact measurement and install without springing or forcing except in the case of expansion loops where cold springing is indicated on the drawings.
- L. Underground pipe shall be laid in dry trenches maintained free of accumulated water. Refer to Division 01 for Excavation, Fill, Backfill and Compaction requirements.
- M. Unless otherwise indicated, branch take-offs shall be from top of mains or headers at either a 45° or 90° angle from the horizontal plane for air lines, and from top, bottom or side for liquids.
- N. Do not use geotextile fabric with footing tile if silt content of soil exceeds 40% or if clay content exceeds 50%. The fabric shall be installed around 1" river rock or 2" limestone.

#### 3.9 DRAINING AND VENTING

- A. Unless otherwise indicated on the drawings, all horizontal water lines, including branches, shall pitch 1" in 40 feet to low points for complete drainage, removal of condensate and venting.
- B. Maintain accurate grade where pipes pitch or slope for venting and drainage. No pipes shall have pockets due to changes in elevation.
- C. Provide drain valves at all low points of water piping systems for complete or sectionalized draining.
- D. Use eccentric reducing fittings on horizontal runs when changing size of pipes for proper drainage and venting. Install gravity drain pipes with bottom of pipe and eccentric reducers in a continuous line; all other liquid lines with top of pipe and eccentric reducers in a continuous line.
- E. Provide air vents at high points and wherever else required to eliminate air in all water piping systems.
- F. Install air vents in accessible locations. If necessary to trap and vent air in a remote location, install an 1/8" pipe from the tapping location to an accessible location and terminate with a venting device.
- G. All vent and drain piping shall be of same materials and construction for the service involved.

#### 3.10 PLUMBING VENTS

A. Vent as shown on the drawings and in accordance with all codes having jurisdiction.

#### 3.11 BRANCH CONNECTIONS

A. For domestic water and vent systems only, make branch connections with standard tee or cross fittings of the type required for the service.

#### PLUMBING PIPING

- B. Reducers are generally not shown. Where pipe sizes change at tee, the tee shall be the size of the largest pipe shown connecting to it.
- C. Do not use double wye or double combination wye and eighth bend DWV fittings in horizontal piping.
- D. Branch connections from the headers and mains may be mechanically formed using an extraction device. The branch piping connection shall be brazed connection for the following services only:
  - 1. Domestic water piping above ground.
- E. Further limit use of mechanically formed fittings as follows:
  - 1. Must have at least same pressure rating as the main.
  - 2. Main must be Type K or L copper tubing.
  - 3. Permanent marking shall indicate insertion depth and orientation.
  - 4. Branch pipe shall conform to the inner curve of the piping main.
  - 5. Main must be 1" or larger.
  - 6. Branch must be 3/4" or larger.
- F. Forged weld-on fittings are limited as follows:
  - 1. Must have at least same pressure rating as the main.
  - 2. Main must be 2-1/2" or larger.
  - 3. Branch line is at least two pipe sizes under main size.

#### 3.12 JOINING OF PIPE

- A. Solder Joints (Copper Pipe):
  - 1. Make up joints with 100% lead-free solder, ASTM B32. Cut tubing so ends are perfectly square and remove all burrs inside and outside. Thoroughly clean sockets of fittings and ends of tubing to remove all oxide, dirt and grease just prior to soldering. Apply flux evenly, but sparingly, over all surfaces to be joined. Heat joints uniformly so solder will flow to all mated surfaces. Wipe excess solder, leaving a uniform fillet around cup of fitting.
  - 2. Flux shall be non-acid type.
  - 3. Solder end valves may be installed directly in the piping system if the entire valve is suitable for use with 470°F melting point solder. Remove discs and seals during soldering if they are not suitable for 470°F.
- B. No-Hub Sleeve Gaskets (No-Hub) (Cast Iron Pipe):
  - 1. Gasket shall be heavy weight class, conforming to ASTM C564.
  - 2. The gasket shall have an internal center stop.
  - 3. The gasket shall be covered by a stainless steel band secured with a minimum of four stainless steel bands per fitting/joint.
  - 4. Sleeve gaskets shall be installed in accordance with the manufacturer's installation instructions.

#### 3.13 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

- A. Disinfection of the domestic water piping shall be completed within three (3) weeks prior to building occupancy. Contractor is responsible for disinfecting water piping if used by workers during construction; disinfection during construction does not eliminate the requirement for final disinfection prior to occupancy. Flushing of piping shall be completed within two (2) weeks prior to building occupancy.
- B. Provide necessary connections at the start of individual sections of mains for adding chlorine.
- C. Before starting work, verify system is complete, flushed and clean.
- Follow the disinfection of potable water procedure outlined in this project's applicable plumbing code.
  For example: IPC 610.1, UPC 609.10, CPC 609.9, and Illinois 890.1180. Where local codes do not outline a disinfection procedure, follow the International Plumbing Code procedure 610.1.
- E. Bleed water from all outlets to ensure chlorine distribution throughout the entire domestic water system.
- F. Take water samples, no sooner than 24 hours after flushing, from 2% of outlets and from water entry. Obtain, analyze, and test samples in accordance with AWWA C651, Section 5 Verification.

#### END OF SECTION 22 10 00

#### SECTION 23 31 00 - DUCTWORK

#### PART 1 - GENERAL

#### 1.1 SECTION INCLUDES

- A. Galvanized Ductwork
- B. Stainless Steel Ductwork
- C. Ductwork Reinforcement
- D. Ductwork Sealants
- E. Rectangular Ductwork
- F. Round and Flat Oval Ductwork
- G. Flexible Duct
- H. Fume Exhaust Duct
- I. Leakage Testing
- J. Ductwork Penetrations
- K. Duct Cleaning

#### 1.2 SUBMITTALS

- A. Submit shop drawings per Division 01.
- B. Submit duct fabrication standards in compliance with SMACNA and these specifications. Clearly indicate metal gauges, reinforcement, and joining methods intended for use for each pressure classification.
  Furnish details of all common duct fittings and joint connections to be used on this project.
- C. The Architect/Engineer may require field verification of sheet metal gauges and reinforcing to verify compliance with these specifications. At the request of the Architect/Engineer, the contractor shall remove a sample of the duct for verification. The contractor shall repair as needed.
- D. Duct Layout Drawings: Submit detailed duct layout drawings at 1/4" minimum scale complete with the following information:
  - 1. Actual duct routing, ductwork fittings, actual sheet metal dimensions including insulation liner and wrap, duct hanger and support types, ductwork accessories, etc. with lengths and weights noted.
  - 2. Differentiate ducts that are wrapped. Include insulation thickness, type of insulation, and acoustical lagging.
  - 3. Room names and numbers, ceiling types, and ceiling heights.

- 4. Indicate location of all beams, bar joists, etc. along with bottom of steel elevations for each member.
- 5. Verify clearances and interferences with other trades prior to preparing drawings. IMEG will provide electronic copies of ventilation drawings for contractor's use if the contractor signs and returns the "Electronic File Transfer" waiver. IMEG will not consider blatant reproductions of original file copies an acceptable alternative for this submittal. Refer also to Section 23 05 00.
- E. Duct Leakage Test Summary Report: Upon completion of the pressure test described in Part 3, the Contractor shall submit an air duct leakage test summary report as outlined in the SMACNA HVAC Duct Leakage Test Manual.

#### 1.3 DEFINITIONS

- A. Duct Sizes shown on drawings are inside clear dimensions. Maintain clear dimensions inside any lining.
- B. Transitions are generally not shown in single-line ductwork. Where sizes change at a divided flow fitting, the larger size shall continue through the fitting.
- C. Exterior Duct: Ductwork located outside the conditioned envelope including exposed ductwork above the roof, outside exterior walls, in attics above insulated ceilings, inside parking garages, and crawl spaces.
- D. Interior Duct: Ductwork located within the conditioned envelope including return air plenums and indirectly conditioned spaces.

#### 1.4 COORDINATION DRAWINGS

- A. Reference Coordination Drawings article in Section 23 05 00 for required duct systems electronic CAD drawings to be provided to Coordinating Contractor for inclusion into composite coordination drawings.
- B. Duct drawings shall be at 1/4" minimum scale complete with the following information:
  - 1. Actual duct routing, ductwork fittings, actual sheet metal dimensions including insulation liner and wrap, duct hanger and support types, ductwork accessories, etc. with lengths and weights noted.
  - 2. Differentiate ducts that are lined or wrapped. Include insulation thickness, type of insulation, and acoustical lagging.
  - 3. Location and size of all duct access doors.
  - 4. Room names and numbers, ceiling types, and ceiling heights.
  - 5. Indicate location of all beams, bar joists, etc. along with bottom of steel elevations for each member.
  - 6. IMEG will provide electronic file copies of ventilation drawings for contractor's use if the contractor signs and returns an "Electronic File Transfer" waiver provided by IMEG. IMEG will not consider blatant reproductions of original file copies an acceptable alternative for coordination drawings. Architectural plans will need to be obtained from the Architect.

#### PART 2 - PRODUCTS

#### 2.1 GENERAL REQUIREMENTS AND SUPPORTS

- A. Rectangular Duct Single Wall:
  - 1. General Requirements:
    - a. All ductwork gauges and reinforcements shall be as listed in SMACNA Duct Construction Standards Chapter 2. Where necessary to fit in confined spaces, furnish heaviest duct gauge and least space consuming reinforcement.
    - b. Transitions shall not exceed the angles in Figure 4-7.
  - 2. Exceptions and modifications to the 2005 HVAC Duct Construction Standards are:
    - a. All ducts shall be cross-broken or beaded.
    - b. Snap lock seams are not permitted.
    - c. Turning vanes shall be used in all 90°° mitered elbows, unless clearly noted otherwise on the drawings. Vanes shall be as follows:
      - 1) Type 1:
        - a) Description: Single wall type with 22-gauge (0.029") or heavier vanes, 3-1/4" blade spacing, and 4" to 4-1/2" radius. Vanes hemmed if recommended by runner manufacturer. Runners shall have extra-long locking tabs. C-value independently tested at below 0.26. EZ Rail II by Sheet Metal Connectors or equal.
        - b) Usage: Limited to 3,000 fpm and vane lengths 36" and under.
      - 2) Turning vanes shall operate quietly. Repair or replace vanes that rattle or flutter.
      - Runners must be installed at a 45<sup>°°</sup> angle. Elbows with different size inlet and outlet must be radius type.
      - 4) Omitting every other vane is prohibited.
    - d. Where smooth radius rectangular elbows are shown, they shall be constructed per SMACNA Figure 4-2. Type RE1 shall be constructed with a centerline duct radius R/W of 1.0. Where shown on drawings, Type RE3 elbows with 3 vanes shall be used with centerline duct radius R/W of 0.6 (SMACNA r/W=0.1). RE1 or RE3 elbows may be used where mitered elbows are shown if space permits. Mitered elbows (with or without turning vanes) may not be substituted for radius elbows. Do not make branch takeoffs within 4 duct diameters on the side of the duct downstream from the inside radius of radius elbows.
    - e. Rectangular branch and tee connections in ducts over 1" pressure class shall be 45°° entry type per Figs. 4-5 and 4-6. Rectangular straight taps are not acceptable above 1" pressure class.
    - f. Bellmouth fittings shown on return duct inlets shall expand at a 60-degree total angle horizontally and vertically (space permitting) and have length of at least 25% of the smallest duct dimension.

- g. Round taps off rectangular unlined ducts shall be flanged conical or bellmouth type (equal to Buckley Bellmouth or Sheet Metal Connectors E-Z Tap), or 45°° rectangular with transition to round (equal to Sheet Metal Connectors Inc. High Efficiency Takeoff). Straight taps are acceptable if pressure class is 1" or less, round duct is 12" diameter or less, and the tap is not located between fans and TAB devices.
- h. Duct offsets shall be constructed as shown on drawings. Additional offsets required in the field shall be formed of mitered elbows without turning vanes for offsets up to 30°° maximum angle in accordance with SMACNA offset Type 2. Offsets of greater than 30°° angle shall be formed of radius elbows with centerline radius R/W=1.0 or greater. SMACNA Type 1 offsets are not permitted.
- i. All lined duct shall utilize dovetail joints where round or conical taps occur. The dovetail joints shall extend past the liner before being folded over.
- j. Cushion heads are acceptable only downstream of TAB devices in ducts up to ± 2" pressure class, and must be less than 6" in length.
- Slide-on flanged transverse joint systems are acceptable provided they are a manufactured product that has been tested for conformance with Chapter 2 of the SMACNA HVAC Duct Construction Standards for sheet and joint deflection at the specified pressure class.
  - 1) Apply sealant to all inside corners. Holes at corners are not acceptable.
  - 2) Manufacturers:
    - a) Ductmate Industries 25/35/45
    - b) Nexus
    - c) Mez
    - d) WDCI
    - e) Other manufacturers must submit test data and fabrication standards and receive Architect/Engineer's approval before any fabrication begins.
- I. Formed-on flanged transverse joint systems are acceptable provided they are a manufactured product that has been tested for conformance with Chapter 2 of the SMACNA HVAC Duct Construction Standards for sheet and joint deflection at the specified pressure class.
  - 1) Apply sealant to all inside corners. Holes at corners are not acceptable.
  - 2) Flanges shall be 24-gauge minimum (not 26 gauge).
  - 3) Manufacturers:
    - a) Lockformer TDC
    - b) TDF
    - c) United McGill
    - d) Sheet Metal Connectors
    - e) Other manufacturers must submit test data and fabrication standards and receive Architect/Engineer's approval before any fabrication begins.

- B. Round Seam Ductwork Single Wall:
  - 1. Conform to applicable portions of Rectangular Duct Section. Round or flat oval ductwork may be substituted for rectangular ductwork where approved by the Architect/Engineer. The spiral seam ductwork shall meet the standards set forth in this specification. The ductwork shall meet or exceed the specified cross-sectional area and insulation requirements. The substitution shall be coordinated with all other trades prior to installation.
  - 2. 90°° elbows shall be smooth radius or have a minimum of five sections with mitered joints and R/D of at least 1.5.
  - 3. Duct and fittings shall meet the required minimum gauges listed in chapter 3 of the SMACNA requirements for the specified pressure class. Ribbed and lightweight duct are not permitted.
  - 4. Ductwork shall be suitable for velocities up to 5,000 fpm.
  - 5. Divided flow fittings may be made as separate fittings or factory installed taps with sound, airtight, continuous welds at intersection of fitting body and tap.
  - 6. Spot weld and bond all fitting seams in the pressure shell. Coat galvanizing damaged by welding with corrosion resistant paint to match galvanized duct color.
  - Ducts with minor axis less than 22" shall be spiral seam type. Larger ducts may be rolled, longitudinal welded seam type. SMACNA seams RL-2 and RL-3 are not permitted.
  - 8. Transverse Joint Connections:
    - a. Crimped joints are not permitted.
    - b. Ducts and fittings 36" in diameter and smaller shall have slip joint connections. Size fitting ends to slip inside mating duct sections with minimum 2-inch insertion length and a stop bead. Use inside slip couplings for duct-to-duct joints, and outside slip couplings for fitting-to-fitting joints.
    - c. Ducts and fittings larger than 36" shall have flanged connections.
    - d. Secure all joints with at least 3 sheet metal screws before sealing.
    - e. Manufacturers, Slide-on Flanges:
      - 1) Ductmate Industries SpiralMate
      - 2) Accuflange
      - 3) Sheet Metal Connectors are acceptable.
    - f. Manufacturers, Self-Sealing Duct Systems:
      - 1) Lindab
      - 2) Ward "Keating Coupling"
- C. Round Snap-Lock Seam Ductwork Single Wall:
  - 1. Factory sealed snap-lock pipe. Transverse and longitudinal seams shall contain factory-applied self-sealing EPDM and co-polymer gasket. Snap-lock shall conform to SMACNA RL-8. Duct and gasket material shall meet the flame/smoke spread rating of 25/50 per ASTM-E84.
  - 2. G-60 galvanized coating meeting ASTM A653 and ASTM A90 G-90 galvanized steel aluminum meeting ASTM B209 Alloy 3003 Temper H14 304 stainless steel meeting ASTM A480 2B Finish.
  - 3. Snap-lock seams are only permitted on systems between -1"w.c. and 2"w.c. pressure class.
  - 4. 90° elbows shall be smooth radius or have a minimum of five sections with mitered joints and R/D of at least 1.5.

- 5. Duct and fittings shall meet the required minimum gauges listed in Chapter 3 of the SMACNA requirements for the specified pressure class.
- 6. Divided flow fittings may be made as separate fittings or factory installed taps with sound, airtight, continuous welds at intersection of fitting body and tap.
- 7. Spot weld and bond all fitting seams in the pressure shell. Coat galvanizing damaged by welding with corrosion resistant paint to match galvanized duct color.
- 8. Manufacturers:
  - a. GreenSeam Industries.
- D. Hangers and Supports General Requirements:
  - 1. Hanger and support materials shall be as defined within Materials and Application Specific section below.
  - 2. Strap Hangers: Strap hanger shall be a minimum of 1 inch, 18 gauge attached to the bottom of ducts.
  - 3. Cable Hangers:
    - Aircraft cable and slip cable hangers are acceptable for ducts up to 18" diameter.
      Protective sleeve tubing shall be used on the cable when supporting duct with exterior insulation. Corner saddles are required when supporting rectangular ductwork.
    - b. Manufacturers; Supports:
      - 1) Gripple
      - 2) Ductmate
      - 3) Duro Dyne
  - 4. Integral Corner Connector Hanger: Integral hanger and corner assembly for use with TDC/TDF style duct flanges. Die stamped offset hanger connects to the flanged corner assembly. For use with aircraft cable or 1/4" or 3/8" diameter threaded rods. Tested to hold up to 1,400 lbs. Install per manufacturer's ratings and instructions.
    - a. Manufacturers; Supports:
      - 1) EZ Hanger

#### 2.2 MATERIAL AND APPLICATION SPECIFIC

- A. Galvanized Steel:
  - 1. General Requirements:
    - a. Duct and reinforcement materials shall conform to ASTM A653 and A924.
    - b. Interior Ductwork and reinforcements: G60 galvanized (0.60 ounces per square foot total zinc coating for two sides per ASTM A90) unless noted otherwise.
    - c. Exterior Ductwork: G90 galvanized (0.90 ounces per square foot total zinc coating for two sides per ASTM A90) unless noted otherwise. G60 is not acceptable for exterior use.
    - d. Ductwork reinforcement shall be of galvanized steel.

- 2. Duct Hangers and Support Material:
  - a. Ductwork hangers and supports shall be of galvanized or painted steel.
  - b. All fasteners shall be galvanized or cadmium plated.
- B. Stainless Steel Ductwork:
  - 1. General Requirements:
    - a. Ductwork shall be Type 304L stainless steel, 16 gauge minimum.
    - b. Ductwork shall be Type 316L stainless steel, 16 gauge minimum.
    - c. Ductwork reinforcement shall be of stainless steel.
  - 2. Duct Hangers and Supports Material:
    - a. Ductwork hangers and supports shall be of stainless steel. Slip cable hangers are acceptable if constructed of stainless steel.
    - b. All fasteners shall be stainless steel or cadmium plated steel.
- C. Fume Exhaust Duct:
  - 1. Stainless Steel:
    - a. Unless shown otherwise on the drawings, all fume exhaust ductwork shall be 16 gauge Type 316L stainless steel. .
    - b. Elbows up to 30° shall be mitered two-piece type. Elbows 31° to 50° shall be mitered three-piece type. Elbows 51° to 90° shall be mitered five-piece type. All elbows shall have a minimum centerline R/D of 1.5. Elbows 10" in diameter and smaller may be die-formed.
    - c. Expanders in horizontal ducts shall be eccentric type with a minimum length of (diameter change x 10) and shall maintain a positive pitch for drainage to the fume hood or exhaust outlet. Expanders in ducts over 30° from horizontal shall be concentric with a minimum length of (diameter change x 5).
    - d. Ducts shall maintain the maximum possible pitch toward their inlets unless a different drainage location is indicated on the drawings. If at least 1/8" per foot pitch cannot be maintained, notify the Architect/Engineer before installing ductwork or other items with which ductwork may conflict.
    - e. All welds shall conform to AWS D9.1M. Welds shall be Gas Tungsten Arc Weld (TIG) or Gas Metal Arc Weld (MIG) type. All filler metal shall conform to AWS A5.9 or A5.22 and be AWS Classification ER308L or ER308LSi with a carbon content of not over 0.03%.
    - f. Supports shall not penetrate duct surfaces. Ductwork shall be completely leak-tight from the inlet to the discharge to the atmosphere, at pressures up to 10" WG. Install caps to seal the ductwork for pressure testing. Plug all spray and drain connections when testing ductwork.
    - g. Where flanged joints are indicated, they shall have 1/4" "Gore-Tex Joint Sealant" gaskets
      (W. L. Gore & Associates, Industrial Products Division, 100 Airport Road, Box 1550, Elkton,
      MD 21921 (410) 392-4440 or (410) 392-3200). PTFE gaskets are also acceptable.

#### 2.3 DUCTWORK REINFORCEMENT

- A. All reinforcement shall be external to the duct except that tie rods may be used with the following limitations.
  - 1. Ducts must be over 18" wide.
  - 2. Duct dimensions must be increased 2" in one dimension (h or w) for each row of tie rods installed.
  - 3. Tie rods must not exceed 1/2" diameter.
  - 4. Manufacturer of tie rod system must certify pressure classifications of various arrangements, and this must be in the shop drawings.

#### 2.4 DUCTWORK SEALANTS

- A. One-part joint sealers shall be water-based mastic systems that meet the following requirements: maximum 48-hour cure time, service temperature of -20°F to +175°F, resistant to mold, mildew and water, flame spread rating below 25 and smoke-developed rating below 50 when tested in accordance with ASTM E84, suitable for all SMACNA seal classes and pressure classes. Mastic used to seal flexible ductwork shall be marked UL 181B-M.
- B. Adhesives and Sealants: All sealers, adhesives, and sealants shall comply with the low emitting material limits of the following standards:
  - 1. LEED v4 Low Emitting Materials Adhesives and Sealants.

#### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Provide openings in ducts for thermometers and controllers.
- B. Locate ducts with space around equipment for normal operation and maintenance.
- C. Do not install ducts or other equipment above electrical switchboards or panelboards. This includes a dedicated space extending 25 feet from the floor to the structural ceiling with width and depth equal to the electrical equipment. Unless intended to serve these rooms, do not install any ductwork or equipment in electrical rooms, transformer rooms, electrical closets, telephone rooms or elevator machine rooms.
- D. Provide temporary closures of metal or taped polyethylene on open ducts to prevent dust from entering ductwork.
- E. Supply ductwork shall be free of construction debris, and shall comply with Level "C" of the SMACNA Duct Cleanliness for New Construction Guidelines.
- F. Repair all duct insulation and liner tears.
- G. Install manual volume dampers in branch supply ducts so all outlets can be adjusted. Do not install dampers at air terminal device or in outlets, unless specifically shown.

- H. Insulate terminal air box reheat coils. Seal insulation tight to form a tight vapor barrier.
- I. Install flexible duct in accordance with the ADC Flexible Duct Performance and Installation Standards.
- J. Flexible duct shall NOT be joined to flat-oval connections. Provide sheet metal oval-to-round transitions where required, to include, but not limited to, all connections to air inlets, air outlets, and terminal air boxes.
- K. Install all exterior ductwork per SMACNA Fig. 6-3. Where drawings do not indicate otherwise, ductwork seams and joints shall be sealed watertight and pitched to shed water.
- L. Support all duct systems in accordance with the SMACNA HVAC Duct Construction Standards: Metal and Flexible and the SMACNA Seismic Restraint Manual: Guidelines for Mechanical Systems, where applicable. Refer to Section 23 05 50 for seismic requirements.
- M. Adhesives, sealants, tapes, vapor retarders, films, and other supplementary materials added to ducts, plenums, housing panels, silencers, etc. shall have flame spread/smoke developed ratings of under 25/50 per ASTM E84, NFPA 255, or UL 723.
- N. All duct support shall extend directly to building structure. Do not support ductwork from pipe hangers unless coordinated with piping contractor prior to installation. Do not allow lighting or ceiling supports to be hung from ductwork or ductwork supports.

#### 3.2 DUCTWORK APPLICATION SCHEDULE

- A. General:
  - 1. Seal Class is per SMACNA HVAC Air Duct Leakage Test Manual
  - 2. Insulation:
    - a. Refer to Section 23 07 13 for insulation types.
    - b. Type A insulation (Flexible Fiberglass Wrap) R-values noted are based on installed values (25% compression).
- B. Supply Duct from Fan to Terminal Air Boxes:
  - 1. Shape:
    - a. Rectangular Duct Single Wall
    - b. Round and Flat Oval Spiral Seam Ductwork Single Wall
  - 2. Material: Galvanized Steel
  - 3. Pressure Class: +6"
  - 4. Seal Class: A
  - 5. Insulation:
    - a. ASHRAE 90.1-2019: 1-1/2" thick Type A (R=4.5)
    - b. IECC-2021: 1-1/2" thick Type A (R=4.5)

- 6. Additional Requirements: Provide all with slide-on flange system or formed-on flanges.
- C. Supply Duct from Terminal Air Boxes to Outlets:
  - 1. Shape:
    - a. Rectangular Duct Single Wall
    - b. Round and Flat Oval Spiral Seam Ductwork Single Wall
  - 2. Material: Galvanized Steel
  - 3. Pressure Class: +2"
  - 4. Seal Class: A
  - 5. Insulation:
    - a. ASHRAE 90.1-2019: 1-1/2" thick Type A (R=4.5)
  - 6. Additional Requirements: None
- D. <u>Fume Exhaust Duct:</u>
  - 1. <u>Shape: Refer to "Fume Exhaust Duct"</u>
  - 2. <u>Material: Stainless Steel</u>
  - 3. <u>Pressure Class: -4"</u>
  - 4. Seal Class: A
  - 5. <u>Insulation: 1-1/2" (40 mm) thick Type A (R=4.5) within 15' (4.5m) of penetration of exterior wall</u> or roof
- E. General Exhaust Duct from Terminal Air Boxes to Outlets:
  - 1. Shape:
    - a. Rectangular Duct Single Wall
    - b. Round and Flat Oval Spiral Seam Ductwork Single Wall
  - 2. Material: Galvanized Steel
  - 3. Pressure Class: -1"
  - 4. Seal Class: A
  - 5. Insulation: None
  - 6. Additional Requirements: None
- F. Ductwork Accessories (Fabric Flex Connectors, Equipment Flanges, etc.):
  - 1. Insulation:
    - a. ASHRAE 90.1-2019: 1-1/2" thick Type A (R=4.5)

#### 3.3 DUCTWORK SEALING

A. General Requirements:

- 1. Openings, such as rotating shafts, shall be sealed with bushings or similar.
- 2. Pressure sensitive tape shall not be used as the primary sealant unless it has been certified to comply with UL-181A or UL-181B by an independent testing laboratory and the tape is used in accordance with that certification.
- 3. All connections shall be sealed including, but not limited to, taps, other branch connections, access doors, access panels, and duct connections to equipment. Sealing that would void product listings is not required. Spiral lock seams need not be sealed.
- 4. Mastic-based duct sealants shall be applied to joints and seams in minimum 3 inch wide by 20 mil thick bands using brush, putty knife, trowel, or spray, unless manufacturer's data sheet specifies other application methods or requirements.
- B. All ducts systems, regardless of pressure class, shall be Seal Class A as defined by Section 5-1 of SMACNA HVAC Air Duct Leakage Test Manual per the Energy Code, unless specifically noted otherwise. Seal Class A shall include sealing of all transverse joints, longitudinal seams, and duct wall penetrations with welds, gaskets, mastics, or fabric-embedded mastic system. Joints are inclusive of, but not limited to, girth joints, branch and sub-branch intersections, duct collar tap-ins, fitting subsections, louver and air terminal connections to ducts, access door and access panel frames and jambs, duct, plenum, and casing abutments to building structures.

#### 3.4 TESTING

- A. Interior Duct Less than 3" WG (positive or negative):
  - 1. Leak testing of these pressure classes is not normally required for interior ductwork (inside the building envelope). However, leak tests will be required if, in the opinion of the Architect/Engineer, the leakage appears excessive. All exterior ductwork shall be tested. If duct has outside wrap, testing shall be done before it is applied.
  - 2. Leak test shall be at the Contractor's expense and shall require capping and sealing all openings.
  - 3. Seal ducts to bring the air leakage into compliance.
  - 4. Contractor shall notify the Architect/Engineer five business days prior to pressurizing ductwork for testing.
- B. Interior Duct 3" WG and Above (positive or negative):
  - 1. A minimum of 25% of interior ductwork (inside the building envelope) shall be tested. The Owner or designated representative shall select the sections to be tested. If duct has outside wrap, testing shall be done before it is applied.
- C. Test Procedure:
  - 1. Testing shall be as listed in the latest edition of the SMACNA HVAC Duct Leakage Manual, with the following additional requirements:
    - a. The required leakage class for Seal Class A, rectangular ducts, shall be 4; round shall be 2.
    - b. Test pressure shall be the specified duct pressure class. Testing at reduced pressures and converting the results mathematically is not acceptable. This is required to test the structural integrity of the duct system.
    - c. If any leak causes discernible noise at a distance of 3 feet, that leak shall be eliminated, regardless of whether that section of duct passed the leakage test.

- d. All joints shall be felt by hand, and all discernible leaks shall be sealed.
- e. Totaling leakage from several tested sections and comparing them to the allowable leakage for the entire system is not acceptable. Each section must pass the test individually.
- f. Contractor shall notify the Architect/Engineer five business days prior to pressurizing ductwork for testing. Failure to notify the Architect/Engineer of pressure testing may require the contractor to repeat the duct pressure test after proper notification.
- g. Upon completion of the pressure test, the contractor shall submit an air duct leakage test summary report as outlined in the SMACNA HVAC Duct Leakage Test Manual.
- h. All access doors, taps to terminal air boxes, and other accessories and penetrations must be installed prior to testing. Including terminal air boxes in the test is not required.
- i. Positive pressure leakage testing is acceptable for negative pressure ductwork.
- D. Fume Exhaust Duct:
  - 1. Testing shall be done before any exterior insulation is applied.
  - 2. Cap each exhaust system at all inlets and at the discharge to atmosphere. Fans, dampers and flexible connections shall be included in the testing.
  - 3. Pressurize each duct system to 7" water column. Leakage shall not exceed 4 cfm regardless of system size.
  - 4. Where several fans discharge into a large collection duct, the collection duct and each individual exhaust duct may be treated as separate systems.

#### 3.5 DUCTWORK PENETRATIONS

- A. All duct penetrations of firewalls shall have fire or fire/smoke dampers where required by code.
- B. Dampers shall be compatible with fire rating of wall assembly. Verify actual rating of any wall being penetrated with Architect/Engineer.
- C. Seal all duct penetrations of walls that are not fire rated by caulking or packing with fiberglass. Install trim strip to cover vacant space and raw construction edges of all openings in finished rooms. Install escutcheon ring at all round duct openings in finished rooms. Trim strips and rings shall be same material and finish as exposed duct.

#### END OF SECTION 23 31 00





	X00	KEYNOTE LEGEND
		REFER TO A000 FOR GENERAL NOTES
	X04	REMOVE EXISTING DOOR, FRAME, AND HARDWARE IN ITS ENTIRETY. PREPARE OPENING TO RECEIVE NEW DOOR, FRAME, AND HARDWARE.
	X05	REMOVE EXISTING DOOR, FRAME, AND HARDWARE IN ITS ENTIRETY. PREPARE OPENING TO BE INFILLED WITH NEW WALL CONSTRUCTION. REFER TO ARCHITECTURAL DIMENSION PLANS FOR ADDITIONAL INFORMATION.
	X07	REMOVE EXISTING CASEWORK IN ITS ENTIRETY
	X10	REMOVE EXISTING CMU WALLS AND DOORS ENTIRELY.
	X13	REMOVE EXISTING FUR-OUT AND GYPSUM BOARD AS NECESSARY TO EXPOSE EXISTING WINDOW THAT IS CURRENTLY COVERED.
	X15	OVERCUT EXISTING EPOXY FLOORING CLEANLY TO ALLOW FOR NEW EPOXY TO BE FLOATED AND BONDED TO EXISTING.
	X16	SAW CUT CONCRETE FLOOR FOR PLUMBING WORK. CONTRACTOR TO X-RAY PRIOR TO ANY SAW CUTTING FLOORS TO AVOID SEVERING ANY
~	$\gamma$	
	X19	REMOVE EXISTING EPOXY FLOOR COATING (ARMORSEAL WATER BASED EPOXY) SEE GENERAL NOTE FOR ADDITIONAL INFORMATION.
	X20	EXISTING FLOOR DRAIN TO BE REMOVED. IN FILL AREA WITH CONCRETE AFTER REMOVAL.

ᡣᠬ᠇ᠬ᠇᠇᠇᠇᠇᠇᠇᠇᠇᠇᠇᠇᠇᠇ GENERAL FLOORING DEMOLITION NOTE FOR ROOM 114A: A. REMOVE THE EXISTING COATINGS BY METHODS IN ACCORDANCE WITH NACE NO. 6/SSPC-SP13. JOINT SURFACE PREPARATION STANDARDS AND ICRI TECHNICAL GUIDELINES. SHOT BLAST OR DIAMOND GRIND TO MECHANICALLY ABRADE CONCRETE SURFACES TO REMOVE LAITANCE, CURING COMPOUNDS, HARDENERS, SEALERS, ALL EXISTING COATINGS AND OTHER CONTAMINANTS AND TO PROVIDE AN ICRI-CSP 3 SURFACE PROFILE. B. VERIFY CONCRETE DRYNESS AND PREPARE CONCRETE SURFACES IN ACCORDANCE WITH NACE No. 6/SSPC-SP13. JOINT SURFACE PREPARATION STANDARDS AND ICRI TECHNICAL GUIDELINES. MOISTURE VAPOR TRANSMISSION SHOULD NOT EXCEED THREE LBS PER 1000 SQ. FT. IN A 24 HOUR PERIOD (REFERENCE ASTM F 1869 STANDARD TEST

PRIMER. REFER TO THE SERIES 208 PRODUCT DATA SHEET FOR MORE INFORMATION. C. AFTER MECHANICALLY ABRADING, VERIFY THAT ALL SURFACES ARE CLEAN, DRY, AND FREE OF ANY CONTAMINANTS, WHICH COULD ADVERSELY AFFECT THE ADHESION OF THE FLOORING SYSTEM.



# MOLECULAR **IMAGING AND** THERANOSTICS CENTER

### 1514 RESEARCH PARK DR, COLUMBIA, MO 65203 CLIENT PROJECT NO. - CP241201 Rm 106 & 114A LAB RENOVATION

## CD 100%: FOR BIDDING



PLAN NORTH			
MARK	DATE	DESCRIPTION	
	01/03/2024	SD SUBMISSION	
	02/07/2024	DD SUBMISSION	
	03/29/2024	DD REVISED SUBMISSION	
	05/08/2024	CD 90% SUBMISSION	
	06/05/2024	CD 100%: FOR BIDDING	
1	06/20/2024	ADDENDUM 01	



MARK.	MANUFACTURER:	STYLE:
ACT4		
	05 61250M	FLAT WHITE USG SHEETRUCK SMOUTH TEXTURE GTPSUM CEILING PANELS
CORNER GUARD		
CG1	CONSTRUCTION SPECIALTIES	LEGS STAINLESS STEEL
FPOXY RESIN BASE		
ERB1	DESCO	QUARTZ CREMONA DOUBLE BROADCAST WITH URETHANE FINISH COAT.
EPOXY RESIN FLOORING		
ERF1	DESCO	QUARTZ CREMONA DOUBLE BROADCAST WITH URETHANE FINISH COAT.
PAINT		
21	SHERWIN WILLIAMS	MACROPOXY 646
22	SHERWIN WILLIAMS	PROMAR 400 ALKYD SEMI GLOSS
23	SHERWIN WILLIAMS	PROMAR 400 ALKYD SEMI GLOSS
KESILIENT BASE		



	NUMBER:	COLOR:		SIZE:
G DX 15/16" GRID PROFILE	3260 24X48	FLAT WHITE	24"x24"	
	CO-8		2" X 48" H.	
	ORANGE PEEL TEXTURE	COLOR TO BE SELECTED BY ARCHITECT FROM ALL MANUFACTURER'S STANDARDS.	4" H.	
	ORANGE PEEL TEXTURE	COLOR TO BE SELECTED BY ARCHITECT FROM ALL MANUFACTURER'S STANDARDS.		
	SW 7009	PEARLY WHITE		
	SW2863	COLOR ON CORRIDOR: POWDER BLUE SW 2863, COLOR ION INTERIOR OF ROOM: PERALY WHITE SW7009		
	SW 2863	CORRIDOR PAINT AS NEEDED - FIELD VERIFY COLOR POWDER BLUE SW 2863		
	COLONIAL GRAY CG TA5			





PLAN NORTH			
MARK	DATE	DESCRIPTION	
	05/08/2024	CD 90% SUBMISSION	
	06/05/2024	CD 100%: FOR BIDDING	
1	06/20/2024	ADDENDUM 01	









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1	06/20/2024	ADDENDUM 01
	02/07/2024	DD SUBMISSION
	03/29/2024	DD REVISED SUBMISSION
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