

SECTION 024119

SELECTIVE DEMOLITION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Demolition and removal of selected portions of a building.

1.02 RELATED SECTIONS

- A. Section 017340 - Indoor Air Quality Control.

1.03 DEFINITIONS

- A. Remove: Remove and legally dispose of items, except those indicated to be reinstalled, salvaged, or to remain the property of the Owner.
- B. Remove and Salvage: Items indicated to be removed and salvaged remain the property of the Owner. Remove, clean, and pack or crate items to protect against damage. Identify contents of containers and deliver to Owner's designated storage area.
- C. Remove and Reinstall: Remove items indicated; clean, service, and otherwise prepare them for reuse; store and protect against damage. Reinstall items in the same locations or in new locations indicated.
- D. Existing to Remain: Protect construction indicated to remain against damage and soiling during demolition activities. When permitted by the Owner and Architect, items may be removed to a suitable, protected storage location during demolition activities and then cleaned and reinstalled in their original locations.

1.04 OWNERSHIP OF MATERIALS

- A. Except for items or materials indicated to be reused, salvaged, reinstalled, or otherwise indicated to remain the property of the Owner, demolished materials shall become the property of the Contractor and shall be removed from the Site with further disposition at the option of the Contractor.

1.05 SUBMITTALS

- A. General: Submit each item in this Section according to the Conditions of the Contract and Division 1 Specification Sections, for information only, unless otherwise indicated.
- B. Proposed dust-control measures.
- C. Proposed noise-control measures.

D. Schedule of selective demolition activities indicating the following:

1. Detailed sequence of selective demolition and removal Work, with starting and ending dates for each activity.
2. Interruption of utility services.
3. Coordination for shutoff, capping and continuation of utility services.
4. Use of elevator and stairs
5. Detailed sequence of selective demolition and removal Work to ensure uninterrupted progress of on-site operations of Owner.
6. Coordination of continuing occupancy by Owner of portions of existing building and of partial occupancy by Owner of completed Work.
7. Locations of temporary partitions and means of egress.

E. Inventory of items to be removed and salvaged.

F. Inventory of items to be removed by Owner.

G. Photographs or videotape, sufficiently detailed, of existing conditions of adjoining construction and site improvements that might be misconstrued as damage caused by selective demolition operations.

H. Record drawings at Project closeout, in accordance with Section 017000 - Contract Closeout, which identify and accurately locate capped utilities and other subsurface structural, mechanical, and/or electrical conditions.

I. Landfill records indicating receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous wastes.

1.06 QUALITY ASSURANCE

A. Demolition Firm Qualifications: Engage an experienced firm that has successfully completed selective demolition Work similar to that indicated for this Project.

B. Regulatory Requirements: Comply with governing EPA notification regulations before starting selective demolition operations. Comply with hauling and disposal regulations of authorities having jurisdiction.

C. Predemolition Conference: Conduct conference at Project Site to comply with Preinstallation Conference Requirements of Section 010390 - Coordination and Meetings.

1.07 PROJECT CONDITIONS

A. Owner will occupy portions of the building immediately adjacent to selective demolition area. Conduct selective demolition so that ongoing operations of Owner are not disrupted. Provide not less than 72 hours notice to Owner of construction and/or demolition activities that will affect ongoing operations of Owner.

B. Owner assumes no responsibility for actual condition of buildings to be selectively demolished.

1. Conditions existing at the time of inspection by the Contractor for bidding purposes will be maintained by the Owner as far as practical.

1.08 WARRANTY

- A. Existing Special Warranty: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition operations by methods and with materials which do not void existing warranties.

PART 2 PRODUCTS

2.01 REPAIR MATERIALS

- A. Use repair materials identical to existing materials.
 - 1. Where identical materials are unavailable or cannot be used for exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible.
 - 2. Use materials whose installed performance equals or surpasses that of existing materials.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that utilities have been disconnected and capped.
- B. Survey existing site conditions and correlate with requirements indicated to determine extents of selective demolition required.
- C. Inventory and record the condition of items designated to be removed and reinstalled and items designated to be removed and salvaged.
- D. When unanticipated structural, mechanical, or electrical elements are encountered that conflict with the intended function or design, investigate and measure the extent of the conflict and promptly submit a written report to the Architect.
- E. Survey the condition of the building to determine whether removing any element might result in a structural deficiency or unplanned collapse of any portion of the structure or adjacent structures during or as a result of selective demolition operations. If any such conditions are encountered, identify the condition and promptly submit a written report to the Architect.
- F. Perform surveys to detect hazards as selective demolition operations progress.

3.02 UTILITY SERVICES

- A. Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.
 - 1. Do not interrupt existing utilities serving occupied or operating facilities, except when authorized in writing by the Owner and other authorities having jurisdiction. Provide temporary services during interruptions to existing utilities which are acceptable to the Owner and other authorities having jurisdiction.
 - a. Reference enclosed University of Kentucky General Conditions and Special Conditions for information regarding Utility Services.

- B. Utility Requirements: Locate, identify, disconnect, and seal or cap off indicated utility services serving buildings or areas to be selectively demolished.
 - 1. Where utility services are required to be removed, relocated, or abandoned, provide bypass connections to maintain continuity of service to other parts of the building before proceeding with selective demolition.
 - 2. Cut-off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal the remaining portion of pipe or conduit after bypassing.
- C. Utility Requirements: Refer to Divisions 20 through 28 Sections for shutting off, disconnecting, removing, and sealing or capping utility services. Do not start selective demolition Work until utility disconnection and sealing operations have been completed and verified in writing.

3.03 PREPARATION

- A. Drain, purge, or otherwise remove, collect, and dispose of chemicals, gases, explosives, acids, flammables, or other dangerous materials before proceeding with selective demolition operations.
- B. Employ a certified, licensed exterminator and to control rodents and vermin before and during selective demolition operations.
- C. Conduct demolition operations and remove debris to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.
 - 1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by governing regulations.
- D. Conduct demolition operations to prevent injury to people and damage to adjacent buildings and facilities to remain. Ensure safe passage of people around selective demolition area.
 - 1. Erect temporary protection, such as walks, fences, railings, canopies, and covered passageways, where required by authorities having jurisdiction.
 - 2. Protect existing site improvements, appurtenances, and landscaping to remain.
 - 3. Erect a plainly visible fence around drip line of individual trees or around perimeter drip line of groups of trees to remain.
 - 4. Provide temporary weather protection on exterior surfaces, during interval between demolition and removal of existing construction and installation of new construction, to ensure that no water leakage or damage occurs to structure or interior areas.
 - 5. Protect walls, ceilings, floors, and other existing finish Work that are indicated to remain and are exposed during selective demolition operations.
 - 6. Cover and protect furniture, furnishings, and equipment that have not been removed.
- E. Erect and maintain dustproof partitions and temporary enclosures to limit dust and dirt migration and to separate areas from fumes and noise generated from selective demolition operations.
 - 1. Construct dustproof partitions of not less than 5/8 inch gypsum wall board over 3 5/8 inch metal studs with joints taped on occupied side.
 - 2. Insulate partition to provide noise protection to occupied areas.
 - 3. Seal joints and perimeter. Equip partitions with dustproof doors and security locks.
 - 4. Protect all air handling equipment.

3.04 POLLUTION CONTROLS

- A. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
 - 1. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level, subject to approval of method by Owner.
- B. Clean adjacent surface and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition before start of selective demolition operations.

3.05 SELECTIVE DEMOLITION

- A. Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete Work within limitations of governing regulations and as follows:
 - 1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition work above each floor or tier before disturbing supporting members on lower levels.
 - 2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. To minimize disturbance of adjacent surfaces, use hand or small power tools designed for sawing or grinding, not hammering or chopping. Temporarily cover openings to remain.
 - 3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
 - 4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.
 - 5. Maintain adequate ventilation when using cutting torches.
 - 6. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
 - 7. Remove structural framing members and lower to ground by method suitable to avoid free-fall and to prevent ground impact or dust generation.
 - 8. Locate selective demolition equipment throughout the structure and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
 - 9. Dispose of demolished items and materials promptly. On-site storage or sale of removed items is prohibited.
 - 10. Return elements of construction and surfaces to remain to condition existing before start of selective demolition operations.
- B. Demolish concrete and masonry in small sections. Cut concrete and masonry at junctures with construction to remain, using power-driven masonry saw or hand tools; do not use power-driven impact tools.
- C. Break-up and remove concrete slabs on grade, unless otherwise shown to remain.
- D. Remove resilient floor coverings and adhesive according to recommendations of the Resilient Floor Covering Institute's (RFCI) "Recommended Work Practices for the Removal of Resilient Floor Coverings" and all subsequent addenda.
 - 1. Remove residual adhesive and prepare substrate for new floor coverings by one of the methods recommended by the RFCI.

- E. Remove air-conditioning equipment scheduled for demolition without releasing refrigerants.

3.06 PATCHING AND REPAIRS

- A. Promptly patch and repair holes and damaged surfaces caused to adjacent construction by selective demolition operations per Cutting and Patching Requirements of Section 101390 - Coordination and Meetings.
- B. Where repairs to existing surfaces are required, patch to produce surfaces suitable for application of new finishes.
 - 1. Completely fill holes and depressions in existing masonry walls to remain with an approved masonry patching material, applied according to manufacturer's printed recommendations.
- C. Restore exposed finishes of patched areas and extend finish restoration into adjoining construction to remain in a manner that eliminates evidence of patching and refinishing.
- D. Patch and repair floor and wall surfaces in the new space where demolished walls or partitions extend one finished area into another. Provide a flush and even surface of uniform color and appearance.
 - 1. Closely match texture and finish of existing adjacent surfaces.
 - 2. Patch with durable seams that are as invisible as possible and are in compliance with specified tolerances.
 - 3. Where patching smooth painted surfaces, extend final paint coat over entire unbroken surface containing the patch after the surface has received primer and second coat.
 - 4. Remove existing floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
 - 5. Inspect and test patched areas to determine integrity of the installation, where feasible.
- E. Patch, repair, or rehang existing ceilings as necessary to provide an even-plane surface of uniform appearance.

3.07 DISPOSAL OF DEMOLISHED MATERIALS

- A. General: Promptly dispose of demolished materials. Do not allow demolished materials to accumulate on-site.
- B. Burning: Do not burn demolished materials.
- C. Disposal: Transport off property of Owner and legally dispose of demolished materials.

3.08 CLEANING

- A. Sweep the building broom clean on completion of selective demolition operations.
- B. Change filters on air-handling equipment upon completion of selective demolition operations.

END OF SECTION

SECTION 055000

METAL FABRICATIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. All miscellaneous iron, steel, and aluminum items not specifically described in other Sections of these Specifications, but required for a complete and operable facility as indicated or implied by the Contract Documents.

1.02 RELATED SECTIONS

- A. Section 099123 – Painting.

1.03 REFERENCES

- A. ASTM A36 - Structural Steel.
- B. ASTM A53 - Hot-Dipped, Zinc-coated Welded and Seamless Steel Pipe.
- C. ASTM A123 - Zinc (Hot-Galvanized) Coatings on Products Fabricated From Rolled, Pressed and Forged Steel Shapes, Plates, Bars, and Strip.
- D. ASTM A153 - Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
- E. ASTM A283 - Carbon Steel Plates, Shapes, and Bars.
- F. ASTM A307 - Carbon Steel Externally Threaded Standard Fasteners.
- G. ASTM A325 - High Strength Bolts for Structural Steel Joints.
- H. ASTM A386 - Zinc-Coating (Hot-Dip) on Assembled Steel Products.
- I. ASTM A500 - Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Round and Shapes.
- J. ASTM A501 - Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.
- K. ASTM B177 - Chromium Electroplating on Steel for Engineering Use.
- L. AWS A2.0 - Standard Welding Symbols.
- M. AWS D1.1 - Structural Welding Code.
- N. SSPC - Steel Structures Painting Council.

1.04 SUBMITTALS

- A. Submit under provisions of Section 013000.

- B. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.
- C. Indicate welded connections using standard AWS A2.0 welding symbols. Indicate net weld lengths.
- D. Design Calculations (Slotted Channel Framing): Provide design calculations prepared by a Specialty Professional Engineer licensed in the State in which the Project is located for the design of slotted channel framing and the connection of the slotted channel framing to the structure. Slotted channel framing and connections shall be designed for the loads and deflection requirements indicated in Equipment Vendor Drawings associated with this Project. The review of the calculations by the Project Structural Engineer shall only be to verify compliance with design intent, application of loads specified, and review of the primary building frame to resist the loads imposed by the component connections.

1.05 QUALIFICATIONS

- A. Prepare Shop Drawings under direct supervision of a Professional Structural Engineer experienced in design of this Work and licensed in the State of Kentucky.
- B. Welders Certificates: Submit under provisions of Section 013000, certifying welders employed on the Work, verifying AWS qualification within the previous 12 months.

1.06 FIELD MEASUREMENTS

- A. Verify that field measurements are as indicated on Drawings, Shop Drawings, and as instructed by the manufacturer.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Steel Sections: ASTM A36.
- B. Steel Tubing: ASTM A500, Grade B and ASTM A501.
- C. Plates: ASTM A283.
- D. Pipe: ASTM A53, Grade B.
- E. Fasteners.
- F. Bolts, Nuts, and Washers: ASTM A325.
- G. Welding Materials: AWS D1.1; type required for materials being welded.
- H. Shop and Touch-Up Primer: SSPC 15, Type 1, red oxide.

2.02 FABRICATION

- A. Fit and shop assemble in largest practical sections, for delivery to site.
- B. Fabricate items with joints tightly fitted and secured.

- C. Continuously seal joined members.
- D. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.
- E. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.
- F. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

2.03 FINISHES

- A. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.
- B. Do not prime surfaces in direct contact with concrete or where field welding is required.
- C. Prime paint items with two coats.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field conditions are acceptable and are ready to receive Work.
- B. Beginning of installation means erector accepts existing conditions.

3.02 PREPARATION

- A. Clean and strip primed steel items to bare metal where site welding is required.
- B. Supply items required to be cast into concrete or embedded in masonry with setting templates, to appropriate sections.

3.03 INSTALLATION

- A. Install items plumb and level, accurately fitted, free from distortion or defects.
- B. Allow for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.
- C. Field weld components indicated on Shop Drawings.
- D. Perform field welding in accordance with AWS D1.1.
- E. Obtain Architect/Engineer approval prior to site cutting or making adjustments not scheduled.
- F. After erection, prime welds, abrasions, and surfaces not shop primed, except surfaces to be in contact with concrete.

3.04 ERECTION TOLERANCES

- A. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.
- B. Maximum Offset From True Alignment: 1/4 inch.

END OF SECTION



SECTION 061000
ROUGH CARPENTRY

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Framing, blocking, and furring.
- B. Coordination of locations and installation of all concealed wood blocking for items included in other Sections of specifications.

1.02 RELATED SECTIONS

- A. Section 072100 – Building Insulation.
- B. Section 081113 – Hollow Metal Doors and Frames.
- C. Section 092116 – Gypsum Board Systems.
- D. Section 099123 – Painting.

1.03 REFERENCES

- A. NFPA - National Forest Products Association.
- B. SPA - Southern Pine Association.
- C. APA - American Plywood Association.
- D. WWPA - Western Wood Products Association.
- E. AWPA - American Wood Preservers Association.

1.04 SUBMITTALS

- A. Submit under provisions of Section 013000.
- B. Product Data: Submit the following:
 - 1. Submit certification by treating plant stating chemicals and processes used, net amount of salts retained, and conformance with applicable standards.
 - 2. Preservation Treated Wood: Submit certification for water-borne preservative that moisture content was reduced to 19 percent maximum, after treatment.
 - 3. Fire Retardant Treatment: Submit certification by treating plant that fire-retardant treatment materials comply with governing ordinances and that treatment will not bleed through finished surfaces.

1.05 QUALITY ASSURANCE

A. Grading Rules:

1. Lumber grading rules and wood species shall conform with Voluntary Product Standard PS-20. Grading rules of the following associations shall also apply to materials produced under their supervisions:
 - a. Northeastern Lumber Manufacturer's Association, Inc. (NELMA).
 - b. Southern Pine Inspection Bureau (SPIB).
 - c. West Coast Lumber Inspection Bureau (WCLIB).
 - d. Western Wood Product Association (WWPA).
2. Plywood shall conform to the following:
 - a. Softwood Plywood - Product Standard PS-1.
 - b. Hardwood Plywood - Product Standard PS-51.

B. Grade Marks: Identify all lumber and plywood by official grade mark.

1. Lumber: Grade stamp to contain symbol of grading agency, mill number or name, grade of lumber, species grouping or combination designation, rules under which graded, where applicable and condition of seasoning at time of manufacturer.
 - a. S-Dry: Maximum 19 percent moisture content.
 - b. MC-5 or KD: Maximum 15 percent moisture content.
 - c. Dense.
2. Softwood Plywood: Appropriate grade trademark of the American Plywood Association.
 - a. Type, grade, class and identification index.
 - b. Inspection and testing agency mark.
3. Hardwood plywood: Appropriate grade mark of qualified inspection testing, or grading mark.

C. Testing:

1. ASTM E84, maximum 25 Flame Spread rating.

D. Requirements of Regulatory Agencies:

1. Fire Hazard Classification: Underwriter's Laboratories, Inc., for treated lumber and plywood.
2. Preservative Treated Lumber and Plywood: American Wood Preservers Bureau Standards.
3. Pressure treated Material: American Wood Preservers Bureau Standards.
4. Span Tables: National Forest Products Association.
5. Working Stresses: Softwood Lumber, National Design Specification, National Forest Products Association.

1.06 DELIVERY, STORAGE AND HANDLING

- A. Immediately upon delivery to job site, place materials in area protected from weather.

- B. Store materials a minimum of 6 inches above ground on framework or blocking and cover with protective waterproof covering, providing adequate air circulation or ventilation.
- C. Do not store seasoned materials in wet or damp area.
- D. Protect fire-retardant materials against high humidity and moisture during storage and erection.
- E. Protect sheet materials against high humidity and moisture during storage and erection.

PART 2 PRODUCTS

2.01 MATERIALS

A. Lumber:

1. Dimension:

- a. Specified lumber dimensions are nominal.
- b. Actual dimensions conform to industry standards established by the American Lumber Standards Committee and the rules writing agencies.

2. Moisture Content: 19 percent maximum at time of permanent closing of building or structure, for lumber 2 inches or less nominal thickness.

3. Surfacing: Surface four sides (S4S), unless otherwise shown or specified.

4. Framing lumber, 2 inches to 4 inches thick, 2 inches to 4 inches wide, any commercial softwood species, unless otherwise shown or specified.

a. Light Framing:

- (1) General Framing: Standard and Better Grade.
- (2) Plates, Blocking, Bracing and Nailers: Utility Grade.

b. Blocking:

- (1) All wood blocking shall comply with ASPA/C20/C27 fire retardant treated products.
 - * Exception 1. Non-fire retardant treated wood blocking shall be permitted at handrails, millwork, cabinets and window and door frames.

5. Miscellaneous Lumber:

- a. Provide wood for support or attachment of other work including cant strips, bucks, nails, blocking, furring, grounds, stripping and similar members.
- b. Provide wood for support or attachment of other work as blocking for, but not limited to the following: horizontal blinds, toilet accessories, handrails and railings, casework, corridor handrails, cubical curtain/IV holder tracks on ceiling and patient TV brackets.
- c. Provide lumber of sizes shown or specified, worked into shapes shown on Drawings.
- d. 15% maximum moisture content for lumber items not specified to receive wood preservative treatment.
- e. Construction Grade No. 3.
- f. Bituminous coating for pressure treated wood in direct contact with galvanized steel framing members: Coat entire surface of all treated wood products in direct contact with galvanized steel framing members with bituminous dampproofing Sonneborne Hydrocide 700 or Architect approved equal.

B. Plywood:

1. Exterior graded AND fire retardant plywood where indicated, or where edge or surface is permanently exposed to weather or where used as underlayment to exterior gypsum sheathing: B - B EXT - APA, graded for treatment where preservative treated plywood is indicated.
2. Plywood Backing Panel: For mounting electrical or telephone equipment, provide fire-retardant treated plywood panels, APA C - D PLUGGED INT with exterior glue, thickness indicated, or if not otherwise indicated, 3/4 inch.

C. Preservative Treated Wood:

1. Waterborne Salt Preservatives for Painted, Stained or Exposed Natural Wood Products:
 - a. AWPB LP-2, above ground application.
 - b. AWPB LP-22, ground contact application.
2. Treat indicated items and the following:
 - a. Wood cants, nailers, curbs, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
 - b. Wood sills, sleepers, blocking, furring, stripping and similar concealed members in contact with masonry or concrete.

D. Fire Retardant Treatment:

1. Provide where required by code. Comply with AWPB Standards for pressure impregnation with Fire Retardant Chemicals.
 - a. Flame Spread: 25 max.
2. Treat all rough framing and blocking items throughout the Project, unless otherwise noted.

PART 3 EXECUTION

3.01 GENERAL

- A. Discard units of material with defects which might impair quality of work, and units which are too small to fabricate work with minimum joints or optimum joint arrangement.
- B. Set carpentry work accurately to required levels and lines, with members plumb and true and accurately cut and fitted.
- C. Securely attach carpentry work to substrate by anchoring and fastening as shown and as required by recognized standards. Countersink nail heads on exposed carpentry work and fill holes.
- D. Use common wire nails except as otherwise indicated. Use finishing nails for finish work. Select fasteners of size that will not penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting of wood; predrill as required.

3.02 INSTALLATION

A. Wood Grounds, Nailers, Blocking and Sleepers:

1. Provide where shown and where required for screening or attachment of other work. Form to shapes as shown and cut as required for true line and level of work to be attached.
2. Attach to substrates as required to support applied loading. Countersink bolts and nuts flush with surfaces, unless otherwise shown. Build into masonry during installation of masonry work. Where possible, anchor to formwork before concrete placement. Do not use power driven anchors unless approved by Architect.
3. Provide permanent grounds of dressed, preservative treated, key-beveled lumber not less than 1-1/2 inches wide and of thickness required to bring face of ground to exact thickness of finish material involved. Remove temporary grounds when no longer required.

B. Blocking Locations:

1. Coordinate locations of blocking with millwork and wall mounted contractor or Owner-furnished items.
2. Provide blocking at all door wall stops.
3. Furnish sufficient blocking to support cubicle curtains, drapery tracks, mirrors, and miscellaneous items.
4. Apply two (2) brush coats of same preservative used in original treatment to all sawed or cut surfaces of treated lumber.

3.03 TEMPORARY WORK

- #### A.
1. Provide temporary stairs, ramps, coverings, decks, handrails, runways, ladders, etc., as required for the purpose of handling materials, personnel and access to the work, and temporary exits from the building.

3.04 CUTTING, FITTING AND PATCHING

- #### A.
1. Include all cutting, fitting and patching of work in connection with other trades which adjoin any part of this Work.

END OF SECTION

SECTION 064100

ARCHITECTURAL WOODWORK

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Solid surface counter tops and vertical surfaces.
- B. Miscellaneous trimwork.

1.02 RELATED SECTIONS

- A. Section 061000 - Rough Carpentry: Blocking and grounds for attachment of woodwork.
- B. Section 099123 – Painting.

1.03 REFERENCES

- A. ANSI A135.4 - Basic Hardboard.
- B. ANSI A208.1 - Mat Formed Wood Particleboard.
- C. ASTM E84 - Test Method for Surface Burning Characteristics of Building Materials.
- D. AWI - Quality Standards.
- E. AWP (American Wood Preservers Association) C2 - Lumber, Timbers, Bridge Ties and Mine Ties - Preservative Treatment by Pressure Process.
- F. AWP (American Wood Preservers Association) C20 - Structural Lumber Fire Retardant Treatment by Pressure Process.
- G. BHMA A156.9 - Cabinet Hardware.
- H. FS MMM-A-130 - Adhesive, Contact.
- I. HPMA (Hardware Plywood Manufacturer's Association) HP - American Standard for Hardwood and Decorative Plywood.
- J. NEMA (National Electric Manufacturers Association) LD3 - High Pressure Decorative Laminates.
- K. NHLA (National Hardwood Lumber Association).
- L. NWWDA (National Wood Window and Door Association) I.S.4 - Water Repellant Preservative Treatment for Millwork.
- M. PS 1 - Construction and Industrial Plywood.
- N. PS 20 - American Softwood Lumber Standard.
- O. ANSI/BHMA A156.9 - Cabinet Hardware.

1.04 SUBMITTALS

- A. Shop Drawings: Plans, elevations, and sections; details at a large scale; show location of each item, identify components used, and indicate method of attachment.
 - 1. Show field measurements.
- B. Lumber: Samples of each species and cut; 1-1/2 by 8 inch pieces.
- C. Veneered Products: Samples conveying range of appearance to be expected; 6 by 12 inch pieces.
- D. Factory Finishes:
 - 1. Samples: 8 by 10 inch step samples, finished, for each finish and color, showing each coat required.
 - 2. Maintenance data.
- E. Manufactured Wood Products:
 - 1. Product data.
 - 2. Maintenance data.
- F. Solid Phenolic:
 - 1. Product data.
 - 2. Maintenance data.
- G. Rigid Cast Acrylic Plastic:
 - 1. Product data, including instructions for fabrication.
 - 2. Color samples for selection.
 - 3. Maintenance data.
- H. Fire-Retardant Treatment Materials:
 - 1. Product data.
 - 2. Treating plant's certification that treatment complies with specified requirements.
 - 3. Maintenance data.
- I. Fabricator Qualifications: For information only.

1.05 QUALITY ASSURANCE

- A. Quality of Materials and Workmanship: Provide woodwork that complies with requirements of "Architectural Woodwork Quality Standards", published by Architectural Woodwork Institute (AWI) (hereinafter referred to as "woodworking standard").
- B. Quality of Factory Finishing: Provide factory finishes that comply with Section 01500, "Architectural Woodwork Quality Standards".
- C. Fabricator Qualifications:
 - 1. All Work of this Section shall be fabricated by a single firm.

D. Standard for Testing Fire-Retardant Materials: Where fire-retardant woodwork is indicated, provide products which, when tested in accordance with ASTM E 84, have maximum flame spread as indicated and maximum smoke developed of 450.

1. Acceptable testing agencies:

- a. Underwriters Laboratories Inc. (UL).
- b. Other agencies acceptable to authorities having jurisdiction.

E. Installer Qualifications: Fabricator shall install his own work.

F. Pre-installation Meeting: Before delivery of woodwork, have the woodwork installer meet with the entity responsible for operation of the HVAC system (or temporary HVAC system) to explain the necessity for maintenance of the design temperature and humidity in woodwork storage and installation areas. Before installation of woodwork, have the woodwork installer meet with installers of related and adjacent work to discuss sequence of installation, protective measures, and consequences of damage to woodwork.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store materials for interior woodwork indoors in air conditioned spaces maintained within design temperature and humidity range.

B. Treated Wood Products: Handle and store as recommended by treatment manufacturer.

1.07 PROJECT CONDITIONS

A. Maintain final design temperature and humidity in areas where woodwork is installed.

B. Fit woodwork to actual construction. Take field measurements before fabricating woodwork.

C. Coordinate installation of woodwork with other work to avoid damage.

D. Coordination Data:

1. Furnish locations and types of all blocking and other anchors to be built into substrates to installers of such work.
2. Furnish treatment manufacturer's instructions for fabrication, handling, storage, installation, and finishing of treated wood materials to fabricators and installers.

PART 2 PRODUCTS

2.01 ARCHITECTURAL WOODWORK

A. Solid surface countertops:

1. Profile: As indicated in Construction Drawings.
2. Finish: Reference Construction Drawings.

B. Plywood:

1. Exterior graded AND fire retardant plywood where indicated, or where edge or surface is permanently exposed to weather or where used as underlayment to exterior gypsum sheathing: B - B EXT - APA, graded for treatment where preservative treated plywood is indicated.
2. Plywood Backing Panel: For mounting electrical or telephone equipment, provide fire-retardant treated plywood panels, APA C - D PLUGGED INT with exterior glue, thickness indicated, or if not otherwise indicated, 3/4 inch.

C. Preservative Treated Wood:

1. Waterborne Salt Preservatives for Painted, Stained or Exposed Natural Wood Products:
 - a. AWPB LP-2, above ground application.
 - b. AWPB LP-22, ground contact application.
2. Treat indicated items and the following:
 - a. Wood cants, nailers, curbs, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
 - b. Wood sills, sleepers, blocking, furring, stripping and similar concealed members in contact with masonry or concrete.

D. Fire Retardant Treatment:

1. Provide where required by code. Comply with AWPB Standards for pressure impregnation with Fire Retardant Chemicals.
 - a. Flame Spread: 25 max.
2. Treat all rough framing and blocking items throughout the Project, unless otherwise noted.

PART 3 EXECUTION

3.01 GENERAL

- A. Discard units of material with defects which might impair quality of work, and units which are too small to fabricate work with minimum joints or optimum joint arrangement.
- B. Set carpentry work accurately to required levels and lines, with members plumb and true and accurately cut and fitted.
- C. Securely attach carpentry work to substrate by anchoring and fastening as shown and as required by recognized standards. Countersink nail heads on exposed carpentry work and fill holes.
- D. Use common wire nails except as otherwise indicated. Use finishing nails for finish work. Select fasteners of size that will not penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting of wood; predrill as required.

3.02 INSTALLATION

A. Wood Grounds, Nailers, Blocking and Sleepers:

1. Provide where shown and where required for screening or attachment of other work. Form to shapes as shown and cut as required for true line and level of work to be attached.
2. Attach to substrates as required to support applied loading. Countersink bolts and nuts flush with surfaces, unless otherwise shown. Build into masonry during installation of masonry work. Where possible, anchor to formwork before concrete placement. Do not use power driven anchors unless approved by Architect.
3. Provide permanent grounds of dressed, preservative treated, key-beveled lumber not less than 1-1/2 inches wide and of thickness required to bring face of ground to exact thickness of finish material involved. Remove temporary grounds when no longer required.

B. Blocking Locations:

1. Coordinate locations of blocking with millwork and wall mounted contractor or Owner-furnished items.
2. Provide blocking at all door wall stops.
3. Furnish sufficient blocking to support cubicle curtains, drapery tracks, mirrors, and miscellaneous items.
4. Apply two (2) brush coats of same preservative used in original treatment to all sawed or cut surfaces of treated lumber.

3.03 TEMPORARY WORK

- #### A.
1. Provide temporary stairs, ramps, coverings, decks, handrails, runways, ladders, etc., as required for the purpose of handling materials, personnel and access to the work, and temporary exits from the building.

3.04 CUTTING, FITTING AND PATCHING

- #### A.
1. Include all cutting, fitting and patching of work in connection with other trades which adjoin any part of this Work.

END OF SECTION

SECTION 064100

ARCHITECTURAL WOODWORK

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Solid surface counter tops and vertical surfaces.
- B. Miscellaneous trimwork.

1.02 RELATED SECTIONS

- A. Section 061000 - Rough Carpentry: Blocking and grounds for attachment of woodwork.
- B. Section 099123 – Painting.

1.03 REFERENCES

- A. ANSI A135.4 - Basic Hardboard.
- B. ANSI A208.1 - Mat Formed Wood Particleboard.
- C. ASTM E84 - Test Method for Surface Burning Characteristics of Building Materials.
- D. AWI - Quality Standards.
- E. AWP (American Wood Preservers Association) C2 - Lumber, Timbers, Bridge Ties and Mine Ties - Preservative Treatment by Pressure Process.
- F. AWP (American Wood Preservers Association) C20 - Structural Lumber Fire Retardant Treatment by Pressure Process.
- G. BHMA A156.9 - Cabinet Hardware.
- H. FS MMM-A-130 - Adhesive, Contact.
- I. HPMA (Hardware Plywood Manufacturer's Association) HP - American Standard for Hardwood and Decorative Plywood.
- J. NEMA (National Electric Manufacturers Association) LD3 - High Pressure Decorative Laminates.
- K. NHLA (National Hardwood Lumber Association).
- L. NWWDA (National Wood Window and Door Association) I.S.4 - Water Repellant Preservative Treatment for Millwork.
- M. PS 1 - Construction and Industrial Plywood.
- N. PS 20 - American Softwood Lumber Standard.
- O. ANSI/BHMA A156.9 - Cabinet Hardware.

1.04 SUBMITTALS

- A. Shop Drawings: Plans, elevations, and sections; details at a large scale; show location of each item, identify components used, and indicate method of attachment.
 - 1. Show field measurements.
- B. Lumber: Samples of each species and cut; 1-1/2 by 8 inch pieces.
- C. Veneered Products: Samples conveying range of appearance to be expected; 6 by 12 inch pieces.
- D. Factory Finishes:
 - 1. Samples: 8 by 10 inch step samples, finished, for each finish and color, showing each coat required.
 - 2. Maintenance data.
- E. Manufactured Wood Products:
 - 1. Product data.
 - 2. Maintenance data.
- F. Solid Phenolic:
 - 1. Product data.
 - 2. Maintenance data.
- G. Rigid Cast Acrylic Plastic:
 - 1. Product data, including instructions for fabrication.
 - 2. Color samples for selection.
 - 3. Maintenance data.
- H. Fire-Retardant Treatment Materials:
 - 1. Product data.
 - 2. Treating plant's certification that treatment complies with specified requirements.
 - 3. Maintenance data.
- I. Fabricator Qualifications: For information only.

1.05 QUALITY ASSURANCE

- A. Quality of Materials and Workmanship: Provide woodwork that complies with requirements of "Architectural Woodwork Quality Standards", published by Architectural Woodwork Institute (AWI) (hereinafter referred to as "woodworking standard").
- B. Quality of Factory Finishing: Provide factory finishes that comply with Section 01500, "Architectural Woodwork Quality Standards".
- C. Fabricator Qualifications:
 - 1. All Work of this Section shall be fabricated by a single firm.

D. Standard for Testing Fire-Retardant Materials: Where fire-retardant woodwork is indicated, provide products which, when tested in accordance with ASTM E 84, have maximum flame spread as indicated and maximum smoke developed of 450.

1. Acceptable testing agencies:

- a. Underwriters Laboratories Inc. (UL).
- b. Other agencies acceptable to authorities having jurisdiction.

E. Installer Qualifications: Fabricator shall install his own work.

F. Pre-installation Meeting: Before delivery of woodwork, have the woodwork installer meet with the entity responsible for operation of the HVAC system (or temporary HVAC system) to explain the necessity for maintenance of the design temperature and humidity in woodwork storage and installation areas. Before installation of woodwork, have the woodwork installer meet with installers of related and adjacent work to discuss sequence of installation, protective measures, and consequences of damage to woodwork.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store materials for interior woodwork indoors in air conditioned spaces maintained within design temperature and humidity range.

B. Treated Wood Products: Handle and store as recommended by treatment manufacturer.

1.07 PROJECT CONDITIONS

A. Maintain final design temperature and humidity in areas where woodwork is installed.

B. Fit woodwork to actual construction. Take field measurements before fabricating woodwork.

C. Coordinate installation of woodwork with other work to avoid damage.

D. Coordination Data:

1. Furnish locations and types of all blocking and other anchors to be built into substrates to installers of such work.
2. Furnish treatment manufacturer's instructions for fabrication, handling, storage, installation, and finishing of treated wood materials to fabricators and installers.

PART 2 PRODUCTS

2.01 ARCHITECTURAL WOODWORK

A. Solid surface countertops:

1. Profile: As indicated in Construction Drawings.
2. Finish: Reference Construction Drawings.

2.02 WOOD MATERIALS

- A. Lumber: Species and grade as specified in woodworking standard, unless otherwise indicated.
1. Comply with applicable requirements of AWI Section 100.
 2. Moisture content at time of fabrication: Not greater than optimum moisture content as specified in woodworking standard.
 3. Provide lumber dressed on all exposed faces, unless otherwise indicated.
 4. Do not use twisted, warped, bowed, or otherwise defective lumber.
 5. Sizes indicated are nominal, unless otherwise indicated.
 6. Do not mark or color lumber, except where such marking will be concealed in finish work.
 7. Fire-retardant treated lumber: Pressure-treated using treatment materials indicated, complying with AWPAC20, kiln-dried to specified moisture content after treatment using methods which will not discolor, warp, or otherwise impair appearance.
 - a. Maintain moisture content required, before and after treatment.
 - b. Mark materials only with testing agency's removable paper marking, unless marking will be concealed when installed.
 - c. Do not use treated lumber that is discolored or does not meet requirements of the woodworking standard.
- B. Plywood: Types, grades, and cores as specified in the woodworking standard, except as otherwise specified in this Section.
1. Comply with applicable requirements of AWI Section 200.
 2. Fire-retardant, particleboard-core plywood: Untreated veneer faces on fire-retardant treated particleboard; maximum flame spread rating of 25.
- C. Particleboard: ANSI A208.1, M-2, or better; exterior glue when used in counters with sinks.
- D. Medium Density Fiberboard: ANSI A208.2, Product Class MD.

2.03 MISCELLANEOUS MATERIALS

- A. Solid Surface Counter Tops: Solid, homogeneous, rigid, cast sheet of plastic resin and minerals.
1. Thicknesses and configurations as indicated in Construction Drawings.
 2. Exact pattern and color to be determined.
 3. Acceptable product(s):
 - a. «Wilsonart» (Group 3).
 - b. "Avonite"; Avonite Inc.
 - c. "Corian"; E. I. du Pont de Nemours and Company, Inc.
 - d. "Fountainhead"; Nevamar Division, International Paper.
 - e. "Gibraltar"; Ralph Wilson Plastics Company.
 - f. "Surell"; Formica Corporation.
- B. Wood Filler for Transparent Finish Woodwork: Match final finish color.
- C. Accessories, Adhesives, Etc. for Fire-Retardant Assemblies: As required by classification or listing.
- D. Fasteners: Style, size, material, and finish as required for the purpose.

2.04 FABRICATION

- A. Fabricate in sizes and shapes indicated and using details indicated.
- B. Complete fabrication and assembly in shop.
 - 1. Disassemble units if too large for convenient shipping or installation.
 - 2. For applied fixtures and fittings, cut openings in shop.
 - 3. For field-applied hardware, drill mounting holes in shop.
 - 4. Ease edges of solid lumber members, unless otherwise noted, using:
 - a. 1/16 inch radius for members 1 inch or less nominal thickness.
 - b. 1/8 inch radius for members more than 1 inch nominal thickness.
- C. Fabricate rigid cast plastic sheets in accordance with manufacturer's instructions; make hairline, rigid joints.
- D. Standing and Running Trim: Miter exposed ends of members to match profile.
 - 1. Rout out backs of flat members over 2 inches wide, unless ends are exposed.
 - 2. Kerf backs of flat members over 4 inches wide, except where ends are exposed.

PART 3 EXECUTION

3.01 PREPARATION

- A. Verify that blocking and backings have been installed at appropriate locations for anchorage.
- B. If shop-fabricated items are not fully fabricated, complete fabrication.

3.02 INSTALLATION - GENERAL

- A. Do not begin installation of interior woodwork until potentially damaging construction operations are complete in the installation area.
- B. Field Joinery: Comply with requirements of the woodworking standard for shop joinery.
- C. Make joints neatly, with uniform appearance.
- D. Install woodwork in correct location, plumb and level, without rack or warp.
 - 1. Install with no variation in flushness of adjoining surfaces.
- E. Conceal all shims.
- F. Touch-up shop finishes at field cuts.
- G. Secure woodwork to blocking or use anchors indicated.
 - 1. Where anchorage method is not indicated, conceal all fasteners.
 - 2. Where exposed nailing is indicated, use finishing nails, countersink, and fill.

3. All window sills shall be secured both by adhesive and concealed screw type fasteners to wood blocking below.
 4. All wood base and wood chair rail shall be secured by concealed screw type fasteners to wood blocking.
- H. Fire-Retardant Treated Wood: Fabricate and install as recommended by treatment manufacturer and within limitations of fire retardant listing.
- I. Repair damaged and defective woodwork to eliminate visual and functional defects; where repair is not possible, replace woodwork.
- J. Touch up shop-applied finishes where damaged or soiled.
- K. Standing and Running Trim: Use longest pieces available and as few joints as possible.
1. Stagger joints in built-up trim members.
 2. Use diagonal (scarfed) joints in lengths of trim.
 3. Cope or miter at inside corners and miter at outside corners; fit tightly.
 4. Allow variation in plumb and level: Not more than 1/8 inch in 8 feet.

3.03 CLEANING

- A. Clean exposed and semi exposed surfaces.

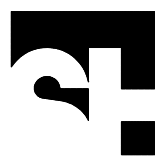
3.04 PROTECTION

- A. Protect architectural woodwork from damage and maintain design environmental conditions.

END OF SECTION

07

THERMAL AND MOISTURE PROTECTION



SECTION 072100
BUILDING INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Acoustical batt insulation in interior wall construction.

1.02 RELATED SECTIONS

- A. Section 092116 - Gypsum Board Systems.

1.03 REFERENCES

- A. ANSI / ASTM D2842 - Water Absorption of Rigid Cellular Plastics.
- B. ASTM C240 - Testing Cellular Glass Insulating Block.
- C. ASTM C578 - Preformed Cellular Polystyrene Thermal Insulation.
- D. ASTM E96 - Test Methods for Water Vapor Transmission of Materials.
- E. FS HH-I-530 - Insulation Board, Thermal, Unfaced, Polyurethane or Polyisocyanurate.
- F. FS HH-I-551 - Insulation Block and Boards, Thermal (Cellular Glass).
- G. FS HH-I-1972 / GEN - Insulation Board, Thermal, Faced, Polyurethane or Polyisocyanurate.
- H. ASTM C665 - Mineral Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
- I. FS HH-I-521 - Insulation Blankets, Thermal, (Mineral Fiber for Ambient Temperatures).
- J. FS HH-I-558 - Insulation, Blocks, Boards, Blankets, Felts, Slidding (Pipe and Tube Covering), and Pipe Fitting Covering, Thermal (Mineral Fiber, Industrial Type).

1.04 DEFINITIONS

- A. Thermal Resistance (R-value): The temperature difference in degrees F between the two surfaces of a material of given thickness, required to make 1 BTU of energy flow through 1 square foot of the material in 1 hour.

1.05 PERFORMANCE REQUIREMENTS

- A. Materials of this Section shall provide continuity of thermal barrier at building enclosure elements.

1.06 SUBMITTALS

- A. Submit under provisions of Section 013000.
- B. Product Data: Provide data on product characteristics, performance criteria, and limitations.

- C. Manufacturer's Installation Instructions: Indicate special environmental conditions required of installation and installation techniques.
- D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

1.07 ENVIRONMENTAL REQUIREMENTS

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

1.08 COORDINATION

- A. Coordinate Work under provisions of Section 010390.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Provide manufacturer's standard preformed insulation units, sized for proper fit in indicated applications.
- B. (Type 1) Glass Fiber Acoustical Insulation - Blanket / Batt:
 - 1. Unfaced Blanket/Batt: Type I (ASTM C 665), passing ASTM E 136 combustion test requirements.
 - 2. Size: 17 inches x 48 inches x 3 inches and 17 inches x 48 inches x 6 inches
 - 3. Sound Transmission Class: STC 51 minimum when used within 3 5/8" steel stud framed partition with 5/8" gypsum wallboard continuous both sides.
 - 4. Flame Spread: 0.
 - 5. Smoke Developed: 0.
 - 6. Products/Manufacturers:
 - a. CertainTeed.
 - b. Johns Manville.
 - c. Owens Corning.
 - d. Substitutions: Under provisions of Section 016000.
- C. (Type 2) Glass Fiber Thermal Insulation - Blanket / Batt:
 - 1. Unfaced Blanket/Batt: Type I (ASTM C 665), Passing ASTM E 136 combustion test requirements.
 - 2. Size: 16 inches x 96 inches x 3 1/2 inches and 16 inches x 96 inches x 6-1/4 inches.
 - 3. R-value: R-11 minimum (3-5/8" stud walls) and R 19 minimum (6" stud walls).
 - 4. Flame Spread: 25.
 - 5. Smoke Developed: 50.
 - 6. Manufacturers: Provide products complying with requirements of the Contract Documents and made by one of the following:
 - a. CertainTeed Corporation.
 - b. Knauf Fiberglass Company.
 - c. Manville Roofing Systems, a Division of Schuller International, Inc.
 - d. Owens-Corning Fiberglass Corporation.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify site conditions under provisions of Section 010390.
- B. Verify that related Work to be performed within indicated spaces before installation of insulation has been completed.
- C. Verify that substrates are in satisfactory condition to receive insulation.
- D. Do not proceed until unsatisfactory conditions have been corrected. Commencement of installation indicates acceptance of conditions.

3.02 PREPARATION

- A. Clean substrates of any substances which might damage materials to be installed.

3.03 INSTALLATION

- A. Do not install insulation which is damaged, wet, soiled, or which has been covered at any time with ice or snow.
- B. Comply with insulation manufacturer's recommendations and installation sequence. Provide permanent placement and support of insulation.
- C. Install materials in a manner which will maximize continuity of thermal envelope. Use a single layer of insulation wherever possible to achieve indicated requirements, unless otherwise indicated.
- D. Insulation Blankets / Batts:
 - 1. Install properly sized blankets / batts conforming to indicated spacings of framing members.
 - 2. Cut insulation neatly as required to fit tightly around obstructions.
 - 3. Application: Friction-fit insulation between metal stud framing members.

3.04 PROTECTION

- A. Protect installed materials from damage until permanent concealing work is completed.
- B. Where concealing work is not performed immediately after installation Work of this Section is completed, erect suitable temporary coverings or enclosures to prevent damage.

END OF SECTION

SECTION 078400

FIRESTOPPING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Through-penetration firestopping in fire rated wall and floor construction.
- B. Construction gap and joint firestopping within fire-rated walls, floors or floor-ceiling assemblies.
- C. Construction gap and joint firestopping at intersections of the same or different materials in fire-rated construction.
- D. Construction gap and joint firestopping at the top of fire-rated walls.
- E. Through-penetration and construction gap/joint smoke-stopping in smoke partitions.

1.02 RELATED SECTIONS

- A. Section 079200 - Joint Sealants.
- B. Section 092116 - Gypsum Board Systems.

1.03 REFERENCES

- A. American Society for Testing and Materials (ASTM) Publications:
 - 1. E 84 - Standard Test Methods for Surface Burning Characteristics of Building Materials.
 - 2. E 119 - Methods of Fire Tests of Building Construction and Materials.
 - 3. E 814 - Standard Method of Fire Tests of Through-Penetration Firestops.
 - 4. C 719 - Adhesion and Cohesion of Elastomeric Joint Sealants under Cyclic Movement.
 - 5. C 920 - Standard Specification of Elastomeric Joint Sealants.
- B. Underwriters Laboratories Inc. (UL) Publications:
 - 1. UL 263 - Fire Tests of Building Construction and Materials
 - 2. UL 723 - Surface Burning Characteristics of Building Materials.
 - 3. UL 1479 - Fire Tests of Through-Penetration Firestops.
 - 4. UL 2079 - Standard for Fire Tests of Joint Systems.
 - 5. Underwriters Laboratories "Fire Resistance Directory" (Current Year).
 - a. Through-Penetration Firestop Device (XHJJ).
 - b. Fire-Resistive Ratings (BXUV).
 - c. Through-Penetration Firestop Systems (XHEZ).
 - d. Fill, Void, or Cavity Material (XHHW).
 - e. Joint Systems (XHBN).
- C. Miscellaneous Publications:
 - 1. Factory Mutual Approval Guide (Current Year).
 - 2. Intertek Testing Service (Warnock Hersey) Certification Listings.

1.04 DEFINITIONS

- A. Fire Rated Assembly: Includes all fire rated walls, floors, floor/ceiling and roof system assemblies. Ratings shall be per ASTM E 119 or UL 263 (See Paragraph 1.03).
- B. Barriers: Time rated fire walls, smoke barrier walls, time rated ceiling/floor assemblies and structural floors.
- C. Firestopping: Use of a material or combination of materials to fill or seal openings in a fire-rated assembly, to restore the integrity of the assembly, and to prevent the spread of heat, fire, gases and smoke.
- D. System: Specific products and applications, classified and numbered by Underwriter’s Laboratories, Inc. to seal openings in fire-rated assemblies.
- E. Penetration: An opening or object passing through or into a fire-rated wall or floor that breaches the fire-rated assembly.
- F. Construction Gaps: Any gap, joint or opening (static or dynamic) between adjacent sections of walls or floors, at wall tops between top of wall and ceiling, exterior walls and structural floors or roof decks. Where dynamic movement is required the system must comply with UL 2079.

1.05 PERFORMANCE REQUIREMENTS

- A. General: For the following constructions, provide through-penetration firestop systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of assembly penetrated.
 - 1. Fire-resistance-rated load-bearing walls, including partitions, with fire-protection-rated openings.
 - 2. Fire-resistance-rated non-load-bearing walls, including partitions, with fire-protection-rated openings.
 - 3. Fire-resistance-rated floor assemblies.
 - 4. Fire-resistance-rated roof assemblies.
 - 5. Fire-resistance-rated joint assemblies between edges of fire-resistance-rated floor assemblies and exterior curtain walls.
- B. Fire-Test Response Characteristics: Provide through-penetration firestop systems that comply with the following requirements and those specified in “Performance Requirements” Paragraph:
 - 1. Firestopping materials shall conform to both Flame (F) and Temperature (T) ratings as required by local building codes and as tested by nationally accepted test agencies per ASTM E814 or UL 1479 fire tests in a configuration that is representative of field conditions.
- C. F-Rated Systems: Provide through-penetration firestop systems with F-ratings indicated, as determined per ASTM E814, but not less than one (1) hour or the fire resistance rating of the assembly being specified.
- D. T-Rated Systems: For the following conditions, provide through-penetration firestop systems with T-ratings indicated, as well as F-ratings, as determined per ASTM E814, where systems protect penetrating items exposed to potential contact with adjacent materials in occupiable floor areas:
 - 1. Penetrations located outside wall cavities.
 - 2. Penetrations located outside fire-resistive shaft enclosures.

3. Penetrations located in construction containing fire-protection-rated openings.
 4. Penetrating items larger than 4 inch diameter nominal pipe or 16 square inches in overall cross-sectional area.
- E. For through-penetration firestop systems exposed to view, traffic, moisture, and physical damage, provide products that after curing do not deteriorate when exposed to these conditions both during and after construction:
1. For piping penetrations for plumbing and wet-pipe sprinkler systems, provide moisture-resistant through-penetration firestop systems.
 2. For floor penetrations with annular spaces exceeding 4 inches in width and exposed to possible loading and traffic, provide firestop systems capable of supporting floor loads involved either by installing floor plates or by other means.
 3. For penetrations involving insulated piping, provide through-penetration firestop systems not requiring removal of insulation.
- F. For through-penetration firestop systems exposed to view, provide products with flame-spread ratings of less than 25 and smoke-developed ratings of less than 450, as determined per ASTM E84.
- G. Firestopping for joints must meet or exceed the requirements for ASTM E1966.E1399 or UL 2079 with movement capabilities equal to those of the anticipated conditions.

1.06 SUBMITTALS

- A. Product Data: For each type of through-penetration firestop system product indicated.
- B. Shop Drawings: For each through-penetration firestop system, show each kind of construction condition penetrated, relationships to adjoining construction and kind of penetrating item. Include firestop design designation of testing and inspecting agency acceptable to authorities having jurisdiction that evidences compliance with requirements for each condition indicated.
1. Submit documentation, including illustrations, from a qualified testing and inspecting agency that is applicable to each through-penetration firestop system configuration for construction and penetrating items.
 2. Where Project conditions require modification of qualified testing and inspecting agency's illustration, with modifications marked, approved by through-penetration firestop system manufacturer's fire-protection engineer.
- C. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Submit document from manufacturer wherein manufacturer recognizes the installer as qualified.

1.07 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who is qualified by having the necessary experience, staff, and training to install manufacturer's products per specified requirements. A manufacturer's willingness to sell its through-penetration firestop system products to Contractor or to an installer engaged by Contractor does not in itself confer qualification on buyer.
- B. Source Limitations: Obtain through-penetration firestop systems, for each kind of penetration and construction conditions indicated, from a single manufacturer.

- C. Firestopping materials and systems must be capable of closing or filling through-openings created by:
 - 1. The burning or melting of combustible pipes, cable jacketing, or pipe insulation materials
 - 2. Deflection of sheet metal due to thermal expansion (electrical & mechanical duct work).
- D. Firestopping material shall be asbestos and lead free and shall not incorporate nor require the use of hazardous solvents.
- E. Firestopping sealants must be flexible, allowing for normal pipe movement.
- F. Firestopping materials shall not shrink upon drying as evidenced by cracking or pulling back from contact surfaces.
- G. Firestopping materials shall be moisture resistant, and may not dissolve in water after curing.
- H. All firestopping materials shall be manufactured by one manufacturer (to the maximum extent or approved by the firestop manufacturer).
- I. Installation of firestopping systems shall be performed by a contractor (or contractors) trained or approved by the firestop manufacturer.
- J. Material used shall be in accordance with the manufacturer's written installation instructions.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Deliver through-penetration firestop system products to Project site in original, unopened containers or packages with intact and legible manufacturer's labels identifying product and manufacturer; date of manufacture; lot number; shelf life, if applicable; qualified testing and inspecting agency's classification marking applicable to Project; curing time; and mixing instructions for multi-component materials.
- B. Store and handle materials for through-penetration firestop systems to prevent their deterioration or damage due to moisture, temperature changes, contaminants, or other causes.
- C. All firestop materials shall be installed prior to expiration of shelf life.

1.09 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install through-penetration firestop systems when ambient or substrate temperatures are outside limits permitted by through-penetration firestop system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.
- B. Ventilate through-penetration firestop systems per the manufacturer's written instructions by natural means or, where this is inadequate, forced-air circulation.
- C. Verify the condition of the substrates before starting Work.
- D. Care should be taken to ensure that firestopping materials are installed so as not to contaminate adjacent surfaces.

1.10 COORDINATION

- A. Coordinate construction of openings and penetrating items to ensure that through-penetration firestop systems are installed according to specified requirements.
- B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate through-penetration firestop systems.
- C. Do not cover up through-penetration firestop system installations that will become concealed behind other construction until building inspector, if required by authorities having jurisdiction, have examined each installation.
- D. Schedule firestopping after installation of penetrants but prior to concealing the openings. **Penetrations shall be firestopped the same day the penetration is created. Provide temporary approved firestopping system of rockwool if required due to scheduling conflicts amongst trades.**
- E. Firestopping shall precede gypsum board finishing.

PART 2 PRODUCTS

2.01 FIRESTOPPING, GENERAL

- A. Compatibility: Provide through-penetration firestop systems that are compatible with one another, with the substrates forming openings, and with the items, if any, penetrating through-penetration firestop systems, under conditions of service and application, as demonstrated by through-penetration firestop system manufacturer based on testing and field experience.
- B. Accessories: Provide components for each through-penetration firestop system that are needed to install fill materials and to comply with “Performance Requirements” Article. Use only components specified by through-penetration firestop system manufacturer and approved by the qualified testing and inspecting agency for firestop systems indicated. Accessories include, but are not limited to the following items:
 - 1. Permanent forming/damming/backing materials, including the following:
 - a. Slag-rock-wool-fiber insulation.
 - b. Sealants used in combination with other forming/damming/backing materials to prevent leakage of fill materials in liquid state.
 - c. Fire-rated form board.
 - d. Poly-Ethylene/Poly-Urethane backer rod.
 - 2. Temporary forming materials.
 - 3. Substrate primers.
 - 4. Collars/Devices.
 - 5. Steel Sleeves.
- C. All firestop products and systems shall be designed and installed so that the basic sealing system will allow the full restoration of the thermal and fire resistance properties of the barrier being penetrated with minimal repair if penetrants are subsequently removed.
- D. For applications where combustible penetrants are involved, i.e. insulated and plastic pipe, a suitable intumescent material must be used.

2.02 FILL MATERIALS

- A. General: Provide through-penetration firestop systems containing the types of fill materials required by the manufacturer. Fill materials are those referred to in directories of the referenced testing and inspecting agencies as fill, void, or cavity materials.
- B. Cast-in-Place Firestop Device: A metallic sleeve lined with an intumescent material sized to fit a specific diameter for non-metallic penetrants.
- C. Latex Sealants: Single-component latex formulations that after cure do not re-emulsify during exposure to moisture.
- D. Firestop Devices: Factory-assembled or field assembled collars or sleeves formed from galvanized steel and lined with intumescent material sized to fit the specific diameter of a non-metallic penetrant.
- E. Intumescent Putties: Non-hardening dielectric, water-resistant putties containing no solvents, inorganic fibers, or silicone compounds.
- F. Intumescent Wrap Strips: Single-component intumescent elastomeric strips with polyethylene on both sides.
- G. Mortars: Prepackaged, dry mixes consisting of a blend of inorganic binders, hydraulic cement, fillers, and lightweight aggregate formulated for mixing with water at Project site to form an expanding homogeneous mortar.
- H. Pillows/Bags: Reusable, heat-expanding pillows/bags consisting of glass-fiber cloth cases filled with a combination of mineral-fiber, water-insoluble expansion agents and fire-retardant additives.

2.03 MIXING

- A. For those products requiring mixing before application, comply with through-penetration firestop system manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

2.04 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with the requirements contained herein, provide single-source firestopping products from only one of the following manufacturers:
 - 1. Hilti, Inc. (Tulsa, OK).
 - 2. International Protective Coatings Corp. (IPC) (Hatfield, PA).
 - 3. Isolatek International (Stanhope, NJ).
 - 4. 3M Fire Protection Products (St. Paul, MN).
- B. Substitutions: Under provisions of Section 016000.

2.05 MATERIALS

A. Intumescent Firestop Sealants and Caulks:

1. FlameSafe FS1900.
2. Cafco Type I.
3. 3M CP 25 WB+.

B. Latex Firestop Sealant:

1. FlameSafe FS900 .
2. Cafco Type C.
3. 3M Firedam 150.

C. Elastomeric Water-Based Sealant:

1. FlameSafe FS1900, FS900+.
2. 3M Firedam 150+, CP 25 WB+.

D. Firestop Putty:

1. FlameSafe FSP1000 Putty & FSP1077 Putty Pads.
2. Cafco Type P.
3. 3M MPS-2+ Putty, MPP-4S+.

E. Firestop Collars:

1. FlameSafe FSWS-1", FSWS-1.5", FlameSafe Devices, FSIS Sleeve.
2. 3M PPD, PPD Ultra Device.

F. Wrap Strips:

1. FlameSafe FSWS 100 Wrap Strip, FSWS 150 Wrap Strip.
2. 3M PPD, PPD Ultra Device.

G. Firestop Mortars:

1. FlameSafe Mortar.
2. Cafco TPS Mortar.
3. 3Mfire barrier Mortar.

H. Firestop Pillows:

1. FlameSafe Bags, FlameSafe Pillows.
2. 3M CS-195+ Composite Sheet.

I. Elastomeric Spray:

1. FlameSafe FS3000, FS2900.
2. 3M Firedam Spray.

J. Accessories: Forming/Damming Materials: Mineral fiberboard or other type as per manufacturer's recommendations.

1.04 DEFINITIONS

- A. Fire Rated Assembly: Includes all fire rated walls, floors, floor/ceiling and roof system assemblies. Ratings shall be per ASTM E 119 or UL 263 (See Paragraph 1.03).
- B. Barriers: Time rated fire walls, smoke barrier walls, time rated ceiling/floor assemblies and structural floors.
- C. Firestopping: Use of a material or combination of materials to fill or seal openings in a fire-rated assembly, to restore the integrity of the assembly, and to prevent the spread of heat, fire, gases and smoke.
- D. System: Specific products and applications, classified and numbered by Underwriter’s Laboratories, Inc. to seal openings in fire-rated assemblies.
- E. Penetration: An opening or object passing through or into a fire-rated wall or floor that breaches the fire-rated assembly.
- F. Construction Gaps: Any gap, joint or opening (static or dynamic) between adjacent sections of walls or floors, at wall tops between top of wall and ceiling, exterior walls and structural floors or roof decks. Where dynamic movement is required the system must comply with UL 2079.

1.05 PERFORMANCE REQUIREMENTS

- A. General: For the following constructions, provide through-penetration firestop systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of assembly penetrated.
 - 1. Fire-resistance-rated load-bearing walls, including partitions, with fire-protection-rated openings.
 - 2. Fire-resistance-rated non-load-bearing walls, including partitions, with fire-protection-rated openings.
 - 3. Fire-resistance-rated floor assemblies.
 - 4. Fire-resistance-rated roof assemblies.
 - 5. Fire-resistance-rated joint assemblies between edges of fire-resistance-rated floor assemblies and exterior curtain walls.
- B. Fire-Test Response Characteristics: Provide through-penetration firestop systems that comply with the following requirements and those specified in “Performance Requirements” Paragraph:
 - 1. Firestopping materials shall conform to both Flame (F) and Temperature (T) ratings as required by local building codes and as tested by nationally accepted test agencies per ASTM E814 or UL 1479 fire tests in a configuration that is representative of field conditions.
- C. F-Rated Systems: Provide through-penetration firestop systems with F-ratings indicated, as determined per ASTM E814, but not less than one (1) hour or the fire resistance rating of the assembly being specified.
- D. T-Rated Systems: For the following conditions, provide through-penetration firestop systems with T-ratings indicated, as well as F-ratings, as determined per ASTM E814, where systems protect penetrating items exposed to potential contact with adjacent materials in occupiable floor areas:
 - 1. Penetrations located outside wall cavities.
 - 2. Penetrations located outside fire-resistive shaft enclosures.

3. Penetrations located in construction containing fire-protection-rated openings.
 4. Penetrating items larger than 4 inch diameter nominal pipe or 16 square inches in overall cross-sectional area.
- E. For through-penetration firestop systems exposed to view, traffic, moisture, and physical damage, provide products that after curing do not deteriorate when exposed to these conditions both during and after construction:
1. For piping penetrations for plumbing and wet-pipe sprinkler systems, provide moisture-resistant through-penetration firestop systems.
 2. For floor penetrations with annular spaces exceeding 4 inches in width and exposed to possible loading and traffic, provide firestop systems capable of supporting floor loads involved either by installing floor plates or by other means.
 3. For penetrations involving insulated piping, provide through-penetration firestop systems not requiring removal of insulation.
- F. For through-penetration firestop systems exposed to view, provide products with flame-spread ratings of less than 25 and smoke-developed ratings of less than 450, as determined per ASTM E84.
- G. Firestopping for joints must meet or exceed the requirements for ASTM E1966.E1399 or UL 2079 with movement capabilities equal to those of the anticipated conditions.

1.06 SUBMITTALS

- A. Product Data: For each type of through-penetration firestop system product indicated.
- B. Shop Drawings: For each through-penetration firestop system, show each kind of construction condition penetrated, relationships to adjoining construction and kind of penetrating item. Include firestop design designation of testing and inspecting agency acceptable to authorities having jurisdiction that evidences compliance with requirements for each condition indicated.
1. Submit documentation, including illustrations, from a qualified testing and inspecting agency that is applicable to each through-penetration firestop system configuration for construction and penetrating items.
 2. Where Project conditions require modification of qualified testing and inspecting agency's illustration, with modifications marked, approved by through-penetration firestop system manufacturer's fire-protection engineer.
- C. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Submit document from manufacturer wherein manufacturer recognizes the installer as qualified.

1.07 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who is qualified by having the necessary experience, staff, and training to install manufacturer's products per specified requirements. A manufacturer's willingness to sell its through-penetration firestop system products to Contractor or to an installer engaged by Contractor does not in itself confer qualification on buyer.
- B. Source Limitations: Obtain through-penetration firestop systems, for each kind of penetration and construction conditions indicated, from a single manufacturer.

- C. Firestopping materials and systems must be capable of closing or filling through-openings created by:
 - 1. The burning or melting of combustible pipes, cable jacketing, or pipe insulation materials
 - 2. Deflection of sheet metal due to thermal expansion (electrical & mechanical duct work).
- D. Firestopping material shall be asbestos and lead free and shall not incorporate nor require the use of hazardous solvents.
- E. Firestopping sealants must be flexible, allowing for normal pipe movement.
- F. Firestopping materials shall not shrink upon drying as evidenced by cracking or pulling back from contact surfaces.
- G. Firestopping materials shall be moisture resistant, and may not dissolve in water after curing.
- H. All firestopping materials shall be manufactured by one manufacturer (to the maximum extent or approved by the firestop manufacturer).
- I. Installation of firestopping systems shall be performed by a contractor (or contractors) trained or approved by the firestop manufacturer.
- J. Material used shall be in accordance with the manufacturer's written installation instructions.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Deliver through-penetration firestop system products to Project site in original, unopened containers or packages with intact and legible manufacturer's labels identifying product and manufacturer; date of manufacture; lot number; shelf life, if applicable; qualified testing and inspecting agency's classification marking applicable to Project; curing time; and mixing instructions for multi-component materials.
- B. Store and handle materials for through-penetration firestop systems to prevent their deterioration or damage due to moisture, temperature changes, contaminants, or other causes.
- C. All firestop materials shall be installed prior to expiration of shelf life.

1.09 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install through-penetration firestop systems when ambient or substrate temperatures are outside limits permitted by through-penetration firestop system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.
- B. Ventilate through-penetration firestop systems per the manufacturer's written instructions by natural means or, where this is inadequate, forced-air circulation.
- C. Verify the condition of the substrates before starting Work.
- D. Care should be taken to ensure that firestopping materials are installed so as not to contaminate adjacent surfaces.

1.10 COORDINATION

- A. Coordinate construction of openings and penetrating items to ensure that through-penetration firestop systems are installed according to specified requirements.
- B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate through-penetration firestop systems.
- C. Do not cover up through-penetration firestop system installations that will become concealed behind other construction until building inspector, if required by authorities having jurisdiction, have examined each installation.
- D. Schedule firestopping after installation of penetrants but prior to concealing the openings. **Penetrations shall be firestopped the same day the penetration is created. Provide temporary approved firestopping system of rockwool if required due to scheduling conflicts amongst trades.**
- E. Firestopping shall precede gypsum board finishing.

PART 2 PRODUCTS

2.01 FIRESTOPPING, GENERAL

- A. Compatibility: Provide through-penetration firestop systems that are compatible with one another, with the substrates forming openings, and with the items, if any, penetrating through-penetration firestop systems, under conditions of service and application, as demonstrated by through-penetration firestop system manufacturer based on testing and field experience.
- B. Accessories: Provide components for each through-penetration firestop system that are needed to install fill materials and to comply with “Performance Requirements” Article. Use only components specified by through-penetration firestop system manufacturer and approved by the qualified testing and inspecting agency for firestop systems indicated. Accessories include, but are not limited to the following items:
 - 1. Permanent forming/damming/backing materials, including the following:
 - a. Slag-rock-wool-fiber insulation.
 - b. Sealants used in combination with other forming/damming/backing materials to prevent leakage of fill materials in liquid state.
 - c. Fire-rated form board.
 - d. Poly-Ethylene/Poly-Urethane backer rod.
 - 2. Temporary forming materials.
 - 3. Substrate primers.
 - 4. Collars/Devices.
 - 5. Steel Sleeves.
- C. All firestop products and systems shall be designed and installed so that the basic sealing system will allow the full restoration of the thermal and fire resistance properties of the barrier being penetrated with minimal repair if penetrants are subsequently removed.
- D. For applications where combustible penetrants are involved, i.e. insulated and plastic pipe, a suitable intumescent material must be used.

2.02 FILL MATERIALS

- A. General: Provide through-penetration firestop systems containing the types of fill materials required by the manufacturer. Fill materials are those referred to in directories of the referenced testing and inspecting agencies as fill, void, or cavity materials.
- B. Cast-in-Place Firestop Device: A metallic sleeve lined with an intumescent material sized to fit a specific diameter for non-metallic penetrants.
- C. Latex Sealants: Single-component latex formulations that after cure do not re-emulsify during exposure to moisture.
- D. Firestop Devices: Factory-assembled or field assembled collars or sleeves formed from galvanized steel and lined with intumescent material sized to fit the specific diameter of a non-metallic penetrant.
- E. Intumescent Putties: Non-hardening dielectric, water-resistant putties containing no solvents, inorganic fibers, or silicone compounds.
- F. Intumescent Wrap Strips: Single-component intumescent elastomeric strips with polyethylene on both sides.
- G. Mortars: Prepackaged, dry mixes consisting of a blend of inorganic binders, hydraulic cement, fillers, and lightweight aggregate formulated for mixing with water at Project site to form an expanding homogeneous mortar.
- H. Pillows/Bags: Reusable, heat-expanding pillows/bags consisting of glass-fiber cloth cases filled with a combination of mineral-fiber, water-insoluble expansion agents and fire-retardant additives.

2.03 MIXING

- A. For those products requiring mixing before application, comply with through-penetration firestop system manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

2.04 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with the requirements contained herein, provide single-source firestopping products from only one of the following manufacturers:
 - 1. Hilti, Inc. (Tulsa, OK).
 - 2. International Protective Coatings Corp. (IPC) (Hatfield, PA).
 - 3. Isolatek International (Stanhope, NJ).
 - 4. 3M Fire Protection Products (St. Paul, MN).
- B. Substitutions: Under provisions of Section 016000.

- C. Firestopping materials and systems must be capable of closing or filling through-openings created by:
 - 1. The burning or melting of combustible pipes, cable jacketing, or pipe insulation materials
 - 2. Deflection of sheet metal due to thermal expansion (electrical & mechanical duct work).
- D. Firestopping material shall be asbestos and lead free and shall not incorporate nor require the use of hazardous solvents.
- E. Firestopping sealants must be flexible, allowing for normal pipe movement.
- F. Firestopping materials shall not shrink upon drying as evidenced by cracking or pulling back from contact surfaces.
- G. Firestopping materials shall be moisture resistant, and may not dissolve in water after curing.
- H. All firestopping materials shall be manufactured by one manufacturer (to the maximum extent or approved by the firestop manufacturer).
- I. Installation of firestopping systems shall be performed by a contractor (or contractors) trained or approved by the firestop manufacturer.
- J. Material used shall be in accordance with the manufacturer's written installation instructions.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Deliver through-penetration firestop system products to Project site in original, unopened containers or packages with intact and legible manufacturer's labels identifying product and manufacturer; date of manufacture; lot number; shelf life, if applicable; qualified testing and inspecting agency's classification marking applicable to Project; curing time; and mixing instructions for multi-component materials.
- B. Store and handle materials for through-penetration firestop systems to prevent their deterioration or damage due to moisture, temperature changes, contaminants, or other causes.
- C. All firestop materials shall be installed prior to expiration of shelf life.

1.09 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install through-penetration firestop systems when ambient or substrate temperatures are outside limits permitted by through-penetration firestop system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.
- B. Ventilate through-penetration firestop systems per the manufacturer's written instructions by natural means or, where this is inadequate, forced-air circulation.
- C. Verify the condition of the substrates before starting Work.
- D. Care should be taken to ensure that firestopping materials are installed so as not to contaminate adjacent surfaces.

1.10 COORDINATION

- A. Coordinate construction of openings and penetrating items to ensure that through-penetration firestop systems are installed according to specified requirements.
- B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate through-penetration firestop systems.
- C. Do not cover up through-penetration firestop system installations that will become concealed behind other construction until building inspector, if required by authorities having jurisdiction, have examined each installation.
- D. Schedule firestopping after installation of penetrants but prior to concealing the openings. **Penetrations shall be firestopped the same day the penetration is created. Provide temporary approved firestopping system of rockwool if required due to scheduling conflicts amongst trades.**
- E. Firestopping shall precede gypsum board finishing.

PART 2 PRODUCTS

2.01 FIRESTOPPING, GENERAL

- A. Compatibility: Provide through-penetration firestop systems that are compatible with one another, with the substrates forming openings, and with the items, if any, penetrating through-penetration firestop systems, under conditions of service and application, as demonstrated by through-penetration firestop system manufacturer based on testing and field experience.
- B. Accessories: Provide components for each through-penetration firestop system that are needed to install fill materials and to comply with “Performance Requirements” Article. Use only components specified by through-penetration firestop system manufacturer and approved by the qualified testing and inspecting agency for firestop systems indicated. Accessories include, but are not limited to the following items:
 - 1. Permanent forming/damming/backing materials, including the following:
 - a. Slag-rock-wool-fiber insulation.
 - b. Sealants used in combination with other forming/damming/backing materials to prevent leakage of fill materials in liquid state.
 - c. Fire-rated form board.
 - d. Poly-Ethylene/Poly-Urethane backer rod.
 - 2. Temporary forming materials.
 - 3. Substrate primers.
 - 4. Collars/Devices.
 - 5. Steel Sleeves.
- C. All firestop products and systems shall be designed and installed so that the basic sealing system will allow the full restoration of the thermal and fire resistance properties of the barrier being penetrated with minimal repair if penetrants are subsequently removed.
- D. For applications where combustible penetrants are involved, i.e. insulated and plastic pipe, a suitable intumescent material must be used.

2.02 FILL MATERIALS

- A. General: Provide through-penetration firestop systems containing the types of fill materials required by the manufacturer. Fill materials are those referred to in directories of the referenced testing and inspecting agencies as fill, void, or cavity materials.
- B. Cast-in-Place Firestop Device: A metallic sleeve lined with an intumescent material sized to fit a specific diameter for non-metallic penetrants.
- C. Latex Sealants: Single-component latex formulations that after cure do not re-emulsify during exposure to moisture.
- D. Firestop Devices: Factory-assembled or field assembled collars or sleeves formed from galvanized steel and lined with intumescent material sized to fit the specific diameter of a non-metallic penetrant.
- E. Intumescent Putties: Non-hardening dielectric, water-resistant putties containing no solvents, inorganic fibers, or silicone compounds.
- F. Intumescent Wrap Strips: Single-component intumescent elastomeric strips with polyethylene on both sides.
- G. Mortars: Prepackaged, dry mixes consisting of a blend of inorganic binders, hydraulic cement, fillers, and lightweight aggregate formulated for mixing with water at Project site to form an expanding homogeneous mortar.
- H. Pillows/Bags: Reusable, heat-expanding pillows/bags consisting of glass-fiber cloth cases filled with a combination of mineral-fiber, water-insoluble expansion agents and fire-retardant additives.

2.03 MIXING

- A. For those products requiring mixing before application, comply with through-penetration firestop system manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

2.04 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with the requirements contained herein, provide single-source firestopping products from only one of the following manufacturers:
 - 1. Hilti, Inc. (Tulsa, OK).
 - 2. International Protective Coatings Corp. (IPC) (Hatfield, PA).
 - 3. Isolatek International (Stanhope, NJ).
 - 4. 3M Fire Protection Products (St. Paul, MN).
- B. Substitutions: Under provisions of Section 016000.

2.05 MATERIALS

A. Intumescent Firestop Sealants and Caulks:

1. FlameSafe FS1900.
2. Cafco Type I.
3. 3M CP 25 WB+.

B. Latex Firestop Sealant:

1. FlameSafe FS900 .
2. Cafco Type C.
3. 3M Firedam 150.

C. Elastomeric Water-Based Sealant:

1. FlameSafe FS1900, FS900+.
2. 3M Firedam 150+, CP 25 WB+.

D. Firestop Putty:

1. FlameSafe FSP1000 Putty & FSP1077 Putty Pads.
2. Cafco Type P.
3. 3M MPS-2+ Putty, MPP-4S+.

E. Firestop Collars:

1. FlameSafe FSWS-1", FSWS-1.5", FlameSafe Devices, FSIS Sleeve.
2. 3M PPD, PPD Ultra Device.

F. Wrap Strips:

1. FlameSafe FSWS 100 Wrap Strip, FSWS 150 Wrap Strip.
2. 3M PPD, PPD Ultra Device.

G. Firestop Mortars:

1. FlameSafe Mortar.
2. Cafco TPS Mortar.
3. 3Mfire barrier Mortar.

H. Firestop Pillows:

1. FlameSafe Bags, FlameSafe Pillows.
2. 3M CS-195+ Composite Sheet.

I. Elastomeric Spray:

1. FlameSafe FS3000, FS2900.
2. 3M Firedam Spray.

J. Accessories: Forming/Damming Materials: Mineral fiberboard or other type as per manufacturer's recommendations.

1.04 DEFINITIONS

- A. Fire Rated Assembly: Includes all fire rated walls, floors, floor/ceiling and roof system assemblies. Ratings shall be per ASTM E 119 or UL 263 (See Paragraph 1.03).
- B. Barriers: Time rated fire walls, smoke barrier walls, time rated ceiling/floor assemblies and structural floors.
- C. Firestopping: Use of a material or combination of materials to fill or seal openings in a fire-rated assembly, to restore the integrity of the assembly, and to prevent the spread of heat, fire, gases and smoke.
- D. System: Specific products and applications, classified and numbered by Underwriter’s Laboratories, Inc. to seal openings in fire-rated assemblies.
- E. Penetration: An opening or object passing through or into a fire-rated wall or floor that breaches the fire-rated assembly.
- F. Construction Gaps: Any gap, joint or opening (static or dynamic) between adjacent sections of walls or floors, at wall tops between top of wall and ceiling, exterior walls and structural floors or roof decks. Where dynamic movement is required the system must comply with UL 2079.

1.05 PERFORMANCE REQUIREMENTS

- A. General: For the following constructions, provide through-penetration firestop systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of assembly penetrated.
 - 1. Fire-resistance-rated load-bearing walls, including partitions, with fire-protection-rated openings.
 - 2. Fire-resistance-rated non-load-bearing walls, including partitions, with fire-protection-rated openings.
 - 3. Fire-resistance-rated floor assemblies.
 - 4. Fire-resistance-rated roof assemblies.
 - 5. Fire-resistance-rated joint assemblies between edges of fire-resistance-rated floor assemblies and exterior curtain walls.
- B. Fire-Test Response Characteristics: Provide through-penetration firestop systems that comply with the following requirements and those specified in “Performance Requirements” Paragraph:
 - 1. Firestopping materials shall conform to both Flame (F) and Temperature (T) ratings as required by local building codes and as tested by nationally accepted test agencies per ASTM E814 or UL 1479 fire tests in a configuration that is representative of field conditions.
- C. F-Rated Systems: Provide through-penetration firestop systems with F-ratings indicated, as determined per ASTM E814, but not less than one (1) hour or the fire resistance rating of the assembly being specified.
- D. T-Rated Systems: For the following conditions, provide through-penetration firestop systems with T-ratings indicated, as well as F-ratings, as determined per ASTM E814, where systems protect penetrating items exposed to potential contact with adjacent materials in occupiable floor areas:
 - 1. Penetrations located outside wall cavities.
 - 2. Penetrations located outside fire-resistive shaft enclosures.

3. Penetrations located in construction containing fire-protection-rated openings.
 4. Penetrating items larger than 4 inch diameter nominal pipe or 16 square inches in overall cross-sectional area.
- E. For through-penetration firestop systems exposed to view, traffic, moisture, and physical damage, provide products that after curing do not deteriorate when exposed to these conditions both during and after construction:
1. For piping penetrations for plumbing and wet-pipe sprinkler systems, provide moisture-resistant through-penetration firestop systems.
 2. For floor penetrations with annular spaces exceeding 4 inches in width and exposed to possible loading and traffic, provide firestop systems capable of supporting floor loads involved either by installing floor plates or by other means.
 3. For penetrations involving insulated piping, provide through-penetration firestop systems not requiring removal of insulation.
- F. For through-penetration firestop systems exposed to view, provide products with flame-spread ratings of less than 25 and smoke-developed ratings of less than 450, as determined per ASTM E84.
- G. Firestopping for joints must meet or exceed the requirements for ASTM E1966.E1399 or UL 2079 with movement capabilities equal to those of the anticipated conditions.

1.06 SUBMITTALS

- A. Product Data: For each type of through-penetration firestop system product indicated.
- B. Shop Drawings: For each through-penetration firestop system, show each kind of construction condition penetrated, relationships to adjoining construction and kind of penetrating item. Include firestop design designation of testing and inspecting agency acceptable to authorities having jurisdiction that evidences compliance with requirements for each condition indicated.
1. Submit documentation, including illustrations, from a qualified testing and inspecting agency that is applicable to each through-penetration firestop system configuration for construction and penetrating items.
 2. Where Project conditions require modification of qualified testing and inspecting agency's illustration, with modifications marked, approved by through-penetration firestop system manufacturer's fire-protection engineer.
- C. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Submit document from manufacturer wherein manufacturer recognizes the installer as qualified.

1.07 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who is qualified by having the necessary experience, staff, and training to install manufacturer's products per specified requirements. A manufacturer's willingness to sell its through-penetration firestop system products to Contractor or to an installer engaged by Contractor does not in itself confer qualification on buyer.
- B. Source Limitations: Obtain through-penetration firestop systems, for each kind of penetration and construction conditions indicated, from a single manufacturer.

- C. Firestopping materials and systems must be capable of closing or filling through-openings created by:
 - 1. The burning or melting of combustible pipes, cable jacketing, or pipe insulation materials
 - 2. Deflection of sheet metal due to thermal expansion (electrical & mechanical duct work).
- D. Firestopping material shall be asbestos and lead free and shall not incorporate nor require the use of hazardous solvents.
- E. Firestopping sealants must be flexible, allowing for normal pipe movement.
- F. Firestopping materials shall not shrink upon drying as evidenced by cracking or pulling back from contact surfaces.
- G. Firestopping materials shall be moisture resistant, and may not dissolve in water after curing.
- H. All firestopping materials shall be manufactured by one manufacturer (to the maximum extent or approved by the firestop manufacturer).
- I. Installation of firestopping systems shall be performed by a contractor (or contractors) trained or approved by the firestop manufacturer.
- J. Material used shall be in accordance with the manufacturer's written installation instructions.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Deliver through-penetration firestop system products to Project site in original, unopened containers or packages with intact and legible manufacturer's labels identifying product and manufacturer; date of manufacture; lot number; shelf life, if applicable; qualified testing and inspecting agency's classification marking applicable to Project; curing time; and mixing instructions for multi-component materials.
- B. Store and handle materials for through-penetration firestop systems to prevent their deterioration or damage due to moisture, temperature changes, contaminants, or other causes.
- C. All firestop materials shall be installed prior to expiration of shelf life.

1.09 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install through-penetration firestop systems when ambient or substrate temperatures are outside limits permitted by through-penetration firestop system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.
- B. Ventilate through-penetration firestop systems per the manufacturer's written instructions by natural means or, where this is inadequate, forced-air circulation.
- C. Verify the condition of the substrates before starting Work.
- D. Care should be taken to ensure that firestopping materials are installed so as not to contaminate adjacent surfaces.

1.10 COORDINATION

- A. Coordinate construction of openings and penetrating items to ensure that through-penetration firestop systems are installed according to specified requirements.
- B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate through-penetration firestop systems.
- C. Do not cover up through-penetration firestop system installations that will become concealed behind other construction until building inspector, if required by authorities having jurisdiction, have examined each installation.
- D. Schedule firestopping after installation of penetrants but prior to concealing the openings. **Penetrations shall be firestopped the same day the penetration is created. Provide temporary approved firestopping system of rockwool if required due to scheduling conflicts amongst trades.**
- E. Firestopping shall precede gypsum board finishing.

PART 2 PRODUCTS

2.01 FIRESTOPPING, GENERAL

- A. Compatibility: Provide through-penetration firestop systems that are compatible with one another, with the substrates forming openings, and with the items, if any, penetrating through-penetration firestop systems, under conditions of service and application, as demonstrated by through-penetration firestop system manufacturer based on testing and field experience.
- B. Accessories: Provide components for each through-penetration firestop system that are needed to install fill materials and to comply with “Performance Requirements” Article. Use only components specified by through-penetration firestop system manufacturer and approved by the qualified testing and inspecting agency for firestop systems indicated. Accessories include, but are not limited to the following items:
 - 1. Permanent forming/damming/backing materials, including the following:
 - a. Slag-rock-wool-fiber insulation.
 - b. Sealants used in combination with other forming/damming/backing materials to prevent leakage of fill materials in liquid state.
 - c. Fire-rated form board.
 - d. Poly-Ethylene/Poly-Urethane backer rod.
 - 2. Temporary forming materials.
 - 3. Substrate primers.
 - 4. Collars/Devices.
 - 5. Steel Sleeves.
- C. All firestop products and systems shall be designed and installed so that the basic sealing system will allow the full restoration of the thermal and fire resistance properties of the barrier being penetrated with minimal repair if penetrants are subsequently removed.
- D. For applications where combustible penetrants are involved, i.e. insulated and plastic pipe, a suitable intumescent material must be used.

2.02 FILL MATERIALS

- A. General: Provide through-penetration firestop systems containing the types of fill materials required by the manufacturer. Fill materials are those referred to in directories of the referenced testing and inspecting agencies as fill, void, or cavity materials.
- B. Cast-in-Place Firestop Device: A metallic sleeve lined with an intumescent material sized to fit a specific diameter for non-metallic penetrants.
- C. Latex Sealants: Single-component latex formulations that after cure do not re-emulsify during exposure to moisture.
- D. Firestop Devices: Factory-assembled or field assembled collars or sleeves formed from galvanized steel and lined with intumescent material sized to fit the specific diameter of a non-metallic penetrant.
- E. Intumescent Putties: Non-hardening dielectric, water-resistant putties containing no solvents, inorganic fibers, or silicone compounds.
- F. Intumescent Wrap Strips: Single-component intumescent elastomeric strips with polyethylene on both sides.
- G. Mortars: Prepackaged, dry mixes consisting of a blend of inorganic binders, hydraulic cement, fillers, and lightweight aggregate formulated for mixing with water at Project site to form an expanding homogeneous mortar.
- H. Pillows/Bags: Reusable, heat-expanding pillows/bags consisting of glass-fiber cloth cases filled with a combination of mineral-fiber, water-insoluble expansion agents and fire-retardant additives.

2.03 MIXING

- A. For those products requiring mixing before application, comply with through-penetration firestop system manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

2.04 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with the requirements contained herein, provide single-source firestopping products from only one of the following manufacturers:
 - 1. Hilti, Inc. (Tulsa, OK).
 - 2. International Protective Coatings Corp. (IPC) (Hatfield, PA).
 - 3. Isolatek International (Stanhope, NJ).
 - 4. 3M Fire Protection Products (St. Paul, MN).
- B. Substitutions: Under provisions of Section 016000.

2.05 MATERIALS

A. Intumescent Firestop Sealants and Caulks:

1. FlameSafe FS1900.
2. Cafco Type I.
3. 3M CP 25 WB+.

B. Latex Firestop Sealant:

1. FlameSafe FS900 .
2. Cafco Type C.
3. 3M Firedam 150.

C. Elastomeric Water-Based Sealant:

1. FlameSafe FS1900, FS900+.
2. 3M Firedam 150+, CP 25 WB+.

D. Firestop Putty:

1. FlameSafe FSP1000 Putty & FSP1077 Putty Pads.
2. Cafco Type P.
3. 3M MPS-2+ Putty, MPP-4S+.

E. Firestop Collars:

1. FlameSafe FSWS-1", FSWS-1.5", FlameSafe Devices, FSIS Sleeve.
2. 3M PPD, PPD Ultra Device.

F. Wrap Strips:

1. FlameSafe FSWS 100 Wrap Strip, FSWS 150 Wrap Strip.
2. 3M PPD, PPD Ultra Device.

G. Firestop Mortars:

1. FlameSafe Mortar.
2. Cafco TPS Mortar.
3. 3Mfire barrier Mortar.

H. Firestop Pillows:

1. FlameSafe Bags, FlameSafe Pillows.
2. 3M CS-195+ Composite Sheet.

I. Elastomeric Spray:

1. FlameSafe FS3000, FS2900.
2. 3M Firedam Spray.

J. Accessories: Forming/Damming Materials: Mineral fiberboard or other type as per manufacturer's recommendations.

- K. Color: All firestopping materials shall be red.

PART 3 EXECUTION

3.01 CONDITIONS REQUIRING FIRESTOPPING

- A. General: Provide firestopping for conditions specified.
- B. Through-Penetrations: Firestopping shall be installed in all open penetrations and in the annular space in all penetrations in any bearing or non-rated barrier.
- C. Membrane-Penetrations: Where required by code, all membrane-penetrations in rated walls shall be protected with firestopping products that meet the requirements of third party time/temperature testing.
- D. Construction Joints/Gaps: Firestopping shall be provided:
1. Between the edges of floor slabs and exterior walls (as required for enclosed areas).
 2. Between the tops of rated walls and the underside of floors/roof decks.
 3. In the control joint in masonry walls and floors.
 4. In expansion joints.
- E. Smoke-Stopping: As required by the other Sections, smoke-stops shall be provided for through-penetrations, membrane-penetrations, and construction gaps with a material approved and tested for such application.

3.02 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
- C. Verify that all pipes, conduits, cables, and/or other items which penetrate fire-rated construction have been permanently installed prior to installation of firestops.

3.03 PREPARATION

- A. Surface Cleaning: Clean out openings immediately before installing through-penetration firestop systems to comply with written recommendations of firestop system manufacturer and the following requirements:
1. Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of through-penetration firestop systems.
 2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with through-penetration firestop systems. Remove loose particles remaining from cleaning operation.
 3. Remove laitance and form-release agents from concrete.

- K. Color: All firestopping materials shall be red.

PART 3 EXECUTION

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 2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with through-penetration firestop systems. Remove loose particles remaining from cleaning operation.
 3. Remove laitance and form-release agents from concrete.

3.04 THROUGH-PENETRATION FIRESTOP SYSTEM

- A. General: Install through-penetration firestop systems to comply with “Performance Requirements” Article and firestop system manufacturer’s written installation instructions and published drawings for products and applications indicated.
 - 1. Installation of firestopping shall be performed by an applicator/installer qualified and trained by the manufacturer.
 - 2. Apply firestopping in accordance with fire test reports, fire resistance requirements, acceptable sample installations, and manufacturer’s recommendations.
 - 3. Unless specified and approved, all insulation used in conjunction with through-penetrants shall remain intact and undamaged and may not be removed.
 - 4. Seal holes and penetrations to ensure an effective smoke seal.
 - 5. In areas of high traffic, protect firestopping materials from damage. If the opening is large, install firestopping materials capable of supporting the weight of a human.
 - 6. Insulation types specified in other Sections shall not be installed in lieu of firestopping material specified herein.
 - 7. All combustible penetrants (e.g. non-metallic pipes or insulated metallic pipes) shall be firestopped using products and systems tested in a configuration representative of the field condition.
- B. Install forming/damming/backing materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.
 - 1. After installing fill materials, remove combustible forming materials and other accessories not indicated as permanent components of firestop systems. Noncombustible damming materials may be left as a permanent component of the firestop system.
- C. Install fill materials for firestop systems by proven techniques to produce the following results:
 - 1. Fill voids and cavities formed by openings, forming materials, accessories, and penetrating items as required to achieve fire-resistance ratings indicated.
 - 2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
 - 3. For fill materials that will remain exposed after completing Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.05 IDENTIFICATION

- A. Retain this article if labels are required; revise if labeling is limited to selected applications. Identify penetration firestopping with preprinted metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches of firestopping edge so labels will be visible to anyone seeking to remove penetrating items or firestopping. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:
 - 1. The words "Warning - Penetration Firestopping - Do Not Disturb. Notify Building Management of Any Damage."
 - 2. Contractor's name, address, and phone number.
 - 3. Designation of applicable testing and inspecting agency.
 - 4. Date of installation.
 - 5. Manufacturer's name.

6. Installer's name.

3.06 FIELD QUALITY CONTROL

- A. Inspecting Agency: The building inspector, if required by authorities having jurisdiction, shall be allowed to inspect through-penetration firestop systems. All areas of Work must be accessible until inspection by the applicable Code Authorities.
- B. Proceed with enclosing through-penetration firestop systems with other construction only after inspections are complete.
- C. Where deficiencies are found, repair or replace through-penetration firestop systems so they comply with requirements.

3.07 CLEANING AND PROTECTION

- A. Clean off excess fill materials adjacent to openings as Work progresses by methods and with cleaning materials that are approved in writing by through-penetration firestop system manufacturers and that do not damage materials in which openings occur. Leave finished Work in neat, clean condition with no evidence of spillovers or damage to adjacent surfaces.
- B. Provide final protection and maintain conditions during and after installation that ensure through-penetration firestop systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated through-penetration firestop systems immediately and install new materials to produce through-penetration firestop systems complying with specified requirements.

END OF SECTION

SECTION 079200

JOINT SEALANTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Preparing substrate surfaces.
- B. Sealant and joint backing.

1.02 RELATED SECTIONS

- A. Section 078400 - Firestopping.
- B. Section 088000 - Glazing: Sealants required in conjunction with glazing methods.
- C. Section 081113 – Hollow Metal Doors and Frames: Sealants required in conjunction with door frames.
- D. Section 092116 - Gypsum Board Systems.

1.03 REFERENCES

- A. ASTM C790 - Use of Latex Sealing Compounds.
- B. ASTM C804 - Use of Solvent-Release Type Sealants.
- C. ASTM C834 - Latex Sealing Compounds.
- D. ASTM C919 - Use of Sealants in Acoustical Applications.
- E. ASTM C920 - Elastomeric Joint Sealants.
- F. ASTM D1056 - Flexible Cellular Materials - Sponge or Expanded Rubber.
- G. ASTM D1565 - Flexible Cellular Materials - Vinyl Chloride Polymers and Copolymers (Open-Cell Foam).
- H. SWRI (Sealant, Waterproofing and Restoration Institute) - Sealant and Caulking Guide Specification.

1.04 SUBMITTALS

- A. Submit under provisions of Section 013000.
- B. Product Data: Provide data indicating sealant chemical characteristics, performance criteria, substrate preparation, limitations, color availability.
- C. Samples: Submit two samples, 1x1 inch in size illustrating sealant colors for selection.
- D. Manufacturer's Installation Instructions: Indicate special procedures, surface preparation, perimeter conditions requiring special attention.

- E. Contractor shall submit a Sealant Schedule, indicating sealant colors to be used at all required locations, prior to installation.

1.05 QUALITY ASSURANCE

- A. Perform Work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.
- B. Perform acoustical sealant application Work in accordance with ASTM C919.
- C. Maintain one copy of each document on site.

1.06 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing the Products specified in this Section with minimum three years documented experience.
- B. Applicator: Company specializing in performing the Work of this Section with minimum five years documented experience and approved by manufacturer.

1.07 ENVIRONMENTAL REQUIREMENTS

- A. Maintain temperature and humidity recommended by the sealant manufacturer during and after installation.

1.08 COORDINATION

- A. Coordinate Work under provisions of Section 010390.
- B. Coordinate the Work with all Sections referencing this Section.

1.09 WARRANTY

- A. Provide five year warranty under provisions of Section 017000.
- B. Warranty: Include coverage for installed sealants and accessories which fail to achieve air tight seal, water tight seal, and exhibit loss of adhesion or cohesion, or do not cure.

PART 2 PRODUCTS

2.01 SEALANTS

- A. (Type A) Oil Based: Single component, resinous compound, elongation capability of 0 to 2 percent of joint width.
- B. (Type B) Bituminous Based: Single component, asphalt compound, elongation capability of 0 to 2 percent of joint width.
- C. (Type C) Acrylic Emulsion Latex: ASTM C920, Grade 1, Class A, Single component, non-staining, non-bleeding, non-sagging; color as selected.
 - 1. Elongation Capability: 2 to 5 percent
 - 2. Service Temperature Range: 2 to 160 degrees F

3. Shore A Hardness Range: 15 to 40
- D. (Type D) Acrylic Sealant: ASTM C920, Grade 1, Class A, single component, solvent curing, non-staining, non-bleeding, non-sagging; color as selected.
1. Elongation Capability: 7.5 to 12 percent
 2. Service Temperature Range: -13 to 180 degrees F
 3. Shore A Hardness Range: 25 to 50
- E. (Type E) Butyl Sealant: ASTM C920, Grade 1, Class A, single component, solvent release, non-skinning, non-sagging, black color.
1. Elongation Capability: 7 to 10 percent
 2. Service Temperature Range: -13 to 180 degrees F
 3. Shore A Hardness Range: 10 to 30
- F. (Type F) Polysulfide Sealant: ASTM C920, Grade 1, Class A, two component, chemical curing, non-staining, non-bleeding, capable of continuous water immersion, non-sagging type; color as selected.
1. Elongation Capability: 25 percent
 2. Service Temperature Range: -40 to 180 degrees F
 3. Shore A Hardness Range: 20 to 35
- G. (Type G) Polyurethane Sealant: ASTM C920, Grade 1, Class A, single component, chemical curing, non-staining, non-bleeding, capable of continuous water immersion, non-sagging type; color as selected.
1. Elongation Capability: 25 percent
 2. Service Temperature Range: -40 to 180 degrees F
 3. Shore A Hardness Range: 20 to 35
- H. (Type H) Polyurethane Sealant: ASTM C920, Grade 1, Class A, multi-component, chemical curing, non-staining, non-bleeding, capable of continuous water immersion, non-sagging type; color as selected.
1. Elongation Capability: 25 percent
 2. Service Temperature Range: -40 to 180 degrees F
 3. Shore A Hardness Range: 20 to 35
- I. (Type I) Silicone Sealant: ASTM C920, Grade 1, Class A, single component, solvent curing, non-sagging, non-staining, fungus resistant, non-bleeding; color as selected.
1. Elongation Capability: 25 percent
 2. Service Temperature Range: -65 to 180 degrees F
 3. Shore A Hardness Range: 15 to 35
- J. (Type J) Silicone Sealant: ASTM C920, Grade 1, Class A, single component, fungus resistant, chemical curing, non-sagging, non-staining, non-bleeding; color as selected.
1. Elongation Capability: 25 percent
 2. Service Temperature Range: -65 to 180 degrees F

3. Shore A Hardness Range: 15 to 25
- K. (Type K) Silicone Sealant: ASTM C920, Grade 1, Class A, single component, fungus resistant, acidic curing, non-sagging, non-staining, non-bleeding; color as selected.
 1. Elongation Capability: 25 percent
 2. Service Temperature Range: -65 to 180 degrees F
 3. Shore A Hardness Range: 15 to 25
- L. (Type L) Two-Part Epoxy Security Sealant (“pick-proof”): DynaPoxy EP-1200, as manufactured by the Pecora Corporation or Architect approved equal; color as selected from manufacturer’s standard colors.

2.02 ACCESSORIES

- A. Primer: Non-staining type as recommended by sealant manufacturer to suit application.
- B. Joint Cleaner: Non-corrosive and non-staining type, recommended by sealant manufacturer; compatible with joint forming materials.
- C. Joint Backing: ASTM D1565; round, open cell polyethylene foam rod; oversized 30 to 50 percent larger than joint width.
- D. Bond Breaker: Pressure sensitive tape recommended by sealant manufacturer to suit application.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that substrate surfaces and joint openings are ready to receive Work.
- B. Verify that joint backing and release tapes are compatible with sealant.

3.02 PREPARATION

- A. Remove loose materials and foreign matter which might impair adhesion of sealant.
- B. Clean and prime joints in accordance with manufacturer's instructions.
- C. Perform preparation in accordance with manufacturer's instructions.
- D. Protect elements surrounding the Work of this Section from damage or disfiguration.

3.03 INSTALLATION

- A. Install sealant in accordance with manufacturer's instructions.
- B. Measure joint dimensions and size materials to achieve required width/depth ratios.
- C. Install joint backing to achieve a neck dimension no greater than 1/3 of the joint width.
- D. Install bond breaker where joint backing is not used.

- E. Install sealant free of air pockets, foreign embedded matter, ridges, and sags.
- F. Apply sealant within recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.
- G. Tool joints concave.

3.04 CLEANING

- A. Clean Work under provisions of Section 017000.
- B. Clean adjacent soiled surfaces.

3.05 PROTECTION OF FINISHED WORK

- A. Protect finished installation under provisions of Section 016000.
- B. Protect sealants until cured.

3.06 SECURITY SEALANT (“PICK-PROOF”) SCHEDULE

- A. Patient Toilet, Patient Toilet/Shower (Psychiatric):
 - 1. Water Closet to Floor/Wall.
 - 2. Lavatory to Wall.
 - 3. Mirror to Wall.
- B. Contractor shall provide pick-proof joint sealer systems (Type L) at all locations within all Patient Care Areas and any other area accessible to patients - reference Patient Safety Plans for locations of Patient Care Areas.

END OF SECTION

SECTION 081113

HOLLOW METAL DOORS AND FRAMES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Non-rated and fire rated steel frames.
- B. Non-rated, and fire-rated, steel doors.

1.02 RELATED SECTIONS

- A. Section 081423 – Impact Resistant Wood Doors.
- B. Section 087100 - Door Hardware.
- C. Section 088000 - Glazing.
- D. Section 099123 – Painting

1.03 REFERENCES

- A. ANSI A117.1 - Specifications for Making Buildings and Facilities Accessible to and Usable by Physically Handicapped People.
- B. ANSI/SDI A250.8-2003 (SDI-100) - Recommended Specifications for Standard Steel Doors and Frames.
- C. ASTM A167 - Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
- D. ASTM A525 - Steel Sheet, Zinc-Coated Galvanized by the Hot-Dip Process.
- E. ASTM E152 - Methods of Fire Tests of Door Assemblies.
- F. DHI - Door Hardware Institute: The Installation of Commercial Steel Doors and Steel Frames, Insulated Steel Doors in Wood Frames and Builder's Hardware.
- G. NFPA 80 - Fire Doors and Windows.
- H. NFPA 252 - Fire Tests for Door Assemblies.
- I. UL 10C - Fire Tests of Door Assemblies.

1.04 SUBMITTALS

- A. Submit under provisions of Section 013000.
- B. Shop Drawings: Indicate frame elevations, reinforcement, and finish.

- C. Product Data: Indicate frame configuration, anchor types and spacings, location of cut-outs for hardware, reinforcement. Indicate door elevations, internal reinforcement, closure method, and cut-outs for glazing, and finish.
- D. Samples: Submit two samples of frame, 1x1 inch in size illustrating factory finished frame colors and surface texture. Submit two samples of door face metal, 1x1 inch in size illustrating pre-finished door colors and surface texture.
- E. Manufacturer's Installation Instructions: Indicate special installation instructions.
- F. Manufacturer's Certificate: Certify that Products meet or exceed specified requirements.

1.05 QUALITY ASSURANCE

- A. Conform to requirements of ANSI/SDI-100 and ANSI A117.1.
- B. Maintain one copy of each document on site.

1.06 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing the Products specified in this Section with minimum three years documented experience.

1.07 REGULATORY REQUIREMENTS

- A. Fire Rated Frame Construction: Conform to NFPA 252 and UL 10C.
- B. Installed Frame Assembly: Conform to NFPA 80 for fire rated class same as fire door.
- C. Fire Rated Door Construction: Conform to ASTM E152, NFPA 252 and UL10C.
- D. Fire Rated Door Construction: Rate of rise of 250 F degrees across door thickness.
- E. Installed Door and Panel Assembly: Conform to NFPA 80 for fire rated class as scheduled.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, protect, and handle products to site under provisions of Section 016000.
- B. Accept frames on site in manufacturer's packaging. Inspect for damage.
- C. Accept doors on site in manufacturer's packaging. Inspect for damage.
- D. Break seal on-site to permit ventilation.

1.09 FIELD MEASUREMENTS

- A. Verify that field measurements are as indicated on Shop Drawings.

1.10 COORDINATION

- A. Coordinate Work under provisions of Section 010390.
- B. Coordinate the Work with frame opening construction, door and hardware installation.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Ceco Door Products (Milan, TN).
- B. Curries Company (Mason City, IA).
- C. Steelcraft (Cincinnati, OH).
- D. Windsor Republic Doors (McKenzie, TN).
- E. Substitutions: Under provisions of Section 016000.

2.02 FRAMES

- A. Interior Frames up to 3'6" in width: SDI-100 - Level 3. Frames shall be fabricated from galvanized steel sheet with painted finish. Provide hospital stops.
- B. Interior Frames 3'-6" and greater in width: SDI-100 - Level 4. Frames shall be fabricated from galvanized steel sheet with painted finish. Provide hospital stops.

2.03 DOORS

- A. Exterior Doors (Thermally Broken): SDI-100, Level 3 (Extra-Heavy Duty), Physical Performance Level A, Model 2 (16 gauge).
 - 1. Unless otherwise indicated, provide thermal-rated assemblies with U-value rating of 0.41 Btu/sq. ft. x h x deg F or better.

2.04 ACCESSORIES

- A. Silencers: Resilient rubber, fitted into drilled hole.

2.05 FABRICATION

- A. Fabricate frames as continuously welded units.
- B. Transom Bars for Glazed Lights: Fixed type, of same profiles as jamb and head.
- C. Fabricate doors and frames with hardware reinforcement plates welded in place.
- D. Attach fire rated label to each fire rated door unit.
- E. Reinforce frames wider than 48 inches with roll formed steel channels fitted tightly into frame head, flush with top.
- F. Prepare frame for silencers. Provide three single silencers for single doors.
- G. Configure exterior frames with special profile to receive recessed weatherstripping.
- H. Fabricate frames to suit masonry wall coursing with 4" head member where indicated.

- I. Provide special frames (pocket door frames, hospital stops, jambless openings, between glass venetian blinds, swing clear hinges, etc.) where specified.

1. Provide hospital stops at all new door frames.

2.06 FINISH

- A. Galvanized Sheet Steel: Per ASTM A525.
- B. Stainless Sheet Steel: Per ASTM A167.
- C. Doors and Frames shall be treated for paint adherence and given a baked-on corrosion-inhibitive prime coat of metallic oxide or synthetic resin primer in accordance with SDA-100 and meeting acceptance criteria of ANSI A224.1.
- D. Reference Section 099123 – Painting for finish field painting of frames.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify substrate conditions under provisions of Section 010390.
- B. Verify that opening sizes and tolerances are acceptable.

3.02 INSTALLATION

- A. Install frames in accordance with ANSI/SDI-100 and DHI.
- B. Coordinate with wallboard wall construction for anchor placement.
- C. Coordinate installation of glass and glazing.
- D. Coordinate installation of frames with expansion joint cover assemblies installation.
- E. Coordinate installation of frames with installation of doors specified in Section 081423 and hardware specified in Section 087100.
- F. Install roll formed steel reinforcement channels between two abutting frames. Anchor to structure and floor.

3.03 ERECTION TOLERANCES

- A. Maximum Diagonal Distortion: 1/16 inch measured with straight edges, crossed corner to corner.

3.04 ADJUSTING

- A. Adjust Work under provisions of Section 01700.
- B. Adjust door for smooth and balanced door movement.

END OF SECTION

SECTION 081423

IMPACT RESISTANT WOOD DOORS

PART 1 GENERAL

1.01 SCOPE

- A. All labor, material, equipment, and related services necessary to furnish and install all high impact resistant non-rated and fire-rated Acrovyn[®] Door Systems doors with flush faces as shown on the drawings or specified herein.

1.02 REFERENCE STANDARDS

- A. ASTM G-21 and ASTM G-22 (Bacteria and Fungal resistance): Provide doors that do not support fungal and bacterial growth when tested in accordance with applicable provisions of ASTM G-21 and ASTM G-22.
- B. ASTM D-543 (Chemical and Stain Resistance): Provide doors that show chemical and stain resistance when tested in accordance with ASTM D-543.
- C. ASTM E152 – Methods of Fire Tests and Door Assemblies
- D. NFPA 252 Standard methods of fire tests of door assemblies
- E. UL-10C Positive Pressure fire tests of door assemblies
- F. NFPA 80 Fire Doors and Windows
- G. NFPA 101 Life Safety Code
- H. MBDC “C2C”, McDonough Braungart Design Chemistry - Cradle to Cradle
- I. CARB Emission Standards Section 93120.2 (a), California Air Resources Board
- J. GGHC Title EP 4.1 PBT Elimination: Dioxins, Green Guide for Health Care v 2.2 ‘07
- K. WDMA Industry Quality Test Standards I.S.1A-04:
 - 1. WDMA TM-7 Test method to determine the physical endurance of wood doors & associated hardware connections under accelerated operating conditions, Window and Door Manufacturers Association
 - 2. WDMA TM-8 Test methods to determine hinge loading resistance of wood door stiles, Window and Door Manufacturers Association
 - 3. WDMA TM-10 - Test method to determine the screw holding capacity of wood door stiles, Window and Door Manufacturers Association
- L. ANSI/BHMA A156.115-W-2006 American National Standard for Hardware Preparation in Wood Doors with Wood or Steel Frames
- M. FSC – Forestry Stewardship Council

1.03 SUBMITTALS

- A. Submit in accordance with Section 013000
- B. Product Data: For each type of door, submit manufacturer's data sheets including details of core and edge construction.
- C. Shop Drawings: Submit complete schedule indicating location, size, hardware sets, swing of each door; elevation of each type of door and construction details not covered in product data and other pertinent information. Indicate dimensions and locations of mortises and holes for hardware, fire ratings, and location of cutouts for glass.
- D. Samples for verification of edge wrapping and edge replaceability. Banded edges will not be approved.
- E. Certification: Submit certification that doors and frames comply with UL10c, Positive Pressure Fire Door Test Method.
- F. Manufacturer's lifetime warranty.

1.04 QUALITY ASSURANCE

- A. Source Limitations: Obtain high impact resistant Acrovyn Door Systems flush doors through one source from a single manufacturer.
- B. Quality Standard: Comply with WDMA Industry Standard (I.S. 1A-04 "Architectural Wood Flush Doors").
 - 1. Doors shall meet performance attributes for the following performance duty level: Extra Heavy Duty.
 - 2. Tolerances for warp, telegraphing, squareness and prefitting dimensions as per the latest edition of WDMA I.S.1A-04.
- C. Fire-Rated Wood Doors: Doors complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-ratings indicated, based on testing according to UBC Standard 7-2, UL-10C Positive Pressure and NFPA 252.
- D. Doors or trial doors of the type specified herein should be installed in an existing facility for over 6 months to verify quality and durability performance of product.

1.05 DELIVERY, STORAGE, HANDLING AND SITE CONDITIONS

- A. Deliver, store, protect and handle products under guidelines of WDMA and manufacturer's care and handling instructions.
- B. Package doors individually using foam interleaf and stack on pallet, not exceeding 15 doors per pallet.
- C. Mark each door with opening number used on shop drawings.

- D. Accept doors on site in manufacturer’s standard packaging. Inspect for damage.
- E. Do not store doors in damp or wet areas. HVAC systems should be operating and balanced prior to arrival of doors. Acceptable humidity shall be no less than 25% or greater than 55%.
- F. Do not subject doors to extreme conditions or changes in heat, dryness or humidity in accordance with the latest edition of WDMA I.S.1A-04.
- G. Protect doors from exposure to natural and artificial light after delivery.
- H. Doors should be lifted and carried when being moved, not dragged across one another.

1.06 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver store, or install doors until building is enclosed, wet work is complete, and HVAC system is operating and will maintain temperature and relative humidity at occupancy levels during the remainder of the construction period.
- B. HVAC systems should be operating and balanced prior to arrival of doors. Acceptable humidity shall be no less than 25% or greater than 55%. Note: Any claim for warp, bow, twist, or telegraphing may be denied if required humidity requirements are not maintained.

1.07 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace doors that are deemed defective in materials or workmanship. Conditions are subject to the terms set forth in the manufacturer’s warranty.
 - 1. Solid-Core Interior Doors: provide manufacturer’s limited lifetime written warranty guarantee against warp, delamination and defects in materials and workmanship.
 - 2. “Edge of a Lifetime” Warranty: If an Acrovyn edge cover is ever damaged, Construction Specialties shall supply a replacement Acrovyn cover at no cost to the Owner. This special Warranty begins 1 month after the original installation date. Labor not included. Stainless Steel edges not included. Refer to our warranty for full details.

PART 2 PRODUCTS

2.01 MANUFACTURER

- A. Subject to compliance with all requirements, provide one of the following:
 - 1. To establish a standard of quality, design and function required, drawings and specifications are based on Construction Specialties, Inc. Acrovyn® Door Systems (800) 972-7214.

2.02 MATERIALS

- A. Door Construction
 - 1. Non Fire Rated Doors and 20-minute interior FLUSH doors conforming to WDMA I.S.1A-04 and the following:
 - a. Thickness: 1 3/4” +/-1/16”, (44.45mm +/- 1.58mm).

- b. Core: Solid. Interior stiles and rails bonded. Tops and bottoms factory sealed with an approved sealer to prevent moisture intrusion.
 - (1). Structural Composite Lumber, 39 lb/ft³ (17.69kg/m³) density - no added urea formaldehyde content
 - c. Crossbanding: FSC certified
 - d. Replaceable door stiles: ¾" (19.05mm) replaceable stiles shall be field replaceable if ever damaged by impact.
 - e. Replaceable door edges: Fully wrapped and rounded Acrovyn or stainless steel door edges shall be field replaceable if ever damaged by impact, exclusive of external fasteners to improve appearance.
 - (1). Subject to the terms and conditions of our Limited Warranty for the lifetime of the doors, the manufacturer shall supply replacement Acrovyn edge covers AT NO COST to the Owner.
 - f. WDMA I.S.1A-04 Performance Duty Level: Extra Heavy Duty
 - g. Durability Performance: Cycle Slam WDMA TM-7, 1990 Extra Heavy Duty- 2,000,000 cycles to insure durability of entire door construction
2. 45 and 60-minute interior FLUSH fire rated doors conforming to WDMA I.A. 1-A and the following:
- a. Thickness: 1 3/4" +/-1/16", (44.45mm +/- 1.58mm)
 - b. Cores: Solid. Interior stiles and rails bonded. Non-combustible mineral composite, 25-32 lb/ft³ density, no added urea formaldehyde content. Tops and bottoms factory sealed with an approved sealer to prevent moisture intrusion.
 - c. Crossbanding: FSC certified
 - d. Replaceable door stiles: ¾" (19.05mm) replaceable stiles shall be field replaceable if ever damaged by impact.
 - e. Replaceable door edges: Fully wrapped and rounded Acrovyn or stainless steel door edges shall be field replaceable if ever damaged by impact, exclusive of external fasteners to improve appearance.
 - (1) Subject to the terms and conditions of our Limited Warranty for the lifetime of the doors, the manufacturer shall supply replacement Acrovyn edge covers AT NO COST to the Owner
 - f. WDMA I.S.1A-04 Performance Duty Level: Extra Heavy Duty
 - g. Durability Performance: Cycle Slam WDMA TM-7, 1990 – 1,000,000 cycles to insure durability of entire door construction
3. 90-minute interior FLUSH fire rated doors conforming to WDMA I.S.1A-04 and the following:
- a. Thickness: 1 3/4" +/-1/16", (44.45mm +/- 1.58mm).
 - b. Core: Solid. Interior stiles and rails bonded, non-combustible mineral composite construction 25-32 lb/ft³ density, no added urea formaldehyde content. Tops and bottoms factory sealed with an approved sealer to prevent moisture intrusion.
 - c. Crossbanding: mineral composite.
 - d. Replaceable door edges: Fully wrapped and rounded Acrovyn or stainless steel door edges shall be field replaceable if ever damaged by impact, exclusive of external fasteners to improve appearance.

- e. WDMA I.S.1A-04 Performance Duty Level: Extra Heavy Duty
- f. Durability Performance: Cycle Slam WDMA TM-7, 1990 – 1,000,000 cycles to insure durability of entire door construction.

B. Door Faces:

- 1. Finish:
 - a. “Chameleon” wood grain or solid color impact resistant, PVC-free Acrovyn. Refer to Finish Schedule.
- 2. Face material base color must be integral throughout to eliminate discoloration caused by scratching.
- 3. Face Veneer Wear Index - Abrasion Resistance Testing - ASTM D4060-90: 28,000 cycles to prove out resistant to scuffing and scratching.
- 4. Face Veneer Impact Resistance - ASTM D-4226: 86 in/lb. (99.08kg/cm³) to confirm impact resistance of face finish.

C. Door stiles to meet or exceed the following performance testing to ensure hardware fastener holding strength:

- 1. WDMA TM-8 "Hinge Loading Resistance" Extra Heavy Duty
- 2. WDMA TM-10 Screw Holding Capacity" Extra Heavy Duty

D. Door Edges:

- 1. Finish to match door face. Refer to Finish Schedule.
- 2. Edges are covered by our “Edge of a Lifetime” Lifetime Limited Warranty from Construction Specialties Acrovyn Door Systems against damage, and begins 1 month following original installation. Refer to our warranty for full details.
- 3. Edges are to fully wrap the door vertical stiles to eliminate banded edges thus improving durability and impact resistance.
- 4. Replaceable edges to be 3/4” (19.05MM) thick for proper edge and face protection.
- 5. Door edges shall be exclusive of fasteners to improve appearance.
- 6. Edges must be flush with face of door thus eliminating raised edges that could be torn off.
- 7. Edges to include 1/4” (6.35mm) radius edges to improve impact deflection. Square or banded edges should not be permitted.
- 8. Edges are to be extruded (not formed) to ensure correct appearance and proper door fit.
- 9. Edges to be provided as part of the construction of the door from single source manufacturer.

E. Adhesives

- 1. Crossbanding to core adhesives shall be Type II, urea formaldehyde free I to improve structural integrity of door.
- 2. Door faces are to be applied to the crossbanded core using Type I, urea formaldehyde free adhesives to eliminate delamination.

2.03 FABRICATION, GENERAL

- A. Doors shall be prefit and beveled at the factory to fit the openings to reduce handling an onsite labor costs. Prefit tolerances shall be in accordance with the requirements of WDMA I.S.1A-04, latest edition.
- B. For fire rated doors comply with clearance requirements of referenced quality standard for fitting in accordance with requirements listed in NFPA 80.
- C. Coordinate measurements of hardware mortises in metal frames. Contractor or door distributor to verify dimensions and alignment before factory machining.
- D. Factory machine doors for hardware that is not surface applied. Comply with final hardware schedules, door frame shop drawings, and hardware templates.
- E. Light openings must be cut by the manufacturer or by a certified machining distributor.
- F. To ensure proper fit of the doors bevel on both strike and hinge edges to be 1/8" in 2" (3.175mm in 50.8mm)
- G. Top and bottom rails shall be factory sealed with an approved wood sealer to eliminate moisture from entering into core thus eliminating warp.
- H. Blocking: provide blocking approved for use in doors of fire ratings indicated as needed to eliminate through-bolting for surface applied hardware.

2.02 ACCESSORIES

- A. Glazing Stops
 - 1. Non Rated
 - a. Metal vision frames
 - 2. Fire Rated
 - a. Metal vision frames
 - 3. Glass: Refer to Section 088000 for glass types.

PART 3 INSTALLATION

3.01 EXAMINATION

- A. Inspect all doors prior to hanging. Repair noticeable marks or defects that may have occurred from improper storage or handling. Field repairs and touchups are the responsibility of the installing contractor upon completion of the initial installation. Field touchup shall include repair of job inflicted mars and final cleaning of finished doors.

- B. Examine door frames and verify that they comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
- C. Adjust frames to plumb condition before door installation. Tolerances for warp, squareness and pre-fitting dimensions shall be as per latest edition of WDMA I.S.1A-04.
- D. Do not install doors in frame openings that are not plumb or are out of tolerance for size or alignment.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Handle doors in accordance with recommendations of WDMA I.S.1A-04 “Care and Installation at Job Site.”
- B. Condition doors to average temperature and humidity in area of installation for not less than 48 hours prior to installation.
- C. Install doors to comply with manufacturer’s written instructions, referenced quality standard and as indicated.
 - 1. Install fire rated doors in corresponding fire-rated frames according to NFPA-80 and ITS/WH requirements.
- D. Factory fitted doors: Align in frames for uniform clearance at each edge.
- E. Set doors plumb, level, square and true.
- F. In the field trimming:
 - 1. Trim door height by cutting door bottom edges to a maximum of 3/4” (19.05mm) per NFPA 80.
 - 2. Trimming of fire rated doors in width can only be done by the manufacturer or a certified machining distributor under special guidance of the manufacturer.
- G. Drill pilot holes for screws and bolts using templates provided by hardware manufacturer.
- H. Exercise caution when drilling pilot holes and installing hinges so that pilot holes are not over drilled and screws are not over torqued. Follow manufacturer’s installation instructions.
- I. Reseal exposed tops and bottom rails of any doors that required site alteration with an approved wood sealer.
- J. Hardware installation: See Division 8 Section “Door Hardware”.
- K. Clean prefinished doors with a rag in concert with water or household cleaners such as Fantastik[®], Formula 409[®], or equivalent. Following use of the cleaner, the cleaned surface should be “rinse wiped” with clean water and wiped dry to remove any remaining residue.

3.03 ADJUSTING

- A. Operating: Re-hang or replace doors that do not swing or operate freely.
- B. Replace doors that are damaged or do not comply with requirements. Doors may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION

SECTION 084000

ALUMINUM STOREFRONT AND ENTRANCES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Furnishing and installation of complete architectural aluminum storefront and entrance systems as shown on Drawings and specified herein.

1.02 RELATED SECTIONS

- A. Section 079200 - Sealants: System perimeter sealant and back-up materials.
- B. Section 087100 - Door Hardware.
- C. Section 088000 - Glass and Glazing.

1.03 REFERENCES

- A. AAMA - Metal Curtain Wall, Window, Store Front and Entrance - Guide Specifications Manual.
- B. AAMA - Aluminum Curtain Wall Design Guide Manual
- C. AAMA - Curtain Wall Manual #10 - Care and Handling of Architectural Aluminum From Shop to Site.
- D. AAMA Series No. 11 - Design Windloads for Buildings and Boundary Layer Wind Tunnel Testing.
- E. AAMA 501 - Methods of Test for Metal Curtain Walls.
- F. AAMA 603.8 - Performance Requirements and Test Procedures for Pigmented Organic Coatings on Extruded Aluminum.
- G. AAMA 605.2 - Specification for High Performance Organic Coatings on Architectural Extrusions and Panels.
- H. AAMA 606.1 - Specifications and Inspection Methods for Integral Color Anodic Finishes for Architectural Aluminum.
- I. AAMA 607.1 - Specifications and Inspection Methods for Clear Anodic Finishes for Architectural Aluminum.
- J. AAMA 608.1 - Specification and Inspection Methods for Electrolytically Deposited Color Anodic Finishes for Architectural Aluminum.
- K. AAMA SFM-1 - Aluminum Storefront and Entrance Manual.
- L. ANSI A117.1 - Safety Standards for the Handicapped.
- M. ANSI/ASTM A36 - Structural Steel.
- N. ANSI/ASTM A386 - Zinc Coating (Hot Dip) on Assembled Steel Products.

- O. ANSI/ASTM A446 - Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Structural (Physical) Quality.
- P. ANSI/ASTM B209 - Aluminum and Aluminum-Alloy Sheet and Plate.
- Q. ANSI/ASTM B221 - Aluminum-Alloy Extruded Bar, Rod, Wire, Shape, and Tube.
- R. ANSI/ASTM E283 - Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors.
- S. ANSI/ASTM E330 - Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.
- T. ANSI/ASTM E331 - Test Method for Water Penetration of Exterior Windows and Curtain Walls
- U. SSPC - Steel Structures Painting Council.
- V. ASTM E413 - Classifications for Determination of Sound Transmission Class.
- W. AAMA TIR - A1 - Sound Control for Aluminum Curtain Walls and Windows.
- X. AAMA FC-1 - Field Check of Metal Curtain Walls for Water Leakage.

1.04 PERFORMANCE REQUIREMENTS

- A. Design and size components to withstand all wind loads and seismic loads and sway displacement as calculated in accordance with Kentucky Building Code.
- B. System to accommodate, without damage to components or deterioration of seals, movement within system, movement between system and peripheral construction, dynamic loading and release of loads, and deflection of structural support framing.
 - 1. Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load deflection of primary building structure as follows:
 - a. Upward and downward movement of 3/8 inch.
- C. Uniform Load Deflection Test
 - 1. (Type 1) Aluminum Storefront and Entrance Systems:
 - a. Test in accordance with ASTM E 330.
 - b. The system shall withstand dead and live loads caused by positive and negative wind pressure acting normal to plane of wall as calculated in accordance with ASCE-7. Refer to Structural Drawings for wind load data.
 - c. Deflection under code required design loads shall not exceed L/175 of the clear span.

D. Uniform Load Structural Test

1. (Type 1) Aluminum Storefront and Entrance Systems:
 - a. Test in accordance with ASTM 330 at a pressure 1.5 times the design wind pressure in 1.05.B.3.b.
 - b. At conclusion of the test, there shall be no glass breakage, permanent damage to fasteners, storefront parts, or any other damage that would cause the storefront to be defective.

E. Air Infiltration Test:

1. (Type 1) Aluminum Storefront and Entrance Systems (Storefront Components Only):
 - a. Test unit in accordance with ASTM E283 at a static air pressure difference of 6.24 psf.
 - b. Air infiltration shall not exceed 0.06 cfm per square foot of fixed storefront wall area.
2. (Type 1) Aluminum Storefront and Entrance Systems (Entrance Components Only):
 - a. With entrance doors closed and locked, test units in accordance with ASTM E283 at a static air pressure difference of 1.56 psf for entrance/storefront components.
 - b. Air infiltration shall not exceed 1.0 cfm per foot of perimeter crack length for double entrance doors and .06 cfm per square foot of fixed storefront wall area.

F. Water Resistance Test:

1. (Type 1) Aluminum Storefront and Entrance Systems (Storefront Components Only):
 - a. Test unit in accordance with ASTM E331.
 - b. There shall be no uncontrollable water leakage at a static test pressure of 8.0 psf..

G. Condensation Resistance Test (CRF)

1. (Type 1) Aluminum Storefront and Entrance Systems (Storefront Components Only):
 - a. Test unit in accordance with ASTM 1502.7.
 - b. Condensation Resistance Factor (CRF) shall be not less than 56 with clear glass.

H. Thermal Transmittance Test (Conductive U Value)

1. (Type 1) Aluminum Storefront and Entrance Systems (Storefront Components Only):
 - a. Test in accordance with ASTM 1503.1.
 - b. Conductive thermal transmittance (U Value) shall be not more than .59 BTU/HR/degree F/sf.
- I. Maintain continuous air and vapor barrier throughout assembly, primarily in line with inside pane of glass and heel bead of glazing compound.
- J. Entrance and storefront framing systems shall be designed to provide for thermal movement of all component materials caused by a cycling temperature range of 180 degrees F over a 12 hour period without causing buckling, stresses on glass, failure of joint seals, undue stress on structural elements, damaging loads on fasteners, reduction of performance, or other detrimental effects. Operating windows and doors shall function normally over this temperature range.

- K. Drain water entering joints, condensation occurring in glazing channels, or migrating moisture occurring within system, to the exterior by a weep drainage network.
- L. Not permitted: Vibration harmonics, wind whistles, noises caused by thermal movement transmitted to other building elements, loosening, weakening, or fracturing of attachments or components of system.
- M. Seismic Performance: Components of this section shall withstand the effects of earthquake motions determined according to KBC and ASCE 7 – 10 Chapter 13.

1.05 SUBMITTALS

- A. Submit under provisions of Section 013000.
- B. Shop Drawings: Drawings shall show scale elevations and sections. Full size sections shall be shown only when needed for clarity. Drawings shall show construction of all parts of the work, including metal and glass thickness, methods of joining, details of all field connections and anchorage, fastening and sealing methods, metal finishes and all pertinent information. Relationship to other work should be clearly indicated. No work shall be fabricated until shop drawings for that work have been finally approved for fabrication.
- C. Delegated-Design Submittal: Submit seismic-force-restraint drawings drawn to scale and prepared by and bearing the seal of a professional engineer responsible for their preparation licensed in Tennessee. Refer to Specification Section 13081 for additional information.
- D. Contractor shall submit finish samples, test reports, and warranties.
 - 1. Samples of materials as may be requested without cost to Owner, i.e., metal, glass, fasteners, anchors, frame sections, mullion section, corner section, etc.

1.06 QUALITY ASSURANCE

- A. Provide test reports from AAMA accredited laboratories certifying the performance as specified in 1.04.
- B. Test reports shall be accompanied by the storefront manufacturer's letter of certification stating that the tested entrance/storefront systems meet or exceed the referenced criteria for the appropriate entrance/storefront types.

1.07 QUALIFICATIONS

- A. Manufacturer and Installer: Company specializing in manufacturing aluminum glazing and storefront systems with minimum three years documented experience.
- B. Installer for Total System: Company authorized by system manufacturer.
- C. Design structural support framing components under direct supervision of a Professional Engineer experienced in design of this work and licensed in the jurisdiction of the Project.

1.08 PRE-INSTALLATION CONFERENCE

- A. Convene one week prior to commencing Work of this Section, under provisions of Section 010390.

1.09 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, protect and handle products to site under provisions of Section 016000.
- B. Handle work of this section in accordance with AAMA requirements.
- C. Protect pre-finished aluminum surfaces with wrapping. Do not use adhesive papers or sprayed coatings, which bond when exposed to sunlight or weather.

1.10 ENVIRONMENTAL REQUIREMENTS

- A. Do not install sealants when ambient temperature is less than 40 degrees F during and 48 hours after installation.

1.11 WARRANTIES

- A. Total Storefront System:
 - 1. The responsible contractor shall assume full responsibility and warrant for one year the satisfactory performance of the total installation of all systems specified herein. This includes the framing, glass (including insulated units), glazing, anchorage and setting system, sealing, flashing, etc., as it relates to air, water and structural adequacy as called for in the specifications and approved shop drawings.
 - 2. Any deficiencies due to such elements not meeting the specifications shall be corrected by the responsible contractor at his expense during the warranty period.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Reference Standard: Kawneer NA (Norcross, GA).
- B. Tubelite.
- C. U S Aluminum Corp.
- D. YKK-AP.
- E. Oldcastle BE.

2.02 ALUMINUM STOREFRONT AND ENTRANCE SYSTEMS

- A. (Type 1) System 451T Center Glazed Thermal Storefront Series with 190 Narrow Stile Entrance Doors as manufactured by Kawneer with 70% PVDF fluopolymer Ultrapon™ Finish, color to match existing.
 - 1. Materials:
 - a. Aluminum: Extruded aluminum shall be 6063-T5 or T6 alloy and temper.

- b. Glass:
 - (1) Storefront: 1" insulating glass units (Glass Type per Frame Elevations). (Reference Section 088000 for Glass and Glazing.)
 - c. Dissimilar Metals: All dissimilar metals must be properly insulated to prevent galvanic action.
 - d. Fasteners: All exposed fasteners shall be aluminum or stainless steel.
 - e. Thermal Barrier: Barrier material shall be poured-in-place two part polyurethane. A nonstructural thermal barrier is unacceptable.
2. Fabrication:
- a. Storefront Frame:
 - (1) Depth of frame shall be 4 1/2" as indicated on construction drawings.
 - (2) Face dimension shall be 2".
 - (3) Frame components shall be screw spline construction.
 - b. Glazing:
 - (1) Entrance door units shall be dry glazed with extruded pressure fitting aluminum glazing stops and EPDM gasket.
 - (2) Storefront units shall be "dry" glazed with EPDM gasket on both exterior and interior.
 - c. Finish (Organic): Finish all exposed areas of aluminum, including all associated components, with 70% PVDF fluoropolymer Ultrapon™ Finish in accordance with Aluminum Association Designation AA-M12-C42-R1X and AAMA Guide Specification 2605-98. Exterior and interior color shall be the same and shall be as selected from manufacturer's standard color selections.

PART 3 EXECUTION

3.01 EXAMINATION

- A. All openings shall be prepared by others to the proper size and shall be plumb, level and in the proper location and alignment as shown on the Architect's Drawings.

3.02 INSTALLATION

- A. Use only skilled tradesmen with work done in accordance with approved shop drawings and specifications.
- B. Storefront system shall be erected plumb and true, in proper alignment and relation to established lines and grades.
- C. Entrance doors shall be securely anchored in place to a straight, plumb and level condition, without distortion. Weather-stripping contact and hardware movement shall be checked and final adjustments made for proper operation and performance of units.
- D. Furnish and apply sealing materials to provide a weather tight installation at all joints and intersections and at opening perimeters.

- E. Sealing materials specified shall be used in strict accordance with the manufacturer's printed instructions, and shall be applied only by mechanics specially trained or experienced in their use. All surfaces must be clean and free of foreign matter before applying sealing materials. Sealing compounds shall be tooled to fill the joint and provide a smooth finished surface.

3.03 ANCHORAGE

- A. Adequately anchor to maintain positions permanently when subjected to normal thermal movement, specified building movement, and specified wind loads.

3.04 PROTECTION AND CLEANING

- A. The general contractor shall protect the aluminum materials and finish against damage from construction activities and harmful substances. The general contractor shall remove any protective coatings as directed by the architect, and shall clean the aluminum surfaces as recommended for the type of finish applied.

END OF SECTION

SECTION 087100
DOOR HARDWARE

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Section Includes: All door hardware except as otherwise specified or specifically omitted herein.

1.02 RELATED SECTIONS

- A. Section 081113 – Hollow Metal Doors and Frames.
- B. Section 081416 - Flush Wood Doors.

1.03 REFERENCES

- A. ANSI A115.1 - Specification for Standard Steel Door and Frame Preparation for Mortise Locks for 1 3/8" and 1 3/4" Doors.
- B. ANSI A115.2 - Specification for Standard Steel Door and Frame Preparation for Bored or Cylindrical Locks for 1 3/8" and 1 3/4" Doors.
- C. ANSI A117.1 - Specifications for Making Buildings and Facilities Accessible to and Usable by Physically Handicapped People.
- D. ANSI/BHMA A156.2 - Bored and Pre-Assembled Locks and Latches.
- E. ANSI/BHMA A156.13 - Mortise Locks and Latches.
- F. ANSI/BHMA A156.18 - Materials and Finishes.
- G. NFPA 80 - Fire Doors and Windows.
- H. NFPA 70 - National Electric Code.
- I. NFPA 101 - Life Safety Code.
- J. NFPA 252 - Fire Tests of Door Assemblies.
- K. UL 10C - Fire Tests of Door Assemblies.
- L. UL 305 - Panic Hardware.
- M. UL 437 - Standard for Safety (High Security Key Locks).
- N. AWI - Architectural Woodwork Institute - Quality Standards.
- O. Americans with Disabilities Act (ADA) - Accessibility Guidelines for Buildings and Facilities.

1.04 SUBMITTALS

- A. Submit under provisions of Section 013000.
- B. Special Submittal Requirements: Combine submittals of this Section with Sections listed below to ensure the "design intent" of the system/assembly is understood and can be reviewed together.
- C. Product Data: Manufacturer's specifications and technical data including the following:
 - 1. Detailed specification of construction and fabrication.
 - 2. Manufacturer's installation instructions.
 - 3. Wiring diagrams for each electric product specified. Coordinate voltage with electrical before submitting.
 - 4. Submit six copies of catalog cuts with hardware schedule.
- D. Shop Drawings - Hardware Schedule: Submit six complete reproducible copy of detailed hardware schedule in a vertical format.
 - 1. List groups and suffixes in proper sequence.
 - 2. Completely describe door and list architectural door number.
 - 3. Manufacturer, product name, and catalog number.
 - 4. Function, type, and style.
 - 5. Size and finish of each item.
 - 6. Mounting heights.
 - 7. Explanation of abbreviations and symbols used within schedule.
 - 8. Detailed wiring diagrams, specially developed for each opening, indicating all electric hardware, security equipment and access control equipment, and door and frame rough-ins required for specific opening.
- E. Templates: Submit templates and "reviewed Hardware Schedule" to door and frame supplier and others as applicable to enable proper and accurate sizing and locations of cutouts and reinforcing.
 - 1. Templates, wiring diagrams and "reviewed Hardware Schedule" of electrical terms to electrical for coordination and verification of voltages and locations.
- F. Samples:
 - 1. One sample of Lever and Rose/Escutcheon design, (pair).
 - 2. Three samples of metal finishes.
- G. Contract Closeout Submittals: Comply with Section 017000, including all specific requirements indicated.
 - 1. Operating and Maintenance Manuals: Submit three sets containing the following:
 - a. Complete information in care, maintenance, and adjustment, and data on repair and replacement parts, and information on preservation of finishes.
 - b. Catalog pages for each product.
 - c. Name, address, and phone number of local representative for each manufacturer.
 - d. Parts list for each product.
 - 2. Copy of final "Hardware Schedule", edited to reflect "As Installed".
 - 3. Copy of final "Keying Schedule".

4. As installed “Wiring Diagrams” for each piece of hardware connected to power, both low voltage and 110 volts.
5. One set of special tools required for maintenance and adjustment of hardware, including changing of cylinders.

1.05 OPERATION AND MAINTENANCE DATA

- A. Submit under provisions of Section 017000.
- B. Maintenance Data: Include data on operating hardware, lubrication requirements, and inspection procedures related to preventative maintenance.

1.06 QUALITY ASSURANCE

- A. Comply with Section 014000.
 1. Statement of qualification for distributor and installers.
 2. Statement of compliance with regulatory requirements and single source responsibility.
 3. Distributor's Qualifications: Firm with 3 years experience in the distribution of commercial hardware.
 - a. Distributor to employ full time Architectural Hardware Consultants (AHC) for the purpose of scheduling and coordinating hardware and establishing keying schedule.
 - b. Hardware Schedule shall be prepared and signed by an AHC.
 4. Installer's Qualifications: Firm with 3 years experienced in installation of similar hardware to that required for this Project, including specific requirements indicated.
 5. Regulatory Label Requirements: Provide testing agency label or stamp on hardware for labeled openings.
 - a. Provide UL listed hardware for labeled and 20 minute openings in conformance with requirements for class of opening scheduled.
 - b. Underwriters Laboratories requirements have precedence over this specification where conflict exists.
 6. Single Source Responsibility: Except where specified in hardware schedule, furnish products of only one manufacturer for each type of hardware.
- B. Review Project for extent of finish hardware required to complete the Work. Where there is a conflict between these Specifications and the existing hardware, notify the Architect in writing and furnish hardware in compliance with the Specification unless otherwise directed in writing by the Architect.
- C. Exit Doors: Openable at all times from the inside without the use of a key or any special knowledge or effort unless specifically noted otherwise.
- D. Fire-Rated Openings: Provide hardware for fire-rated openings in compliance with NFPA 80. This requirement takes precedence over other requirements for such hardware. Provide only such hardware which has been tested and listed by UL for the type and size of door required, and complies with the requirements of the door and the door frame labels. Latching hardware, door closers, ball bearing hinges, and seals are required whether or not listed in the Hardware schedule.
 1. Where panic exit devices are required on fire-rated doors, provide supplementary marking on door UL label on exit device indicating "Fire Exit Hardware".

1.07 REGULATORY REQUIREMENTS

- A. Conform to applicable State Building Code, NFPA 80, and NFPA 101 for requirements applicable to fire rated doors and frames.
- B. Products Requiring Electrical Connection: Listed and classified by Underwriters' Laboratories, Inc., as suitable for the purpose specified and indicated.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Acceptance at the Site: Individually package each unit of finish hardware complete with proper fastening and appurtenances, clearly marked on the outside to indicate contents and specific locations in the Work.
- B. Deliver packaged hardware items at the times and to the locations (shop or field) for installation, as directed by the Contractor.

1.09 COORDINATION

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

1.10 WARRANTY

- A. Provide written guarantee from hardware supplier as follows:
 - 1. Non-electronic Closers: Ten years.
 - 2. Electronic Closers: Two years.
 - 3. Exit Devices and Locksets: Three years
 - 4. All other Hardware: Two years.

1.11 OWNER'S INSTRUCTION

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

1.12 MAINTENANCE

- A. Extra Materials: Deliver to Owner extra materials from same production run as products installed. Package products with protective covering and identify with descriptive labels.
 - 1. Where interchangeable cores are specified, provide ten extra interchangeable cores for each masterkeyed group.
 - 2. Special Tools: Provide special wrenches and tools applicable to each different or special hardware component.
 - 3. Maintenance Tools: Provide maintenance tools and accessories supplied by hardware component manufacturer.

4. Delivery, Storage and Protection: Comply with Owner’s requirements for delivery, storage and protection of extra materials.

B. Maintenance Service: Submit for Owner’s consideration maintenance service agreement for electronic products installed.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Approval of manufacturers other than those listed subject to compliance with the provisions of Section 016000.

<u>Item</u>	<u>Specified Manufacturer</u>	<u>Approved Equal</u>	<u>Approved Equal</u>
Hinges	Stanley	McKinney	Hager
Continuous Hinges	Stanley	Pemko	Hager
Locksets - Lever	Schlage	Sargent	Best
Locksets - Anti-Ligature	TownSteel	Schlage	-
Cylinders	<i>Reference 3.05 - Schedule of Finish Hardware - General Notes</i>		
Closers	LCN	Corbin Russwin	Norton
Pushes/Pulls	Hager	Rockwood	Trimco
Kick/Armor Plates/Guards	Hager	Rockwood	Trimco
Stops	Hager	Rockwood	Trimco
Detention Stops	Stanley	Hager	Trimco
Seals/Sweeps	Zero	NGP	Trimco
Thresholds	Zero	NGP	Trimco

B. Furnish all items of hardware required to complete the work in accordance with specifications and plans.

C. Carefully inspect Project for the extent of the finish hardware required to complete the Work. Where there is a conflict between these Specifications and the existing hardware furnish finish hardware to specification.

2.02 MATERIALS

A. Hinges:

1. Template screw hole locations.
2. Minimum of 2 permanently lubricated non-detachable bearings.
3. Equip with easily seated, non-rising pins.
4. Sufficient size to allow 180-degree swing of door.
5. Furnish hinges with five knuckles and flush bearings.
6. Provide hinge type as listed in schedule.
7. Furnish 3 hinges per leaf to 7 foot 6 inch height. Add one for each additional 30 inches in height or fraction thereof.
8. Tested and approved by BHMA for all applicable ANSI Standards for type, size, function and finish.
9. UL10C listed for fire door applications.
10. Provide hospital tips were indicated.

B. Geared Continuous Hinges:

1. Tested and approved by BHMA for ANSI A156.26-1996 Grade 1.
2. Anti-spinning through fastener.
3. UL10C listed for fire door applications.
4. Non-handed.
5. Lifetime warranty.
6. Provide Fire Pins for fire door applications.
7. Sufficient size to permit door to swing 180 degrees.
8. Provide hospital tips where indicated.

C. Cylindrical Type Locks and Latchsets:

1. Provide cylindrical locksets that comply with ANSI A156.2, Series 4000, Operational Grade 1, Security Grade 1.
2. Provide cylindrical locksets that comply with UL10C and UBC 7-2 positive pressure requirements.
3. Locksets and cores to be of the same manufacturer to maintain complete lockset warranty.
4. Locksets to have anti-rotational studs that are thru-bolted.
5. Keyed lever shall not have exposed "keeper" hole.
6. Each lever to have independent spring mechanism controlling it.
7. Locksets to have 2-3/4 inch backset.
8. Locksets to have 9/16 inch throw latchbolt.
9. Outside lever sleeve to be seamless, of one-piece construction made of a hardened steel alloy.
10. Keyed lever to be removable only after core is removed, by authorized control key.
11. Provide locksets with removable and interchangeable core cylinders.
12. Hub, side plate, shrouded rose locking pin to be a one-piece casting with a shrouded locking lug.
13. Locksets outside locked lever must withstand a minimum 1400 inch pounds of torque. In excess of that, a replaceable part will shear. Key from outside and inside lever will still operate lockset.
14. Core face must be the same finish as the lockset.
15. Functions and design as indicated in Schedule of Finish Hardware.

D. Mortise Locks:

1. Provide mortise locksets that comply with ANSI A156.13, Series 1000, Operational Grade 1, Security Grade 1.
2. Provide mortise locksets that comply with UL10C and UBC 7-2 positive pressure requirements.
3. Provide mortise locksets that comply with ANSI/ASTM F476-76 Grade 50, UL Listed for locksets utilizing concealed cylinders.
4. Manufacture lock cases from fully wrapped, heavy 12-gauge steel. Exposed edge case configurations are not acceptable.
5. Lock cases to have screw layouts of staggered configuration. Parallel screw layouts are not acceptable.
6. Lock cases to be multi-functional that transform into different functions without opening the lock case.
7. Lock components to be manufactured of zinc dichromate-plated steel. Use of plastic parts, spacers, and/or bushings is not acceptable.
8. Lock components to incorporate a spring-loaded fusible link for fire/life safety. Gravity fusible links are acceptable.
9. Latchbolts to have a standard 2 3/4" backset with a full 3/4" throw.
10. Latchbolts to be non-handed, field reversible without opening the lock case.
11. Latchbolts to be two-piece, anti-friction, manufactured from stainless steel. Solid latchbolts and/or plastic anti-friction devices are not acceptable.

12. Deadbolts to be 1 3/4" total length; have standard 1" throw with a minimum 3/4" internal engagement when fully extended.
13. Deadbolts to be constructed of stainless steel, incorporating a security roller pin with a minimum Rc60 rating for surface hardness.
14. Lever Assemblies: Lever assembly (external) to be one-piece design attached by threaded bushing. Lever assembly (internal) shall be attached by screwless shank. Lever attachment by common tools (allen nuts and/or set screws) is not acceptable. Levers to have independent rotation in both directions. Lever operation to be free-wheeling (clutch) when in locked mode. Spring cages are to be incorporated into lever assemblies. Hub blocking plate to be solid, cast stainless steel. manufacturer's utilizing open hub designs are not acceptable. Spindles to be independent, designed to "break-away" at a maximum of 75 psi torque.
15. Through-bolt lever assemblies through the door for positive interlock. Use of through-the-door spindle for attachment is not acceptable.
16. Strikes to be non-handed and bridged to ensure deadlatching. Use of fillers of any kind for deadlatch engagement is not acceptable.
17. Mounting tabs are to be automatic self-adjusting, vertically and horizontally, for door bevel and strike alignment.
18. Cylinders to be secured by a cast stainless steel dual retainer. Use of screws and/or stamped retainers is not acceptable.
19. Thumbturn and back-plate to be manufactured from castings compliant with ANSI 117 accessibility standard.
20. Use of an exposed toggle on edge of door as "locked indicator" is not acceptable.

E. Door Closers:

1. Tested and approved by BHMA for ANSI 156.4, Grade 1.
2. UL10C certified.
3. Closer shall have extra-duty arms and knuckles.
4. Conform to ANSI 117.1.
5. Maximum 2 7/16 inch case projection.
6. Separate adjusting valves for closing and latching speed, and backcheck.
7. Provide adapter plates, shim spacers and blade stop spacers as required by frame and door conditions.
8. Full rack and pinion type closer with 1½" minimum bore.
9. Mount closers on non-public side of door, unless otherwise noted in specification.
10. Closers shall be non-handed, non-sized and multi-sized 1 through 6.
11. Provide closers without hold-open capability at all smoke/fire resistance rated doors.

F. Kickplates: Provide with four beveled edges, 16 inches high by width less 2 inches on single doors and 1 inch on pairs of doors. Furnish tamper-resistant, countersunk screws to match finish.

G. Armor Plates: Provide with four beveled edges, 32 inches high by width as required for consistent and exact 1/8 inch gap between armor plate and door edging. Furnish tamper-resistant, countersunk screws to match finish.

H. Door Edging: Non-mortise, non-overlap, beveled edge, 32 inches high. Furnish tamper-resistant, countersunk screws to match finish.

I. Silencers: Furnish silencers on all interior frames, 3 for single doors, 2 for pairs. Omit where any type of seals occur.

2.03 FINISH

- A. Generally to be BHMA 626 Satin Chrome. (Protection plates, guards, pushes and pulls shall be BHMA 630).
- B. Designations used in Schedule of Finish Hardware and elsewhere to indicate hardware finishes are those listed in ANSI/BHMA A156.18 including coordination with traditional U.S. finishes shown by certain manufacturers for their products
- C. Powder coat door closers to match other hardware, unless otherwise noted.
- D. Aluminum items shall be finished to match predominant adjacent material. Seals to coordinate with frame color.

2.04 KEYS AND KEYING:

- A. Provide keyed construction cores and keys during the construction period. Construction control and operating keys and core shall not be part of the Owner's permanent keying system or furnished in the same keyway (or key section) as the Owner's permanent keying system. Permanent cores and keys (prepared according to the accepted keying schedule) will be furnished to the Owner.
- B. Cylinders: Reference 3.05 - Schedule of Finish Hardware - General Notes.
- C. Permanent keys and cores: Stamped with the applicable key mark for identification. These visual key control marks or codes will not include the actual key cuts. Permanent keys will also be stamped "Do Not Duplicate."
- D. Transmit Grand Masterkeys, Masterkeys and other Security keys to Owner by Registered Mail, return receipt requested.
- E. Furnish keys in the following quantities:
 - 1. 2 each Grand Masterkeys.
 - 2. 4 each Masterkeys.
 - 3. 2 each Change Keys each keyed core.
 - 4. 15 each Construction Masterkeys.
 - 5. 1 each Control Keys.
- F. The Owner, or the Owner's agent, will install permanent cores and return the construction cores to the Hardware Supplier. Construction cores and keys remain the property of the Hardware Supplier.
- G. Keying Schedule: Arrange for a keying meeting, and programming meeting with Architect, Owner and hardware supplier, and other involved parties to ensure locksets and locking hardware, are functionally correct and keying and programming complies with Project requirements. Furnish 3 typed copies of keying and programming schedule to Architect.

PART 3 EXECUTION

3.01 EXAMINATION

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

3.02 HARDWARE LOCATIONS

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

3.03 INSTALLATION

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

3.04 FIELD QUALITY CONTROL AND FINAL ADJUSTMENT

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

3. Report findings, in writing, outlining corrective actions and recommendations.

3.05 SCHEDULE OF FINISH HARDWARE

A. Legend of Listed Manufacturers:

1. DO Dorma Architectural Hardware (Reamstown, PA).
2. HA Hager Companies (St. Louis, MO).
3. KA KABA Ilco Corp. (Winston Salem, NC).
4. LC LCN Closers (Princeton, IL).
5. RW Rockwood Manufacturing Company (Rockwood, PA).
6. SA Sargent Manufacturing Co. (New Haven, CT).
7. SC Schlage Lock Co., Division of IR Safety and Security (Colorado Springs, CO).
8. ST Stanley Door Systems (Chatsworth, CA).
9. SE Securitron Magnalock Corp. (Sparks, NV).
10. TS TownSteel, Inc. (Covina, CA).
11. ZE Zero International, Inc. (Bronx, NY).

- B. The items listed in the following "Schedule of Finish Hardware" shall conform throughout to the requirements of the foregoing specification.
- C. Reference Opening Schedule on the Construction Drawings for additional information pertaining to individual door openings.

General Notes
Provide Sargent LA 6-pin interchangeable core for all locksets. Coordinate with Owner's Door Vendor and specified locksets to ensure compatibility.
Provide UL Listed assemblies at all rated openings (reference Opening Schedule and Construction Drawings for delineation of rated openings).
Provide tamper resistant screws at all hinges, continuous hinges, armor plates, wall/floor stops, and any other accessible fastener location within all Patient Care Areas and any other area accessible to Patients. Reference Patient Safety Plans for locations where tamper-resistant fasteners are required.
Provide consistent and exact 1/8" gap between all armor plates and door edging.
Provide UL listed overlapping metal astragals at all smoke and fire double egress doors.
Provide UL listed overlapping metal astragals and coordinator at all smoke and fire double doors.
Provide blocking at all door wall stops per the provisions of Specification Section 061000 - Rough Carpentry.
Coordinate installation of all Owner and Contractor Furnished electronic devices and provide all wiring, components, etc. as required for a complete and functioning installation.
Contractor may combine power supplies for electronic devices where permitted by requirements of power supply and electronic device manufacturers.
Power for all electronic security and locking devices shall be fed from emergency circuits - coordinate with Electrical Scope of Work.
Provide tactile handicapped warning for latchsets/locksets at all locations required by all applicable Codes.

Hardware Set - 01						
Doors						
101	102	103	104			
Quantity	Description			Comments		
1	Continuous Hinge					
1	Classroom Lockset - Anti-Ligature					
1	Closer			Closer - Concealed Overhead Track		
1	Wall Bumper - Detention					

Hardware Set - 02						
Doors						
109-2	109-3	109-4	109-5			
Quantity	Description			Comments		
1	Continuous Hinge					
1	Storeroom Lockset - Anti-Ligature					
1	Closer			Room Side		
1	Wall Bumper - Detention					

Hardware Set - 03						
Doors						
109-1						
Quantity	Description			Comments		
1	Continuous Hinge					
1	Exit Panic Device - Rim					
1	Closer			Closer - Concealed Overhead Track		
1	Wall Bumper - Detention					
1	Electromagnetic Lock - 1800 lbs					
2	Card Reader			CFCI		
1	Keyswitch - Alternate Position					
1	Power Supply					
Description of Operation - Electronic Door Hardware						
Type	Single Swing Access Controlled Exit Access Door - positive latching required.					
Activation (Both Sides)	Card Reader (CFCI) mounted at 48" AFF in wall 8" horizontally from door frame strike side. Card Readers momentarily de-energize electromagnetic lock allowing door to be opened via panic device/latchset.					
Alternate Position Keyswitch	Alternate position keyswitch alternatively toggles electromagnetic lock on/off. Alternate position keyswitch to be mounted at 72" AFF directly above Card Reader on corridor side of door.					
Fire Alarm	Fire alarm to deactivate electromagnetic lock(s).					
Remarks						
Provide timer as required for Owner adjustment of electromechanical lock de-energizing time.						
Electromechanical maglock shall be mounted in standard configuration at door head - to be controlled by Card Reader. Provide in-wall blocking and all required angle shims at locations of wall-mounted electromechanical maglocks to ensure proper alignment of locks. Coordinate exact mounting configuration of wall-mounted electromechanical maglocks with Architect prior to installation.						
Provide all required "Stop Filler Plate" assemblies as required for mounting of electromechanical maglock from push sides of doors. All wiring shall be concealed in door frame and/or wall construction - exposed (surface-mount) conduit is not acceptable.						
Contractor shall provide complete interface of C.F.C.I electromagnetic maglock / power supply assemblies with C.F.C.I Keyswitch, and C.F.C.I. fire alarm systems, and shall provide all required junction box and conduit required for installation of all equipment/systems.						
Key Switch Cylinder and Core shall be provided by the Contractor via Owner's Keying Vendor.						

Hardware Set - 04						
Doors						
109-6						
Quantity	Description			Comments		
1	Continuous Hinge					
1	Exit Panic Device - Rim					
1	Closer			Closer - Concealed Overhead Track		
1	Electromagnetic Lock - 1800 lbs					
2	Keyswitch - Momentary					
1	Keyswitch - Alternate Position					
1	Power Supply					
1	Threshold					
1	Weatherstripping					
1	Auto Door Bottom					
Description of Operation - Electronic Door Hardware						
Type	Single Swing Access Controlled Exit Access Door - positive latching required.					
Activation (Both Sides)	Momentary keyswitches mounted at 48" AFF momentarily deactivate electromagnetic lock allowing door to be opened.					
Alternate Position Keyswitch	Alternate position keyswitch alternatively toggles electromagnetic lock on/off. Alternate position keyswitch to be mounted at 72" AFF directly above momentary keyswitch on Gym side of door.					
Fire Alarm	Fire alarm to deactivate electromagnetic lock(s).					
Remarks						
Provide timer as required for Owner adjustment of electromechanical lock de-energizing time.						
Electromechanical maglocks shall be mounted in standard configuration at door head - to be controlled by momentary keyswitch. Provide in-wall blocking and all required angle shims at locations of wall-mounted electromechanical maglocks to ensure proper alignment of locks. Coordinate exact mounting configuration of wall-mounted electromechanical maglocks with Architect prior to installation.						
Provide all required "Stop Filler Plate" assemblies as required for mounting of electromechanical maglock from push sides of doors. All wiring shall be concealed in door frame and/or wall construction - exposed (surface-mount) conduit is not acceptable.						
Contractor shall provide complete interface of C.F.C.I electromagnetic maglock / power supply assemblies with C.F.C.I Keyswitch, and C.F.C.I. fire alarm systems, and shall provide all required junction box and conduit required for installation of all equipment/systems.						
Key Switch Cylinder and Core shall be provided by the Contractor via Owner's Keying Vendor.						

Hardware Set - 05						
Doors						
109-7						
Quantity	Description			Comments		
1	Continuous Hinge					
1	Classroom Lockset - Anti-Ligature					
1	Closer			Closer - Concealed Overhead Track		
1	Threshold					
1	Weatherstripping					
1	Auto Door Bottom					

END OF SECTION

SECTION 088000

GLAZING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Glass and glazing for other Sections referencing this Section for products and installation.
- B. Glass and glazing for hollow metal work.

1.02 RELATED SECTIONS

- A. Section 079200 - Joint Sealants: Sealant and back-up material.
- B. Section 081113 - Hollow Metal Doors and Frames.
- C. Section 081423 – Impact Resistant Wood Doors.

1.03 REFERENCES

- A. ANSI/ASTM E330 - Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.
- B. ANSI Z97.1 - Safety Performance Specifications and Methods of Test for Safety Glazing Used in Buildings.
- C. ASTM C1036 - Flat Glass.
- D. ASTM C1048 - Heat-Treated Flat Glass - Kind HS, Kind FT Coated and Uncoated Glass.
- E. ASTM C1172 - Standard Specification for Laminated Architectural Float Glass.
- F. ASTM E546 - Test Method For Frost Point of Sealed Insulating Glass Units.
- G. ASTM E576 - Test Method For Dew/Frost Point of Sealed Insulating Glass Units in Vertical Position.
- H. ASTM E773 - Test Method for Seal Durability of Sealed Insulating Glass Units.
- I. ASTM E774 - Sealed Insulating Glass Units.
- J. FGMA - Glazing Manual.
- K. FGMA - Sealant Manual.
- L. FS TT-C-00598 - Calking Compound, Oil and Resin Base Type.
- M. FS TT-S-001657 - Sealing Compound, Single Component, Butyl Rubber Based, Solvent Release Type.
- N. FS TT-S-00227 - Sealing Compound, Rubber Base, Two Component.
- O. FS TT-S-00230 - Sealing Compounds, Synthetic-Rubber Base, Single Component, Chemically Curing.

- P. FS TT-S-01543 - Sealing Compound, Silicone Rubber Base.
- Q. FS TT-G-410 - Glazing Compound, Sash (Metal) for Back Bedding and Face Glazing (Not for Channel or Stop Glazing).
- R. Laminators Safety Glass Association - Standards Manual.
- S. SIGMA - Sealed Insulated Glass Manufacturers Association.

1.04 SUBMITTALS

- A. Submit under provisions of Section 013000.
- B. Product Data on Glass Types Specified:
 - 1. Provide structural, physical and environmental characteristics, size limitations, special handling or installation requirements.
- C. Product Data on Glazing Accessories: Provide chemical, functional, and environmental characteristics, limitations, special application requirements. Identify available colors.
- D. Samples: Submit two samples, 12x12 inch in size, illustrating each glass unit, coloration and design.
- E. Samples: Submit one 12 inch long bead of glazing sealant, color as selected.
- F. Manufacturer's Installation Instructions: Indicate special precautions required.
- G. Manufacturer's Certificate: Certify that glass meets or exceeds specified requirements.

1.05 QUALITY ASSURANCE

- A. Perform Work in accordance with FGMA Glazing Manual, FGMA Sealant Manual, SIGMA and Laminators Safety Glass Association - Standards Manual for glazing installation methods.
- B. Maintain one copy of each document on site.

1.06 PRE-INSTALLATION CONFERENCE

- A. Convene one week prior to commencing Work of this Section, under provisions of Section 010390.

1.07 ENVIRONMENTAL REQUIREMENTS

- A. Do not install glazing when ambient temperature is less than 50 degrees F.
- B. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

1.08 FIELD MEASUREMENTS

- A. Verify that field measurements are as indicated on Shop Drawings.

1.09 COORDINATION

- A. Coordinate Work under provisions of Section 010390.
- B. Coordinate the Work with glazing frames, wall openings, and perimeter air and vapor seal to adjacent Work.

1.10 WARRANTY

- A. Provide ten year manufacturer's warranty for all materials specified herein under provisions of Section 017000.
- B. Warranty: Include coverage for delamination of laminated glass and replacement of same.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Clear Glass, Tinted Glass for Single Pane and Insulating Unit Applications:
 - 1. PPG Industries, Inc. (Pittsburgh, PA).
 - 2. Interpane Glass Co. (Clinton, NC).
 - 3. Pilkington North America, Inc. (Toledo, OH).
 - 4. Viracon (Owatonna, MN).
- B. Fire Rated Glass: Technical Glass Products (Kirkland, WA).
- C. Decorative Glass: Technical Glass Products (Kirkland, WA).
- D. Substitutions: Under provisions of Section 016000.
- E. Acceptable Manufacturers/Fabricators (General Note): Obtain materials from only one manufacturer and one fabricator for each aforementioned category (A/B).

2.02 GLASS/GLAZING

- A. (Type G-1) Clear – Laminated
 - 1. Overall Unit Thickness: 7/16"
 - 2. Description: 3/16" Clear tempered, 0.060 Saflex PVB, 3/16" Clear Tempered.
- B. (Type G-2) Vision – Fire Rated
 - 1. Lite Thickness: 5/16"
 - 2. Description: TGP Firelite Plus, laminated glass ceramic fire rated up to 3 hours with hose stream tests, meets ANSI 297.1 and CPSC 16CFR1201 (Cat. I and II).

C. (Type G-3) Vision - Exterior

1" INSULATING PPG CLEAR SOLARBAN 70 XL (#2)

1. Overall Unit Thickness: 1".
2. Lite Thickness: As Noted
3. Airspace: 3/8" (Pending thickness of Indoor Lites).
4. Sealing System: Dual Seal Silicone.
5. Warranty: 10 Year Insulated, 5 Year Laminated
6. Outdoor Lite: 1/4" PPG Clear Solarban 70 XL (#2) Surface, Tempered
7. Indoor Lite: 7/16" Clear Laminated (3/16" clear tempered, 0.060 Saflex PVB, 3/16" Clear Tempered).
8. Performance Values:

Visible Light Transmission:	63%
U-Value Winter:	0.28 Btu/hr-ft ² /F
U-Value Summer:	0.26 Btu/hr-ft ² /F
SHGC:	0.28
Shading Coefficient:	0.32
Outdoor Visible Light Reflectance:	12%
9. Provide units meeting the aforementioned Performance Values which comply with all requirements of Section 2406 - Safety Glazing of the Florida Building Code at all locations indicated in the Drawings or required by the FBC.

2.03 GLAZING ACCESSORIES

- A. Setting Blocks: Neoprene 80 - 90 Shore A durometer hardness, length of 0.1 inch for each square foot of glazing or minimum 4 inch x width of glazing rabbet space minus 1/16 inch x height to suit glazing method and pane weight and area.
- B. Spacer Shims: Neoprene, 50 - 60 Shore A durometer hardness, minimum 3 inch long x one half the height of the glazing stop x thickness to suit application.
- C. Glazing Tape: Preformed butyl compound with integral resilient tube spacing device; 10 - 15 Shore A durometer hardness; coiled on release paper; gray color.
- D. Glazing Gaskets: Resilient polyvinyl chloride extruded shape to suit glazing channel retaining slot; color as selected.
- E. Glazing Clips: Manufacturer's standard type.

2.04 SOURCE QUALITY CONTROL AND TESTS

- A. Provide testing of glass under provisions of Section 014000.
- B. Provide shop inspection and testing for glass.
- C. Test samples in accordance with ANSI Z97.1.
- D. Provide identification on each pane of safety (tempered) glazing consisting of a clearly visible label specifying the labeler, the manufacturer or installer, and the safety glazing standard with which it complies. The label shall be acid etched, sand blasted, ceramic fired, or an embossed mark, or shall be of a type that once applied cannot be removed without being destroyed.

PART 3 EXECUTION

3.01 INSTALLERS

- A. As approved by Architect.

3.02 EXAMINATION

- A. Verify prepared openings under provisions of Section 010390.
- B. Verify that openings for glazing are correctly sized and within tolerance.
- C. Verify that surfaces of glazing channels or recesses are clean, free of obstructions, and ready to receive glazing.

3.03 PREPARATION

- A. Clean contact surfaces with solvent and wipe dry.
- B. Seal porous glazing channels or recesses with substrate compatible primer or sealer.
- C. Prime surfaces scheduled to receive sealant.

3.04 INTERIOR - DRY METHOD (TAPE AND TAPE)

- A. Cut glazing tape to length and set against permanent stops, projecting 1/16 inch above sight line.
- B. Place setting blocks at 1/4 points with edge block no more than 6 inches from corners.
- C. Rest glazing on setting blocks and push against tape for full contact at perimeter of pane or unit.
- D. Place glazing tape on free perimeter of glazing in same manner described above.
- E. Install removable stop without displacement of tape. Exert pressure on tape for full continuous contact.
- F. Knife trim protruding tape.

3.05 QUALITY CONTROL

- A. Field inspection will be performed under provisions of Section 014000.
- B. Inspection shall monitor quality of glazing and installation.

3.06 MANUFACTURER'S FIELD SERVICES

- A. Glass and glazing product manufacturers to provide field surveillance of the installation of their products under provisions of Section 014000.
- B. Monitor and report installation procedures, unacceptable conditions.

3.07 CLEANING

- A. Clean Work under provisions of Section 017000.
- B. Remove glazing materials from finish surfaces.
- C. Remove labels after Work is complete.
- D. Clean glass and mirrors.

3.08 PROTECTION OF FINISHED WORK

- A. Protect finished Work under provisions of Section 016000.
- B. After installation, mark pane with an “X” by using removable plastic tape or paste. Do not mark heat absorbing or reflective glass units.

3.09 SCHEDULE

- A. Reference Opening Schedule and Frame Elevations for glass types.

END OF SECTION

SECTION 092116

GYPSUM BOARD SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Interior steel framing members to receive gypsum board, including components for walls and partitions, and for suspended and furred gypsum board ceilings.
- B. Gypsum board materials.
- C. Taped and sanded joint treatment.

1.02 RELATED SECTIONS

- A. Section 061000 - Rough Carpentry.
- B. Section 072100 - Building Insulation.
- C. Section 081113 - Hollow Metal Doors and Frames.
- D. Section 099123 – Painting.

1.03 REFERENCES

- A. ASTM C36 - Gypsum Wallboard.
- B. ASTM C79 - Gypsum Sheathing Board.
- C. ASTM C442 - Gypsum Backing Board and Core Board.
- D. ASTM C475 - Joint Treatment Materials for Gypsum Wallboard Construction.
- E. ASTM C514 - Nails for the Application of Gypsum Wallboard.
- F. ASTM C557 - Adhesive for Fastening Gypsum Wallboard to Wood Framing.
- G. ASTM C630 - Water Resistant Gypsum Backing Board.
- H. ASTM C645 - Non-Load (Axial) Bearing Steel Studs, Runners (Track), and Rigid Furring Channels for Screw Application of Gypsum Board.
- I. ASTM C665 - Mineral Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
- J. ASTM C754 - Installation of Framing Members to Receive Screw Attached Gypsum Wallboard, Backing Board, or Water Resistant Backing Board.
- K. ASTM C840 - Application and Finishing of Gypsum Board.
- L. ASTM C931 - Exterior Gypsum Soffit Board.

- M. ASTM C1002 - Steel Drill Screws for the Application of Gypsum Board.
- N. ASTM E90 - Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions.
- O. ASTM E119 - Fire Tests of Building Construction and Materials.
- P. GA-201 - Gypsum Board for Walls and Ceilings.
- Q. GA-216 - Recommended Specifications for the Application and Finishing of Gypsum Board.
- R. GA-600 - Fire Resistance Design Manual.

1.04 SUBMITTALS

- A. Submit under provisions of Section 013000.
- B. Shop Drawings: Indicate special details associated with fireproofing, acoustical seals.
- C. Product Data: Provide data on metal framing, gypsum board, joint tape, and trim accessories.
- D. Samples: Submit two samples of gypsum board, 12x12 inches in size illustrating finish color and texture.

1.05 QUALITY ASSURANCE

- A. Perform Work in accordance with ASTM C840, GA-201, GA-216 and GA-600.
- B. Maintain one copy of each document on site.

1.06 QUALIFICATIONS

- A. Applicator: Company specializing in performing the Work of this Section with minimum 10 years documented experience.

1.07 REGULATORY REQUIREMENTS

- A. Conform to applicable codes and referenced standards for fire rated assemblies as follows:
 - 1. Fire Rated Partitions: Listed assembly by UL.
 - 2. Fire Rated Ceiling and Soffits: Listed assembly by UL.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. USG Corporation (Chicago, IL).
- B. Georgia Pacific Corporation (Atlanta, GA).
- C. National Gypsum Company (Charlotte, NC).
- D. Substitutions: Under provisions of Section 016000.

2.02 INTERIOR FRAMING MATERIALS

- A. Studs and Tracks: ASTM C645; GA-216 and GA-600; galvanized sheet steel, C shape, with knurled faces, of gauges listed below:
 - 1. Interior, non-load-bearing, full-height: 20 gauge, maximum permissible length.
 - 2. Interior, non-load-bearing, non-full-height: 22 gauge, 12' length typical.
- B. Furring, Framing and Accessories: ASTM C645, GA-216 and GA-600.
- C. Fasteners: ASTM C514, ASTM C1002, GA-216.
- D. Anchorage to Substrate: Tie wire, screws and other metal supports, of type and size to suit application; to rigidly secure materials in place.
- E. Adhesive: ASTM C557, GA-216.

2.03 STEEL FRAMING COMPONENTS FOR SUSPENDED AND FURRED CEILINGS

- A. General: Provide components complying with ASTM C 754 for conditions indicated.
- B. Seismic Restraint Requirements: Provide all ceiling restraint systems required by governing Codes for the Seismic Design Category of the Project. Refer to Structural Drawings.
- C. Wire Ties: ASTM A 641, Class 1 zinc coating, soft temper, 16 gage, 0.062" diameter.
- D. Channels: Cold-rolled steel, 0.0598" minimum thickness of base (uncoated) metal and 7/16" wide flanges, and as follows:
 - E. Carrying Channels: 1-1/2" deep, 475 lb/1000 feet, unless otherwise indicated.
 - F. Furring Channels: 3/4" deep, 300 lb/1000 feet, unless otherwise indicated.
 - G. Finish: Rust-inhibitive paint, unless otherwise indicated.
- H. Finish: ASTM A 653, G 60 hot-dip galvanized coating for framing for exterior soffits and where indicated.
- I. Steel Studs for Furring Channels: ASTM C 645, with flange edges of studs bent back 90 degrees and doubled over to form 3/16" wide minimum lip (return), and complying with the following requirements for minimum thickness of base (uncoated) metal and for depth:
 - 1. Thickness: 25 gage, 0.0179", unless otherwise indicated.
 - 2. Depth: 1-5/8", unless otherwise indicated.
 - 3. Protective Coating: ASTM A 653, G 40 hot-dip galvanized coating.
- J. Steel Rigid Furring Channels: ASTM C 645, G 40 zinc coating per ASTM A 525, hat-shaped, 25 gage [0.0179"], 7/8" deep, unless indicated otherwise.

- K. Grid Suspension System for Interior Ceilings: ASTM C 645, manufacturer's standard direct-hung, heavy duty grid suspension system composed of main tees and cross-furring members that interlock to form a modular supporting network, complete with channel wall molding, furring shoes, clips and other system framing accessories required for conditions indicated.
1. Subject to compliance with requirements, provide one of the following products:
 - a. Drywall Furring System; Armstrong World Industries, Inc.
 - b. 630 Fire Front System; Chicago Metallic Corp.,
 - c. Donn Rigid X System; USG Interiors Inc.
 2. Provide U.L. Rated Systems where indicated.
 3. Conventional steel framing of suspended gypsum board ceilings is acceptable at Contractor's option or as required by ceiling profile or installation conditions. Provide studs, channels, and furring channels as specified herein and in sizes and spacing to support ceiling board.
- L. Hangers: Comply with requirements of ASTM C 754. Suspension shall be by wire, rods or flat hangers as detailed or as required by conditions.

2.04 GYPSUM BOARD MATERIALS

- A. Standard Gypsum Board: ASTM C36; 5/8" inch thick, maximum permissible length; ends square cut, tapered edges.
- B. Moisture Resistant Gypsum Board:
1. Untiled Areas: Sheetrock Brand Mold Tough Gypsum Panels as manufactured by USG Corporation or Architect approved equal prior to Bid, fire resistive type where required, 5/8 inch thick, maximum permissible length; ends square cut, tapered edges, full height of all walls where specified.
 2. Tiled Areas: DensArmor Plus Paperless Interior Panel as manufactured by Georgia Pacific Corporation or Architect approved equal prior to Bid, 5/8" thick, maximum permissible length; ends square cut, tapered edges.
 3. Install Fiberock Brand Aqua-Tough Gypsum Interior Panels as manufactured by USG Corporation (Chicago, IL), where both impact resistant gypsum board and moisture resistant gypsum board are specified at the same location.
- C. Impact Resistant Gypsum Board: National Gypsum Company (Charlotte, NC) Hi-Impact Brand XP Wallboard **or Architect approved equal prior to Bid**, 5/8" thick, maximum permissible length; ends square cut, tapered edges.
- D. Fire Rated Gypsum Board: ASTM C36; fire resistive type, UL rated; 5/8 inch thick, maximum permissible length; ends square cut, tapered edges.

- E. Exterior Sheathing: Georgia-Pacific Corporation Dens-Glass Gold Gypsum Sheathing or Architect approved equal prior to Bid. 5/8 inch thick for vertical and horizontal applications, maximum permissible length; ends square cut, tapered edges.
 - 1. Glass-Fiber Sheathing Tape for Exterior Sheathing: Self-adhering, glass fiber tape, minimum 2 inches wide, 10 by 10 or 10 by 20 threads per inch, of type recommended by sheathing and tape manufacturers for use with silicone emulsion sealant in sealing joints in glass-mat gypsum sheathing board with a history of successful in-service use.
 - a. Available Products:
 - (1) FibaTape as manufactured by Saint-Gobain Technical Fabrics, Inc. (Granville, NY).
 - (2) Quik-Tape as manufactured by Quik-Tape, Inc.

2.05 ACCESSORIES

- A. Acoustical Sealant: USG Corporation SHEETROCK Brand Acoustical Sealant or approved equal.
- B. Laminating Adhesive for Multiple Layers: Special adhesive or joint compound specifically recommended for laminating multiple layers of gypsum wall board.
- C. Laminating Adhesive for Direct Application: Special adhesive or joint compound specifically recommended for adhering gypsum wall board to solid substrates.
- D. Corner Bead: DUR-A-BEAD as manufactured by USG Corporation or Architect approved equal. All corner bead shall be securely screwed in place.
- E. Edge Trim: SHEETROCK No. 200 Series as manufactured by USG Corporation or Architect approved equal.
- F. Joint Materials: Untiled Areas: Sheetrock Brand Joint Tape, Sheetrock Brand Setting-Type Joint Compound (Durabond) as manufactured by USG Corporation.
- G. Fasteners: ASTM C1002, Type S and W.
- H. Exterior Aluminum Reveal Moldings: Exterior Soffit Board: "F" Vented Reveal Molding: DRMF-50-V-75 as manufactured by Fry Reglet Corporation (Alhambra, CA) or Architect approved equal.
- I. Stainless steel 'J' Bead: Exterior Soffit Board "F" Vented Reveal Molding: DRMF-50-V-75 as manufactured by Fry Reglet Corporation (Alhambra, CA) or Architect approved equal.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify site conditions under provisions of Section 010390.
- B. Verify that site conditions are ready to receive Work and opening dimensions are as indicated on Shop Drawings.

3.02 METAL STUD INSTALLATION

- A. Install studs in accordance with manufacturer's instructions.

- B. Metal Stud Spacing: 16 inches on center maximum.
- C. Refer to Drawings for locations where partitions stud framing extends through the ceiling to the structure above. Maintain clearance under structural building members to avoid deflection transfer to studs. Provide extended leg ceiling runners.
- D. Blocking: Screw wood blocking to studs. Install blocking for support of plumbing fixtures, toilet partitions, wall cabinets, toilet accessories, hardware, etc.

3.03 WALL FURRING INSTALLATION

- A. Erect wall furring for direct attachment to concrete block or concrete.
- B. Erect furring channels vertically; space maximum 16 inches on center, not more than 4 inches from floor and ceiling lines. Secure in place on alternate channel flanges at maximum 24 inches on center.
- C. Install thermal and acoustical insulation in conjunction with Section 072100 in accordance with manufacturer's instructions.
- D. Erect free-standing metal stud framing tight to concrete and concrete masonry walls, attached by adjustable furring brackets in accordance with manufacturer's instructions.

3.04 SHAFT WALL INSTALLATION

- A. General: Install gypsum board shaft-wall assemblies to comply with requirements of fire-resistance-rated assemblies indicated, manufacturer's written installation instructions, and the following:
 - 1. ASTM C 754 for installing steel framing except comply with framing spacing indicated.
- B. Do not bridge architectural or building expansion joints with shaft-wall assemblies; frame both sides of expansion joints with furring and other support.
- C. Isolate perimeter of gypsum panels from building structure to prevent cracking of panels, while maintaining continuity of fire-rated construction.
- D. Firestop Tracks: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.
- E. Control Joints: Install control joints according to ASTM C 840 and in specific locations approved by Architect, while maintaining fire-resistance rating of gypsum board shaft-wall assemblies.
- F. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by faces of adjacent framing.

3.05 ACOUSTICAL ACCESSORIES INSTALLATION

- A. Place acoustical insulation in partitions tight within spaces, around cut openings, behind and around electrical and mechanical items within or behind partitions, and tight to items passing through partitions.
- B. Install acoustical sealant within partitions in accordance with manufacturer's instructions.

C. Install acoustical sealant at gypsum board perimeter at:

1. Metal Framing: Two beads.
2. Face Layer.
3. Caulk all penetrations of partitions by conduit, pipe, duct work, rough-in boxes, etc.

3.06 GYPSUM BOARD INSTALLATION

- A. Install gypsum board in accordance with GA-201, GA-216 and GA-600 and manufacturer's instructions.
- B. Erect single layer gypsum board vertically, with ends and edges occurring over firm bearing.
- C. Erect single layer fire rated gypsum board vertically, with edges and ends occurring over firm bearing.
- D. Use screws when fastening gypsum board to metal furring or framing.
- E. Use screws when fastening gypsum board to wood furring or framing.
- F. Double Layer Applications: Use gypsum board for first layer, placed perpendicular to framing or furring members. Use fire rated gypsum backing board for fire rated partitions.
- G. Double Layer Applications: Secure second layer to first with fasteners.
- H. Place second layer perpendicular to first layer. Offset joints of second layer from joints of first layer.
- I. Treat cut edges and holes in moisture resistant gypsum board with sealant.
- J. Place control joints consistent with lines of building spaces as directed and in accordance with manufacturer's recommendations.
- K. Place corner beads at external corners. Use longest practical length. Place edge trim where gypsum board abuts dissimilar materials.
- L. Apply gypsum board to curved walls in accordance with GA-216.

3.07 EXTERIOR SHEATHING INSTALLATION

- A. General: Install sheathing to comply with manufacturer's written instructions.
- B. Cut boards at penetrations, edges, and other obstructions of the work; fit tightly against abutting construction, except provide a 3/8-inch setback where non-load-bearing construction abuts structural elements.
- C. Coordinate sheathing installation with flashing and joint sealant installation so these materials are installed in the sequence and manner that prevent exterior moisture from passing through completed exterior wall assembly.
- D. Apply fasteners so screw heads bear tightly against face of sheathing boards but do not cut into facing.
- E. Do not bridge building expansion joints with sheathing; cut and space edges to match spacing of structural support elements.

F. Flashing: Flash all lintels and shelf angles in sheathing with specified sheet metal flashing and trim systems and self-adhering membrane flashing.

H. Sheathing Tape and Sealant Application:

1. Sealing Sheathing Joints: Seal joints according to sheathing manufacturer's written recommendations and as follows:
2. Apply elastomeric sealant on joints and fasteners and trowel flat. Apply sufficient quantity of sealant to completely cover joints and fasteners after troweling. Seal other penetrations and openings.

3.08 JOINT TREATMENT

A. Provide gypsum wallboard finish levels in accordance with ASTM-C840 and GA-214, minimally complying as follows:

1. Unless otherwise indicated, provide Level 1 Finish on fully concealed surfaces, including:
 - a. First ply of two layer gypsum wallboard systems.
 - b. Surfaces above finished ceilings.
 - c. Surfaces inside plenums, chases or cavities.
2. Provide Level 2 Finish on backing boards to receive mortar-set tile.
3. Unless otherwise indicated, provide Level 4 Finish on exposed surfaces to receive no further finish, or to receive lusterless coatings, including:
 - a. Flat paint.
 - b. Eggshell paint.
4. Provide Level 5 Finish on exposed surfaces to receive lustrous coatings, including:
 - a. Semigloss or gloss paint.
 - b. High build glazed or epoxy coatings.
5. In addition, provide Level 4 Finish on other surfaces so indicated or implied on Drawings.

B. Securely attach continuous corner beads to external corners in accordance with manufacturer's directions.

C. Where wallboard abuts dissimilar surfaces securely attach continuous trim beads in accordance with manufacturer's directions.

1. Where bead abuts exterior metal window frames or other metal components, separate from other material by use of foam tape.
2. Install accessories.

D. Apply joint treatment compound full height of partition in accordance with manufacturer's directions.

E. Fill joints, screw heads and internal corners with compound.

F. Have surfaces with gypsum wallboard finish Level 4 or 5 primed by painter.

- G. After painter has applied primer to wallboard surfaces, repair and refinish defective areas.
- H. If wallboard is damaged, or surfaces are roughened, repair, or remove and replace, to satisfaction of the Owner, at no additional cost to the Owner.

3.09 TOLERANCES

- A. Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8 inch in 10 feet in any direction.

END OF SECTION

SECTION 092400

CEMENT PLASTERING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Exterior vertical plasterwork (stucco).
 - 2. Exterior horizontal and nonvertical plasterwork (stucco).

1.03 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project Site.

1.04 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Show locations and installation of control and expansion joints, including plans, elevations, sections, details of components, and attachments to other work.
- C. Samples: For each type of factory-prepared finish coat and for each color and texture specified.
- D. Samples for Initial Selection: For each type of factory-prepared finish coat and for each color and texture specified.
- E. Samples for Verification: For each type of factory-prepared finish coat and for each color and texture specified, 12 by 12 inches, and prepared on rigid backing.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Store materials inside under cover, and keep them dry and protected against damage from weather, moisture, direct sunlight, surface contamination, corrosion, construction traffic, and other causes.

1.06 FIELD CONDITIONS

- A. Comply with ASTM C 926 requirements.
- B. Exterior Plasterwork:
 - 1. Apply and cure plaster to prevent plaster drying out during curing period. Use procedures required by climatic conditions, including moist curing, providing coverings, and providing barriers to deflect sunlight and wind.
 - 2. Apply plaster when ambient temperature is greater than 40 deg F.
 - 3. Protect plaster coats from freezing for not less than 48 hours after set of plaster coat has occurred.

- C. Factory-Prepared Finishes: Comply with manufacturer's written recommendations for environmental conditions for applying finishes.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. Fire-Resistance Ratings: Where indicated, provide cement plaster assemblies identical to those of assemblies tested for fire resistance according to ASTM E 119 by a qualified testing agency.

2.02 METAL LATH

- A. Expanded-Metal Lath: ASTM C 847, cold-rolled carbon-steel sheet with ASTM A 653/A 653M, G60 (Z180), hot-dip galvanized-zinc coating.
- B. Paper Backing: FS UU-B-790a, Type I, Grade D, Style 2 vapor-permeable paper.
 - 1. Provide paper-backed lath unless otherwise indicated.

2.03 ACCESSORIES

- A. General: Comply with ASTM C 1063, and coordinate depth of trim and accessories with thicknesses and number of plaster coats required.
- B. Metal Accessories:
 - 1. Foundation Weep Screenshot: Fabricated from hot-dip galvanized-steel sheet, ASTM A 653/A 653M, G60 (Z180) zinc coating.
 - 2. Cornerite: Fabricated from metal lath with ASTM A 653/A 653M, G60 (Z180), hot-dip galvanized-zinc coating.
 - 3. External- (Outside-) Corner Reinforcement: Fabricated from metal lath with ASTM A 653/A 653M, G60 (Z180), hot-dip galvanized-zinc coating.
 - 4. Cornerbeads: Fabricated from zinc-coated (galvanized) steel.
 - a. Smallnose cornerbead with expanded flanges; use unless otherwise indicated.
 - b. Smallnose cornerbead with perforated flanges; use on curved corners.
 - c. Smallnose cornerbead with expanded flanges reinforced by perforated stiffening rib; use on columns and for finishing unit masonry corners.
 - d. Bullnose cornerbead, radius 3/4 inch minimum, with expanded flanges; use at locations indicated on Drawings.
 - 5. Casing Beads: Fabricated from zinc-coated (galvanized) steel; square-edged style; with expanded flanges.
 - 6. Control Joints: Fabricated from zinc-coated (galvanized) steel; one-piece-type, folded pair of unperforated screeds in M-shaped configuration; with perforated flanges and removable protective tape on plaster face of control joint.
 - 7. Expansion Joints: Fabricated from zinc-coated (galvanized) steel; folded pair of unperforated screeds in M-shaped configuration; with expanded flanges.
 - 8. Two-Piece Expansion Joints: Fabricated from zinc-coated (galvanized) steel; formed to produce slip-joint and square-edged reveal that is adjustable from 1/4 to 5/8 inch (6 to 16 mm) wide; with perforated flanges.

2.04 MISCELLANEOUS MATERIALS

- A. Water for Mixing and Finishing Plaster: Potable and free of substances capable of affecting plaster set or of damaging plaster, lath, or accessories.
- B. Fiber for Base Coat: Alkaline-resistant glass or polypropylene fibers, 1/2 inch (13 mm) long, free of contaminants, manufactured for use in cement plaster.
- C. Bonding Compound: ASTM C 932.
- D. Fasteners for Attaching Metal Lath to Substrates: ASTM C 1063.
- E. Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, not less than 0.0475-inch (1.21-mm) diameter unless otherwise indicated.
- F. Sound-Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.
 - 1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.

2.05 PLASTER MATERIALS

- A. Portland Cement: ASTM C 150/C 150M, Type I.
 - 1. Color for Finish Coats: Match existing adjacent finish.
- B. Masonry Cement: ASTM C 91, Type N.
 - 1. Color for Finish Coats: Match existing adjacent finish.
- C. Plastic Cement: ASTM C 1328.
- D. Colorants for Job-Mixed Finish Coats: Colorfast mineral pigments that produce finish plaster color to match existing adjacent finish
- E. Lime: ASTM C 206, Type S; or ASTM C 207, Type S.
- F. Sand Aggregate: ASTM C 897.
 - 1. Color for Job-Mixed Finish Coats: to match existing adjacent finish.
- G. Perlite Aggregate: ASTM C 35.
- H. Ready-Mixed Finish-Coat Plaster: Mill-mixed portland cement, aggregates, coloring agents, and proprietary ingredients.
 - 1. Color: Match existing adjacent finish.

2.06 PLASTER MIXES

- A. General: Comply with ASTM C 926 for applications indicated.
1. Fiber Content: Add fiber to base-coat mixes after ingredients have mixed at least two minutes. Comply with fiber manufacturer's written instructions for fiber quantities in mixes, but do not exceed 1 lb of fiber/cu. yd. (0.6 kg of fiber/cu. m) of cementitious materials.
- B. Base-Coat Mixes for Use over Metal Lath: Scratch and brown coats for three-coat plasterwork as follows:
1. Portland Cement Mixes:
 - a. Scratch Coat: For cementitious material, mix 1 part Portland Cement and 0 to 3/4 parts lime. Use 2-1/2 to 4 parts aggregate per part of cementitious material.
 - b. Brown Coat: For cementitious material, mix 1 part Portland Cement and 0 to 3/4 parts lime. Use 3 to 5 parts aggregate per part of cementitious material, but not less than volume of aggregate used in scratch coat.
 2. Masonry Cement Mixes:
 - a. Scratch Coat: Mix 1 part masonry cement and 2-1/2 to 4 parts aggregate.
 - b. Brown Coat: Mix 1 part masonry cement and 3 to 5 parts aggregate, but not less than volume of aggregate used in scratch coat.
 3. Portland and Masonry Cement Mixes:
 - a. Scratch Coat: For cementitious material, mix 1 part portland cement and 1 part masonry cement. Use 2-1/2 to 4 parts aggregate per part of cementitious material.
 - b. Brown Coat: For cementitious material, mix 1 part portland cement and 1 part masonry cement. Use 3 to 5 parts aggregate per part of cementitious material, but not less than volume of aggregate used in scratch coat.
 4. Plastic Cement Mixes:
 - a. Scratch Coat: Mix 1 part plastic cement and 2-1/2 to 4 parts aggregate.
 - b. Brown Coat: Mix 1 part plastic cement and 3 to 5 parts aggregate, but not less than volume of aggregate used in scratch coat.
 5. Portland and Plastic Cement Mixes:
 - a. Scratch Coat: For cementitious material, mix 1 part plastic cement and 1 part portland cement. Use 2-1/2 to 4 parts aggregate per part of cementitious material.
 - b. Brown Coat: For cementitious material, mix 1 part plastic cement and 1 part portland cement. Use 3 to 5 parts aggregate per part of cementitious material, but not less than volume of aggregate used in scratch coat.
- C. Job-Mixed Finish-Coat Mixes:
1. Portland Cement Mix: For cementitious materials, mix 1 part Portland cement and 3/4 to 1-1/2 parts lime. Use 1-1/2 to 3 parts aggregate per part of cementitious material.
 2. Masonry Cement Mix: Use 1 part masonry cement and 1-1/2 to 3 parts aggregate.

3. Portland and Masonry Cement Mix: For cementitious materials, mix 1 part Portland cement and 1 part masonry cement. Use 1-1/2 to 3 parts aggregate per part of cementitious material.
 4. Plastic Cement Mix: Use 1 part plastic cement and 1-1/2 to 3 parts aggregate.
- D. Factory-Prepared Finish-Coat Mixes: For ready-mixed finish-coat plaster, comply with manufacturer's written instructions.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Protect adjacent work from soiling, spattering, moisture deterioration, and other harmful effects caused by plastering.
- B. Prepare smooth, solid substrates for plaster according to ASTM C 926.

3.03 INSTALLATION, GENERAL

- A. Fire-Resistance-Rated Assemblies: Install components according to requirements for design designations from listing organization and publication indicated on Drawings.
- B. Sound-Attenuation Blankets: Where required, install blankets before installing lath unless blankets are readily installed after lath has been installed on one side.

3.04 INSTALLING METAL LATH

- A. Metal Lath: Install according to ASTM C 1063.
 1. Partition Framing and Vertical Furring: Install flat-diamond-mesh lath.
 2. Flat-Ceiling and Horizontal Framing: Install flat-diamond-mesh lath.
 3. On Solid Surfaces, Not Otherwise Furred: Install self-furring, diamond-mesh lath.

3.05 INSTALLING ACCESSORIES

- A. Install according to ASTM C 1063 and at locations indicated on Drawings.
- B. Reinforcement for External (Outside) Corners:
 1. Install lath-type, external-corner reinforcement at exterior locations.
 2. Install cornerbead at interior locations.
- C. Control Joints: Locate as approved by Architect for visual effect and as follows:
 1. As required to delineate plasterwork into areas (panels) of the following maximum sizes:
 - a. Vertical Surfaces: 144 sq. ft.

b. Horizontal and Other Nonvertical Surfaces: 100 sq. ft.

2. At distances between control joints of not greater than 18 feet (5.5 m) o.c.
3. As required to delineate plasterwork into areas (panels) with length-to-width ratios of not greater than 2-1/2:1.
4. Where control joints occur in surface of construction directly behind plaster.
5. Where plasterwork areas change dimensions, to delineate rectangular-shaped areas (panels) and to relieve the stress that occurs at the corner formed by the dimension change.

3.06 PLASTER APPLICATION

A. General: Comply with ASTM C 926.

1. Do not deviate more than plus or minus 1/4 inch in 10 feet (6 mm in 3 m) from a true plane in finished plaster surfaces when measured by a 10-foot (3-m) straightedge placed on surface.
2. Finish plaster flush with metal frames and other built-in metal items or accessories that act as a plaster ground unless otherwise indicated. Where casing bead does not terminate plaster at metal frame, cut base coat free from metal frame before plaster sets and groove finish coat at junctures with metal.
3. Provide plaster surfaces that are ready to receive field-applied finishes indicated.

B. Bonding Compound: Apply on unit masonry and concrete substrates for direct application of plaster.

C. Walls; Base-Coat Mixes for Use over Metal Lath: For scratch and brown coats, for three-coat plasterwork with 3/4-inch (19-mm) total thickness, as follows:

1. Portland cement mixes.
2. Masonry cement mixes.
3. Portland and masonry cement mixes.
4. Plastic cement mixes.
5. Portland and plastic cement mixes.

D. Concealed Exterior Plasterwork: Where plaster application is used as a base for adhered finishes, omit finish coat.

E. Concealed Interior Plasterwork:

1. Where plaster application is concealed behind built-in cabinets, similar furnishings, and equipment, apply finish coat.
2. Where plaster application is concealed above suspended ceilings and in similar locations, omit finish coat.
3. Where plaster application is used as a base for adhesive application of tile and similar finishes, omit finish coat.

3.07 PLASTER REPAIRS

A. Repair or replace work to eliminate cracks, dents, blisters, buckles, crazing and check cracking, dry outs, efflorescence, sweat outs, and similar defects and where bond to substrate has failed.

3.08 CLEANING AND PROTECTION

- A. Remove temporary protection and enclosure of other work after plastering is complete. Promptly remove plaster from door frames, windows, and other surfaces not indicated to be plastered. Repair floors, walls, and other surfaces stained, marred, or otherwise damaged during plastering.

END OF SECTION

SECTION 095100
ACOUSTICAL CEILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Suspended metal grid ceiling system and perimeter trim.
- B. Acoustical tile.

1.02 RELATED SECTIONS

- A. Section 072100 - Building Insulation.
- B. Section 092116 - Gypsum Board Systems.

1.03 REFERENCES

- A. ASTM C635 - Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings.
- B. ASTM C636 - Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels.
- C. ASTM C665 - Mineral Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
- D. ASTM E580 - Practice for Application of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Requiring Seismic Restraint.
- E. ASTM E1264 - Classification of Acoustical Ceiling Products.
- F. Ceilings and Interior Systems Contractors Association (CISCA) - Acoustical Ceilings: Use and Practice.
- G. UL - Fire Resistance Directory and Building Material Directory.

1.04 SYSTEM DESCRIPTION

- A. Suspension system to rigidly secure acoustical ceiling system including integral mechanical and electrical components with maximum deflection of 1/360.

1.05 SUBMITTALS

- A. Submit under provisions of Section 013000.
- B. Shop Drawings: Indicate grid layout and related dimensioning, junctions with other work or ceiling finishes and interrelation of mechanical and electrical items related to system.
- C. Product Data: Provide data on metal grid system components and acoustical units.
- D. Samples: Submit two samples full size illustrating material and finish of acoustical units.

- E. Samples: Submit two samples each, 6 inches long, of suspension system main runner, cross runner, and edge trim.
- F. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

1.06 QUALIFICATIONS

- A. Grid Manufacturer: Company specializing in manufacturing the Products specified in this Section with minimum three years documented experience.
- B. Acoustical Unit Manufacturer: Company specializing in manufacturing the Products specified in this Section with minimum three years documented experience.

1.07 REGULATORY REQUIREMENTS

- A. Conform to applicable codes for combustibility requirements for materials.

1.08 ENVIRONMENTAL REQUIREMENTS

- A. Maintain uniform temperature of minimum 60 degrees F and maximum humidity of 40 percent prior to, during, and after acoustical unit installation.

1.09 SEQUENCING

- A. Sequence Work under the provisions of Section 010100.
- B. Sequence Work to ensure acoustical ceilings are not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated, and overhead work is completed, tested, and approved.
- C. Install acoustical units after interior wet work is dry.

1.10 EXTRA MATERIALS

- A. Furnish under provisions of Section 017000.
- B. At time of installation completion, deliver stock of maintenance materials to the Owner. Furnish products matching those actually installed, packaged for storage and clearly labeled.
 - 1. Acoustic Tile: Two (2) percent of each variety installed.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS - SUSPENSION SYSTEM

- A. Chicago Metallic (Chicago, IL).
- B. USG Corporation / Donn Ceilings (Chicago, IL).
- C. Armstrong World Industries, Inc. (Lancaster, PA).
- D. Substitutions: Under provisions of Section 016000.

2.02 SUSPENSION SYSTEM - MATERIAL

- A. Non-fire Rated Straight Grid: ASTM C635, intermediate and heavy duty; exposed T; components die cut and interlocking.
- B. Straight Grid Materials: Commercial quality cold rolled steel with galvanized coating.
- C. Exposed straight grid surface width 15/16" inch.
- D. Provide Kenbeck Company (St. Charles, MO) Ultra-Flex Angles Edge Moulding or Architect approved equal at all intersections of suspended acoustical ceiling system with radiused wall or soffit conditions.
- E. Accessories: Stabilizer bars, clips, splices, edge moldings, gaskets, and hold down clips required for suspended grid system.
- F. Support Channels and Hangers: Primed steel; size and type to suit application and ceiling system flatness requirement specified.
- G. Seismic Restraint Requirements: Provide all ceiling restraint systems required by governing Codes for the Seismic Design Category of the Project. Refer to Structural Drawings.

2.03 SUSPENSION SYSTEMS

- A. (Type 1) Suspension System:
 - 1. Armstrong World Industries, Inc, Prelude XL.
 - 2. Grid Size: 15/16".
 - 3. Color: White.

2.04 ACCEPTABLE MANUFACTURERS - ACOUSTICAL UNITS

- A. USG Corporation (Chicago, IL).
- B. Armstrong World Industries, Inc. (Lancaster, PA).
- C. Substitutions: Under provisions of Section 016000.

2.05 ACOUSTICAL TILE UNITS

- A. (Type ACT1) Acoustical Tile in Suspension System Type 1:
 - 1. Armstrong World Industries, Inc, Fine Fissured 1729A. (SQ - Square Edge)
 - 2. Tile Size: 2' x 2' x 5/8"
 - 3. Color: White.
 - 4. Provide hold-down clips where indicated or required by applicable Codes.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify site conditions under provisions of Section 010390.
- B. Verify that layout of hangers will not interfere with other Work.

3.02 INSTALLATION - LAY-IN GRID SUSPENSION SYSTEM

- A. Install suspension system in accordance with ASTM C636, manufacturer's instructions, and as supplemented in this Section.
- B. Install system capable of supporting imposed loads to a deflection of 1/360 maximum including all additional reinforcement necessary to support ceiling mounted equipment, curtain tracks, etc.
- C. Install after major above ceiling work is complete. Coordinate the location of hangers with other work.
- D. Supply hangers or inserts for installation with instructions for their correct placement.
- E. Provide hanger clips during steel deck erection. Provide additional hangers and inserts as required.
- F. Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.
- G. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.
- H. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability. Support fixture loads by supplementary hangers located within 6 inches of each corner; or support components independently.
- I. Do not eccentrically load system, or produce rotation of runners.
- J. Install edge molding at intersection of ceiling and vertical surfaces, using longest practical lengths. Miter corners. Provide edge moldings at junctions with other interruptions.
- K. Form expansion joints per Manufacturer's recommendations. Form to accommodate plus or minus one inch movement. Maintain visual closure.

3.03 INSTALLATION - ACOUSTICAL UNITS

- A. Install acoustical units in accordance with manufacturer's instructions.
- B. Fit acoustical units in place, free from damaged edges or other defects detrimental to appearance and function.
- C. Lay directional patterned units in basket weave pattern. Fit border trim neatly against abutting surfaces.
- D. Install units after above ceiling work is complete.

- E. Install acoustical units level, in uniform plane, and free from twist, warp and dents.
- F. Cut tile to fit irregular grid and perimeter edge trim. Double cut and field paint exposed edges of tegular units.
- G. Where round obstructions occur, provide preformed closers to match edge molding.

3.04 ERECTION TOLERANCES

- A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet.
- B. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

END OF SECTION

SECTION 096500
RESILIENT FLOORING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Resilient Tile Flooring.
- B. Resilient Sheet Flooring.
- C. Resilient Base.
- D. Resilient Vinyl Plank Flooring.

1.02 REFERENCES

- A. ASTM E84 - Surface Burning Characteristics of Building Materials.
- B. ASTM F1066 - Vinyl Composition Floor Tile.
- C. FS L-F-1641 - Floor Covering Translucent or Transparent Vinyl Surface with Basking.
- D. FS L-F-475 - Floor Covering, Vinyl Surface (Tile and Roll), with Backing.
- E. FS SS-W-40 - Wall Base: Rubber and Vinyl Plastic.

1.03 SUBMITTALS

- A. Product Data: Submit technical data from each manufacturer of resilient products required.
- B. Initial Samples: Submit manufacturer's standard color selection samples for resilient products required, including all available colors and patterns.
- C. Maintenance Procedures: Submit manufacturer's published instructions for care and cleaning of resilient flooring products specified.

1.04 QUALITY ASSURANCE

- A. Manufacturer: For each type of product required, including adhesives, cleaning compounds, and other accessories, provide the same product by one manufacturer throughout the Project.

1.05 PROJECT CONDITIONS

- A. Environmental Requirements: At least 48 hours prior to beginning Work, move resilient flooring materials to areas of installation and maintain at minimum 70 degrees F until 48 hours after completing installation and at minimum 55 degrees F thereafter.
- B. Sequencing: Do not begin installation of resilient flooring products until painting has been completed in each area.
- C. Existing Conditions: Do not install resilient flooring on concrete substrates until testing has been conducted to assure that moisture levels are acceptable.

1.06 EXTRA MATERIALS

- A. Furnish under provisions of Section 017000.
- B. At time of installation completion deliver stock of maintenance materials to the Owner. Furnish products matching those actually installed, packaged for storage and clearly labeled.
 - 1. Resilient Tile Flooring: 5 percent of each variety installed.
 - 2. Resilient Sheet Flooring: 5 percent of each variety installed.
 - 3. Resilient Base: 10 percent of each variety installed.
 - 4. Resilient Vinyl Plank Flooring: 5 percent of each variety installed.

PART 2 PRODUCTS

2.01 RESILIENT BASE MATERIALS

- A. (Type RB#) Rubber Wall Base: FS SS-W-40, Type I, and as follows:
 - 1. Reference Construction Drawings and Finish Schedule for resilient base manufacturers, pattern numbers, and colors.
 - 2. Substitutions: Under provisions of Section 016000.
 - 3. Composition: Free of asbestos.

2.02 RESILIENT VINYL PLANK FLOORING MATERIALS

- A. (Type LVT#) Vinyl Plank Flooring:
 - 1. Reference Construction Drawings and Finish Schedule for resilient vinyl plank flooring manufacturers, pattern numbers, and colors.
 - 2. Substitutions: Under provisions of Section 016000.
 - 3. Composition: Free of asbestos

2.03 MISCELLANEOUS ACCESSORIES

- A. Resilient Edge Strips: Solid rubber or vinyl edging, in tapered or rounded profile, nominally 1 inch in width and 1/8 inch in thickness.
 - 1. Color: Matching flooring.
- B. Adhesive: Type recommended by manufacturer of resilient product for specific substrate conditions.
- C. Primer: Type recommended by manufacturer of resilient product for application to concrete substrates.
- D. Patching Compound: Latex leveling and patching compound acceptable to manufacturer of resilient product.
- E. Sealers or Polishes: Types recommended by flooring manufacturer.
- F. Welding Rods: Color(s) and pattern(s) as selected from selected manufacturer's standard selections.

PART 3 EXECUTION

3.01 EXAMINATION

- A. General: Inspect substrates and conditions of installation to verify that Work may properly commence. Do not proceed with the Work until unsatisfactory conditions have been corrected.
- B. Concrete Substrates: Perform manufacturer's recommended moisture tests before beginning installation, to verify that concrete surfaces have cured sufficiently to allow adhesive bond to resilient flooring.

3.02 PREPARATION

- A. Substrates: Fill minor depressions, cracks, and other irregularities with patching compound.
 - 1. Remove paint, curing compounds, and other materials that could interfere with adhesion of resilient products.
 - 2. Sweep or vacuum clean substrate immediately prior to beginning installation in each area.
 - 3. Apply primer to concrete substrates prior to application of adhesive, following manufacturer's printed instructions.

3.03 GENERAL INSTALLATION REQUIREMENTS

- A. Comply with manufacturer's published recommendations for installation in each area, extending resilient flooring into spaces, which are partially concealed. Cut and fit tightly to fixtures, pipes, and other obstructions, as well as to walls and partitions.
- B. Tightly adhere resilient flooring to substrate with no open joints or cracks, and without raised or blistered areas. Spread adhesive evenly, so that final installation will be without telegraphed markings from adhesive or substrate.

3.04 RESILIENT BASE INSTALLATION

- A. Apply base securely in locations indicated, using maximum lengths available to minimize joints. Adhere to substrate with full spread of adhesive, assuring continuous contact with vertical and horizontal surfaces. Site-fabricate corners, coping or mitering inside corners and heat-forming outside corners using manufacturer-approved device.
 - 1. At irregular vertical surfaces where top edge of resilient base does not make continuous contact, fill voids with manufacturer's recommended adhesive compound.

3.05 RESILIENT VINYL PLANK FLOORING INSTALLATION

- A. Install resilient vinyl plank flooring in accordance with recommendations of selected manufacturer.
 - 1. Layout resilient vinyl plank flooring to achieve minimum number of seams and for pattern match between abutting edges. Double-cut if required.
 - 2. Lay planks flat and allow to come to room temperature prior to installation.
 - 3. Install the planks beginning from the center of the room, and roll the floor surface to work wrinkles and air pockets out past the outer edges.
 - 4. Fit the resilient vinyl plank flooring neatly and tightly into breaks and recesses, around pipes and penetrations, under saddles and thresholds, and around permanent cabinets and equipment.

- B. Remove excessive adhesive in accordance with selected manufacturer's instructions without the use of solvents.
- C. Install resilient edge stripping at termination of vinyl plank flooring where substrate is exposed and extends beyond.

3.06 INSTALLATION OF MISCELLANEOUS ACCESSORIES

- A. Resilient Edge Strips: At locations shown on Drawings, or where recommended by manufacturer or otherwise required to protect edge of resilient flooring, install resilient edge strips securely with recommended adhesive, to achieve tightly butted joint.

3.07 CLEANING

- A. Initial Cleaning: Remove excess and waste materials promptly, and sweep or vacuum clean resilient flooring as soon as installation has been completed in each area. After adhesive has had adequate time to set, mop each area with damp mop and mild detergent.
- B. Final Cleaning: Remove scuff marks, excess adhesive, and other foreign substances using only cleaning products and techniques recommended by manufacturer of resilient products.

3.08 PROTECTION

- A. Construction Period: Cover traffic routes across completed resilient flooring with plywood, hardboard, or other durable material to protect against damage from leaded dollies and other construction traffic.
 - 1. Polish: Apply protective polish to clean resilient flooring surfaces, unless manufacturer of resilient product recommends otherwise.
- B. Final Protection: Cover resilient floor surface with non-staining building paper until substantial completion in each area.

END OF SECTION

SECTION 099123

PAINTING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Surface preparation and field application of paints and coatings.

1.02 RELATED SECTIONS

- A. Section 055000 - Metal Fabrications.
- B. Section 061000 - Rough Carpentry.
- C. Section 064100 - Architectural Woodwork.
- D. Section 081113 – Hollow Metal Doors and Frames.
- E. Section 092116 - Gypsum Board Systems.

1.03 REFERENCES

- A. ASTM D16 - Definitions of Terms Relating to Paint, Varnish, Lacquer, and Related Products.
- B. ASTM D2016 - Test Method for Moisture Content of Wood.
- C. AWWA (American Water Works Association) - C204 - Chlorinated Rubber-Alkyd Paint Systems for the Exterior of Above Ground Steel Water Piping.
- D. AWWA (American Water Works Association) - D102 - Painting Steel Water Storage Tanks.
- E. NACE (National Association of Corrosion Engineers) - Industrial Maintenance Painting.
- F. NPCA (National Paint and Coatings Association) - Guide to U.S. Government Paint Specifications.
- G. PDCA (Painting and Decorating Contractors of America) - Painting - Architectural Specifications Manual.
- H. SSPC (Steel Structures Painting Council) - Steel Structures Painting Manual.

1.04 DEFINITIONS

- A. Conform to ASTM D16 for interpretation of terms used in this Section.

1.05 SUBMITTALS

- A. Submit under provisions of Section 013000.
- B. Product Data: Provide data on all finishing products.
- C. Samples: Submit two samples, 2x2 inches in size illustrating range of colors and textures available for each surface finishing product scheduled.

- D. Samples: Submit two samples, 12x12 inches in size illustrating selected colors and textures for each color selected.
- E. Manufacturer's Instructions: Indicate special surface preparation procedures, substrate conditions requiring special attention, etc.

1.06 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing the Products specified in this Section with minimum ten years documented experience.
- B. Applicator: Company specializing in performing the Work of this Section with minimum 5 years documented experience approved by manufacturer.

1.07 REGULATORY REQUIREMENTS

- A. Conform to applicable codes and referenced standards for flame and smoke rating requirements for finishes. Follow local VOC regulations for paints and coatings.

1.08 FIELD SAMPLES

- A. Provide field sample of paint under provisions of Section 014000.
- B. Provide field sample panel, 4 feet long by 4 feet wide, illustrating coating colors, textures, and finishes.
- C. Locate where directed.
- D. Accepted sample may remain as part of the Work.

1.09 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, protect and handle products to site under provisions of Section 016000.
- B. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.
- C. Container label to include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.
- D. Store paint materials at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

1.10 ENVIRONMENTAL REQUIREMENTS

- A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.
- B. Do not apply exterior coatings during rain or snow, or when relative humidity is outside the humidity ranges required by the paint product manufacturer.

- C. Minimum Application Temperatures for Latex Paints: 45 degrees F for interiors; 50 degrees F for exterior; unless required otherwise by manufacturer's instructions.
- D. Minimum Application Temperature for Varnish and Finishes: 65 degrees F for interior or exterior, unless required otherwise by manufacturer's instructions.
- E. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Acceptable manufacturers of other Paints, Transparent Finishes, Stains, Primer Sealers, Block Fillers, and Field Catalyzed Coatings required but not specifically identified in Construction Drawings:
 - 1. Sherwin – Williams.
 - 2. Benjamin Moore.
 - 3. Glidden.

2.02 MATERIALS

- A. Reference Interior Design Construction Drawings for paint manufacturer and color selections.
- B. Coatings: Ready mixed, except field catalyzed coatings. Process pigments to a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating; good flow and brushing properties; capable of drying or curing free of streaks or sags.
- C. Accessory Materials: Linseed oil, shellac, turpentine, paint thinners and other materials not specifically indicated but required to achieve the finishes specified, of commercial quality.
- D. Patching Materials: Latex filler.
- E. Fastener Head Cover Materials: Latex filler.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify site conditions under provisions of Section 010390.
- B. Verify that surfaces and substrate conditions are ready to receive Work as instructed by the product manufacturer.
- C. Examine surfaces scheduled to be finished prior to commencement of Work. Report any condition that may potentially affect proper application.
- D. Test shop applied primer for compatibility with subsequent cover materials.
- E. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
 - 1. Plaster and Gypsum Wallboard: 12 percent.
 - 2. Masonry, Concrete, and Concrete Unit Masonry: 12 percent.

3. Interior Wood: 15 percent, measured in accordance with ASTM D2016.
4. Exterior Wood: 15 percent, measured in accordance with ASTM D2016.
5. Concrete Floors: 8 percent.

3.02 PREPARATION

- A. Remove or mask electrical plates, hardware, light fixture trim, escutcheons, and fittings prior to preparing surfaces or finishing.
- B. Correct defects and clean surfaces which affect Work of this Section. Remove existing coatings that exhibit loose surface defects.
- C. Seal with shellac and seal marks which may bleed through surface finishes.
- D. Impervious Surfaces: Remove mildew by scrubbing with solution of tri-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.
- E. Aluminum Surfaces Scheduled for Paint Finish: Remove surface contamination by steam or high pressure water. Remove oxidation with acid etch and solvent washing. Apply etching primer immediately following cleaning.
- F. Asphalt, Creosote, or Bituminous Surfaces Scheduled for Paint Finish: Remove foreign particles to permit adhesion of finishing materials. Apply latex based compatible sealer or primer.
- G. Insulated Coverings: Remove dirt, grease, and oil from canvas and cotton.
- H. Concrete Floors: Remove contamination, acid etch, and rinse floors with clear water. Verify required acid-alkali balance is achieved. Allow to dry.
- I. Copper Surfaces Scheduled for a Paint Finish: Remove contamination by steam, high pressure water, or solvent washing. Apply vinyl etch primer immediately following cleaning.
- J. Copper Surfaces Scheduled for a Natural Oxidized Finish: Remove contamination by applying oxidizing solution of copper acetate and ammonium chloride in acetic acid. Rub on repeatedly for required effect. Once attained, rinse surfaces with clear water and allow to dry.
- K. Gypsum Board Surfaces: Fill minor defects with filler compound. Spot prime defects after repair.
- L. Galvanized Surfaces: Remove surface contamination and oils and wash with solvent. Apply coat of etching primer.
- M. Concrete and Unit Masonry Surfaces Scheduled to Receive Paint Finish: Remove dirt, loose mortar, scale, salt or alkali powder, and other foreign matter. Remove oil and grease with a solution of tri-sodium phosphate; rinse well and allow to dry. Remove stains caused by weathering of corroding metals with a solution of sodium metasilicate after thoroughly wetting with water. Allow to dry.
- N. Plaster Surfaces: Fill hairline cracks, small holes, and imperfections with latex patching plaster. Make smooth and flush with adjacent surfaces. Wash and neutralize high alkali surfaces.
- O. Uncoated Steel and Iron Surfaces: Remove grease, mill scale, weld splatter, dirt, and rust. Where heavy coatings of scale are evident, remove by hand or power tool wire brushing or sandblasting; clean by washing with solvent. Apply a treatment of phosphoric acid solution, ensuring weld joints, bolts, and nuts are similarly cleaned. Spot prime paint after repairs.

- P. Shop Primed Steel Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Prime metal items including shop primed items.
- Q. Interior Wood Items Scheduled to Receive Paint Finish: Wipe off dust and grit prior to priming. Seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after primer has dried; sand between coats.
- R. Interior Wood Items Scheduled to Receive Transparent Finish: Wipe off dust and grit prior to sealing, seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after sealer has dried; sand lightly between coats.
- S. Exterior Wood Scheduled to Receive Paint Finish: Remove dust, grit, and foreign matter. Seal knots, pitch streaks, and sappy sections. Fill nail holes with tinted exterior caulking compound after prime coat has been applied.
- T. Exterior Wood Scheduled to Receive Transparent Finish: Remove dust, grit, and foreign matter; seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes with tinted exterior caulking compound after sealer has been applied.
- U. Wood and Metal Doors Scheduled for Painting: Seal top and bottom edges with primer.

3.03 APPLICATION

- A. Apply products in accordance with manufacturer's instructions.
- B. Do not apply finishes to surfaces that are not dry.
- C. Apply each coat to uniform finish.
- D. Apply each coat of paint slightly darker than preceding coat unless otherwise approved.
- E. Sand wood and metal lightly between coats to achieve required finish.
- F. Vacuum clean surfaces free of loose particles. Use tack cloth just prior to applying next coat.
- G. Allow applied coat to dry before next coat is applied.
- H. Where clear finishes are required, tint fillers to match wood. Work fillers into the grain before set. Wipe excess from surface.
- I. Prime concealed surfaces of interior and exterior woodwork with primer paint.
- J. Prime concealed surfaces of interior woodwork scheduled to receive stain or varnish finish with gloss varnish reduced 25 percent with mineral spirits.

3.04 FINISHING MECHANICAL AND ELECTRICAL EQUIPMENT

- A. Refer to Mechanical and Electrical specifications for schedule of color coding and identification banding of equipment, duct work, piping, and conduit.
- B. Paint shop primed equipment. Paint shop prefinished items occurring at interior areas.

- C. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.
- D. Prime and paint insulated and exposed pipes, conduit, boxes, insulated and exposed ducts, hangers, brackets, collars and supports, etc., except where items are prefinished.
- E. Paint interior surfaces of air ducts, and convector and baseboard heating cabinets that are visible through grilles and louvers with one coat of flat black paint, to visible surfaces. Paint dampers exposed behind louvers, grilles, and convector and baseboard cabinets to match face panels.
- F. Paint exposed conduit and electrical equipment occurring in finished areas.
- G. Paint both sides and edges of plywood backboards for electrical and telephone equipment before installing equipment.
- H. Color code equipment, piping, conduit, and exposed duct work in accordance with requirements indicated. Color band and identify with flow arrows, names, and numbering.
- I. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.05 FIELD QUALITY CONTROL

- A. Field inspection and testing will be performed under provisions of Section 014000.
- B. Test questionable coated areas in accordance with manufacturer's recommendations.

3.06 CLEANING

- A. Clean Work under provisions of Section 017000.
- B. Collect waste material which may constitute a fire hazard, place in closed metal containers and remove daily from site.

3.07 SCHEDULE

- A. Steel - Unprimed:
 - 1. One coat of alkyd primer.
 - a. S-W Pro Industrial Pro-Cryl® Primer, B66-310 Series (2-4 mils dry).
 - 2. Two coats of latex enamel, semi-gloss.
 - a. S-W Metalatex® Semi-Gloss Coating B42 Series (1.5 - 4.0 mils dry per coat), or Pro-Industrial 0 VOC Acrylic B66W651 Series.
- B. Steel - Primed:
 - 1. Touch-up with zinc rich primer.
 - 2. Two coats of alkyd enamel, semi-gloss, or ProCryl B34W251 ProMar 200 Alkyd SG.

C. Steel - Galvanized:

1. One coat galvanized primer.
 - a. S-W Pro Industrial Pro-Cryl® Primer, B66-310 Series (2-4 mils dry).
2. Two coats of latex enamel, semi-gloss.
 - a. S-W Metalatex® Semi-Gloss Coating B42 Series (1.5 - 4.0 mils dry per coat), or 0 VOC Acrylic (Pro-Industrial) B66W651.

D. Aluminum - Mill Finish:

1. One coat etching primer.
 - a. S-W DTM Wash Primer, B71Y1 (0.7 - 1.3 mils dry)(spray application recommended).
2. Two coats of alkyd enamel, gloss.
 - a. S-W Metalatex® Semi-Gloss Coating B42 Series (1.5 - 4.0 mils dry per coat), or 0 VOC Acrylic (Pro-Industrial) B66W651.

E. Interior Concrete, Concrete Block/Masonry:

1. One coat of block primer sealer latex.
 - a. S-W Loxon Masonry Primer® A24W8300 (7 mils wet, 3 mils dry).
2. Two coats of latex, semi-gloss enamel.
 - a. S-W ProMar®/0 VOC 200 Latex Semi-Gloss, B3W2651 Series (4 mils wet, 1.3 mils dry per coat).

F. Wood - Painted:

1. One coat of alkyd primer sealer.
 - a. S-W Multi-Purpose Oil Base Primer B49W8820 (4 mils wet, 1.6 mils dry).
2. Two coats of latex enamel, semi-gloss.
 - a. S-W ProClassic® Waterborne Acrylic Semi-Gloss Enamel, B31 Series (4 mils wet, 1.3 mils dry per coat).

G. Wood - Transparent:

1. Filler coat (for open grained wood only).
2. Two coats of stain.
 - a. S-W Minwax 250 VOC Oil Stain.
3. One coat sealer.

4. Two coats of varnish, satin.
 - a. S-W Wood Classics® Waterborne Polyurethane Varnish, Gloss or Satin (4 mils wet, 1.0 mil dry per coat).
- H. Gypsum Board in Other Areas:
 1. One coat of latex primer sealer.
 - a. S-W PrepRite®/0 VOC 200 Latex Primer, B28W2600 (4 mils wet, 1.2 mils dry).
 2. Two coats of latex eggshell.
 - a. S-W ProMar®/0 VOC 200 Latex Egg-Shell, B20W2651 Series (4 mils wet, 1.6 mils dry per coat).
- I. Gypsum Board in Wet Areas (Toilets Rooms/Janitorial Closets):
 1. One coat of latex primer sealer.
 - a. 0 VOC 200 Latex Primer, B28W200 (4 mils wet, 1.2 mils dry).
 2. Two coats of low gloss water epoxy.
 - a. S-W Water Based Catalyzed Epoxy semi-gloss, B70/B60V25 Series (2.5-3 mils dry per coat), or Precatalyzed Water Based Epoxy K46W151.
- J. Gypsum Board (Exterior):
 1. One coat of exterior latex primer.
 - a. S-W A-100 Exterior Latex Primer, B42W41 (4 mils wet, 1.4 mils dry).
 2. Two coats of exterior latex eggshell.
 - a. S-W A-100 Exterior Latex Satin, A82 Series (4 mils wet, 1.4 mils dry per coat).

END OF SECTION

SECTION 102239

OPERABLE PANEL PARTITIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Furnishing and installation of operable panel partitions, including all required labor, materials and equipment.

1.02 RELATED SECTIONS

- A. Section 055000 - Metal Fabrications: Structural steel supports for operable panel partitions.
- B. Section 072100 - Building Insulation: Acoustic insulation required above ceiling over operable panel partitions required for continuity of acoustic system.
- C. Section 092116 - Gypsum Board Systems: Soffit construction at and above ceiling over operable panel partitions required for continuity of acoustic system.

1.03 SUBMITTALS

- A. Submit in accordance with Section 013000.
- B. Shop drawings: submit shop drawings fully describing partition fabrication, layout, and installation. Include details of track, trolleys, hardware, etc. Indicate loading to be imposed in the supporting structure. Show all anchorage, accessory items, caulking, and finishes.

1.04 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Components of this section shall withstand the effects of earthquake motions determined according to Memphis/Shelby County, TN IBC and ASCE 7 – 10 Chapter 13.

1.05 QUALITY ASSURANCE

- A. The operable panel partitions herein specified shall be furnished and installed by an authorized local distributor licensed by the operable panel partition manufacturer. Local distribution is required to insure prompt project coordination and future customer service.

1.06 ACOUSTICAL PERFORMANCE

- A. Laboratory acoustical performance of the operable wall shall have been tested in an independent acoustical laboratory in accordance with ASTM E90 test procedure, and shall have attained an STC rating of no less than 50. A written test report by the test facility shall be available upon request.

1.07 WARRANTY

- A. Complete operable panel partition system shall be warranted against defects in material and workmanship for a period of two (2) years from Date of Substantial Completion.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Reference Standard: Modernfold, Inc. (New Castle, IN).
- B. Hufcor, Inc. (Janesville, WI).
- C. Panelfold, Inc. (Miami, FL).
- D. Substitutions: Under provisions of Section 01600.

2.02 OPERABLE PANEL PARTITIONS

- A. (Type 1) Acousti-Seal 932 Operable Wall, Paired Panel Partition as manufactured by Modernfold, Inc.
 - 1. Operation: Operable panel partitions shall be a series of flat panels hinged in pairs, 3 panel or triple panel groups are not permitted, manually operated, top supported with operable floor seals.
 - 2. Panel Construction:
 - a. Panels shall be nominal 3 inch thick in manufacturer's standard 48 inch width maximum. All panel horizontal and vertical framing elements shall be formed steel.
 - b. Panel skin shall be 0.50 inch medium density fiberboard, single material or composite layers, continuously bonded to panel frame.
 - c. Panel Hinges: Full leaf butt hinges, attached directly to the panel frame. Welded hinge anchor plates within panel shall further support hinge mounting to frame. Hinges mounted into panel edge or vertical astragal are not acceptable.
 - d. Panels shall not require trim on the vertical edges and shall create a minimal groove at panel-to-panel joints.
 - e. Panel weight shall be 9 pounds per square foot.
 - f. System must be adhere to STC 50 minimum.
 - 3. Panel Finish:
 - a. Reference Interior Design Construction Drawings for finish selection.
 - 4. Sound Seals:
 - a. Vertical interlocking sound seals between panels (astragals) of a reversible tongue and groove configuration shall be required in each panel edge, permitting universal panel operation. Astragals shall be steel for maximum durability and fire resistance. Rigid plastic astragals or astragals in only one panel edge are not acceptable.
 - b. Horizontal top and bottom seals shall be continuous contact extruded vinyl bulb shape with pairs of non-contacting vinyl fingers to prevent distortion and no mechanically operated parts.
 - 5. Suspension System:
 - a. Track shall be minimum 11 gauge roll-formed steel. Track shall be supported by adjustable steel hanger brackets connected to structural support by pairs of 0.38 inch diameter threaded rods. Brackets must support the load bearing surface of the track.

- b. Exposed track soffit shall be all steel, integral to the track and prime painted. Wood or aluminum soffits are not acceptable.
 - c. Each panel (except hinged panels) shall have one all-steel trolley with steel tired ball-bearing wheels. Nylon or plastic tires are not acceptable.
6. Required Blocking:
- a. Provide all required blocking for support of head and jamb members, including in-wall blocking at stack pocket and in-wall blocking at leading edge wall intersection.

PART 3 EXECUTION

3.01 PREPARATION

- A. Preparation of opening shall be by General Contractor. Any deviation of site conditions contrary to approved shop drawings shall be called to the attention of the Architect prior to commencement of installation.

3.02 DELIVERY AND STORAGE

- A. Delivery to the job site shall be coordinated by General Contractor. Proper storage of partitions before installation and continued protection during and after installation shall be the responsibility of the General Contractor.

3.03 INSTALLATION

- A. Installation shall be by an authorized factory trained installer. Installation shall be in accordance with ASTM E557 installation procedure.

3.04 WORKMANSHIP

- A. The complete installation of the operable wall system as called for and detailed on the Drawings shall be provided in strict accordance with the drawings and manufacturers standard printed specifications, instructions and recommendations.

3.05 OPERABLE PANEL PARTITION SCHEDULE

Room ID	Type	Quantity	Description
101/102	1	1	Operable panel partition system for ~27'-6" wide x 10'-0" high opening between Group 1 [101] and Group 2 [102]. System shall include optional Remote Expandable Jamb Closure with Type II Pocket Door Assembly, with leading edge intersection (t-intersection) at wall.
103/104	1	1	Operable panel partition system for ~21'-0" wide x 10'-0" high opening between Group 3 [103] and Group 4 [104]. System shall include optional Remote Expandable Jamb Closure with Type II Pocket Door Assembly, with leading edge intersection (t-intersection) at wall.

END OF SECTION

SECTION 102600

WALL PROTECTION SPECIALITES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Corner guards.

1.02 RELATED SECTIONS

- A. Section 061000 - Rough Carpentry: Support for wall-mounted items.
- B. Section 092116 - Gypsum Board Systems: Steel channel supports for corner guard and crash rail anchors.

1.03 REFERENCES

- A. ANSI A117.1 - Specifications for Making Buildings and Facilities Accessible To and Usable By Physically Handicapped People.

1.04 PERFORMANCE REQUIREMENTS

- A. Corner Guards and Handrails: Resist lateral impact force of 100 lbs at any point without damage or permanent set.

1.05 SUBMITTALS

- A. Submit under provisions of Section 013000.
- B. Product Data: Indicate physical dimensions, features, wall mounting brackets with mounted measurements, anchorage details, and rough-in measurements.
- C. Samples: Submit two sections of corner guard 24 inches long, illustrating component design, configuration, color and finish.
- D. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

1.06 QUALITY ASSURANCE

- A. Perform Work in accordance with ANSI A117.1 and requirements for the physically handicapped.

1.07 FIELD MEASUREMENTS

- A. Verify that field measurements are as indicated on Drawings and as instructed by the manufacturer.

1.08 COORDINATION

- A. Coordinate Work under provisions of Section 010390.
- B. Coordinate the Work with wall or partition sections for installation of concealed support or anchor devices.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Pawling Corp., Standard Products (Wassaic, NY).
- B. Construction Specialties, Inc. (Muncy, PA).
- C. InPro Corporation (Muskego, WI).
- D. Substitutions: Under provisions of Section 016000.

2.02 WALL AND CORNER GUARDS – BASIS OF DESIGN

- A. (Type WP1) Corner Guards
 - 1. Reference Interior Design Construction Drawings and Finish Schedule for corner guard manufacturers, profile details and colors.
 - 2. Substitutions: Under provisions of Section 016000.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify site conditions under provisions of Section 010390.
- B. Verify that rough-in for components are correctly sized and located.

3.02 INSTALLATION

- A. Install components in accordance with manufacturer's instructions, level and plumb, secured rigidly in position to wall framing members only.

END OF SECTION

SECTION 104400

FIRE PROTECTION SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Fire extinguishers.
- B. Detention fire extinguisher cabinets.
- C. Accessories.

1.02 RELATED SECTIONS

- A. Section 061000 - Rough Carpentry: Wood blocking and shims required at all fire extinguisher cabinet and bracket locations.

1.03 REFERENCES

- A. ANSI/NFPA 10 - Portable Fire Extinguishers.
- B. ANSI/UL 92 - Fire Extinguisher and Booster Hose.
- C. ANSI/UL 711 - Rating and Fire Testing of Fire Extinguishers.
- D. UL 8 - Foam Fire Extinguishers.
- E. UL 154 - Carbon Dioxide Fire Extinguishers.
- F. UL 299 - Dry Chemical Fire Extinguishers.
- G. UL 626 - 2 1/2 Gallon Stored Pressure, Water Type Fire Extinguishers.
- H. UL 1093 - Halogenated Agent Fire Extinguishers.

1.04 SUBMITTALS

- A. Submit under provisions of Section 013000.
- B. Shop Drawings: Indicate cabinet physical dimensions, rough-in measurements for recessed cabinets, wall bracket mounting measurements, and locations.
- C. Product Data: Provide extinguisher operational features, color and finish, and anchorage details.
- D. Manufacturer's Installation Instructions: Indicate special criteria and wall opening coordination requirements.
- E. Manufacturer's Certificate: Certify that Products meet or exceed specified requirements.

1.05 OPERATION AND MAINTENANCE DATA

- A. Submit under provisions of Section 017000.
- B. Maintenance Data: Include test, refill or recharge schedules and re-certification requirements.

1.06 QUALITY ASSURANCE

- A. Provide units conforming with NFPA 10.
- B. Maintain one copy of document on site.

1.07 REGULATORY REQUIREMENTS

- A. Conform to applicable codes for requirements for extinguishers.

1.08 ENVIRONMENTAL REQUIREMENTS

- A. Do not install extinguishers when ambient temperature may cause freezing of extinguisher ingredients.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Larsens Manufacturing Co. (Minneapolis, MN).
- B. Substitutions: Under provisions of Section 016000.

2.02 FIRE EXTINGUISHERS, CABINETS AND ACCESSORIES

- A. (Type 1) Detention Fire Extinguisher Cabinet and Extinguisher in Non-Fireresistance Rated Partition:
 - 1. Extinguisher: Model MP10 Multi-Purpose Dry Chemical Fire Extinguishers as manufactured by Larsens Manufacturing Co.
 - 2. Cabinet: Model DEC-2409-R4 Semi-Recessed Solid Cabinet for non-fireresistance rated partitions as manufactured by Larsens Manufacturing Co. with locking system keyed to Owner's building master key system (Verify keyway with Owner).
 - a. Door Style: Solid.
 - b. Trim and Door Material: Stainless Steel.
 - c. Trim Projection/Shape: 3 1/2", rolled edge.
 - d. Lettering Style/Color: Vertical red lettering stating "FIRE EXTINGUISHER".
 - e. Mounting Height: 4'-6" AFF to top of extinguisher as mounted in cabinet.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify wall openings under provisions of Section 010390.
- B. Verify rough openings for cabinet are correctly sized and located.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install cabinets plumb and level in wall openings. Verify mounting heights with Architect prior to commencement of construction.
- C. Secure rigidly in place.
- D. Place extinguishers and accessories in cabinets or on wall brackets as indicated.

END OF SECTION

SECTION 123200

LAMINATE CLAD CASEWORK

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Fixed modular laminate clad casework and components.
- B. Custom laminate clad casework and components.
- C. Plastic laminate clad and solid surface countertops.

1.02 RELATED WORK

- A. Section 061000 - Rough Carpentry: Blocking in walls where required.
- B. Section 064100 - Architectural Woodwork: Millwork and trim.
- C. Section 096500 - Resilient Base.
- D. Divisions 20 through 28 - Mechanical and Electrical: Sinks and service fixtures, service and waste lines and all connections, vents, electrical service fixtures, hoods and ducting within or adjacent to casework or otherwise required.

1.03 DEFINITIONS

- A. Identification of casework components and related products by surface visibility.
 - 1. Open Interiors: Any open storage unit without solid door or drawer fronts and units with full glass insert doors and/or acrylic doors.
 - 2. Closed Interiors: Any closed storage unit behind solid door or drawer fronts, sliding solid doors.
 - 3. Exposed Ends: Any storage unit exterior side surface that is visible after installation.
 - 4. Other Exposed Surfaces: Faces of doors and drawers when closed, and tops of cabinets less than 72 inches above furnished floor.
 - 5. Semi-Exposed Surfaces: Interior surfaces which are visible, bottoms of wall cabinets and tops of cabinets 72 inches or more above finished floor.
 - 6. Concealed Surfaces: Any surface not visible after installation.

1.04 QUALITY ASSURANCE

- A. Manufacturer: Minimum of 5 years experience in providing manufactured casework systems for similar types of projects, produce evidence of financial stability, bonding capacity, and adequate facilities and personnel required to perform on this Project.
- B. AWI Certification: The selected manufacturer shall be AWI CERTIFIED.

1.05 SUBMITTALS

- A. Submit under provisions of Section 013000.
- B. Product Data: Manufacturer's catalog with specifications and construction details.

- C. Shop Drawings: Indicate dimensions, description of materials and finishes, general construction, specific modifications, component connections, anchorage methods, hardware, and installation procedures, plus the following specific requirements.
 - 1. Include Section Drawings of typical and special casework, work surfaces and accessories.
 - 2. Indicate locations of plumbing and electrical service field connection by others.
- D. Casework Samples:
 - 1. Base cabinet: Cabinet conforming to specifications, with drawer and door.
 - 2. Wall cabinet: Cabinet conforming to specifications, with door.
 - 3. Cabinet samples shall be complete with specified hardware for doors, drawers and shelves.
 - 4. Component samples: Two sets of samples for each of the following:
 - a. Decorative laminate color charts.
 - b. PVC edgings.

1.06 PRODUCT HANDLING

- A. Deliver completed laminate clad casework, countertops, and related products only after wet operations in building are completed, store in ventilated place, protected from the weather, with relative humidity range of 20 percent to 50 percent.
- B. Protect finished surfaces from soiling and damage during handling and installation with a protective covering.

1.07 JOB CONDITIONS

- A. Environmental Requirements: Do not install casework until permanent HVAC systems are operating and temperature and humidity have been stabilized for at least 1 week.
 - 1. Manufacturer/Supplier shall advise Contractor of temperature and humidity requirements for architectural casework installation areas.
 - 2. After installation, control temperature and humidity to maintain relative humidity between 25 percent and 55 percent.
- B. Conditions: Do not install casework until interior concrete work, masonry, plastering and other wet operations are complete.

1.08 REGULATORY REQUIREMENTS

- A. Conform to ANSI A117.1 code for access for the handicapped.
- B. Conform to Americans with Disabilities Act (ADA) "Accessibility Guidelines for Buildings and Facilities" for access for the handicapped.

1.09 WARRANTY

- A. Lifetime Guarantee and Limited Warranty to the original Owner against defective material and fabrication for as long as they own the product. Warranty shall cover cost replacement and/or repair only, manufacturer will correct defects in material and/or fabrication without charge.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Manufacturers:

1. Construction Drawings and specifications are based on manufacturer's literature from TMI Systems Design Corporation (Dickinson, ND). Product: Fixed modular and custom casework and accessories as indicated in Construction Drawings and as follows:
 - a. Base cabinets indicated to be 31" in height shall be manufacturer's standard 29 1/8" height base cabinets (30 5/8" to top of countertop) with 2" aprons at all kneespaces (including pencil drawers and keyboard trays) as required to maintain 27" minimum high knee clearance per ADA requirements.
 - b. Base cabinets indicated to be 34" in height shall be manufacturer's standard 31 5/8" height base cabinets (33 1/8" to top of countertop).
 - c. Base cabinets indicated to be 36" in height shall be manufacturer's standard 35 3/8" height base cabinets (36 7/8" to top of countertop) with 2" aprons at all kneespaces (including pencil drawers and keyboard trays).
 - d. Wall cabinets indicated to be 15" in height shall be manufacturer's standard 15 1/4" height wall cabinets.
 - e. Wall cabinets indicated to be 30" in height shall be manufacturer's standard 31 5/8" height wall cabinets.
 - f. Full-height cabinets indicated to be 86" in height shall be manufacturer's standard 84 1/2" height full-height cabinets.
2. Comparable systems meeting all requirements contained within this Section from the following manufacturers shall be acceptable:
 - a. LSI Corporation of America, Inc. (Minneapolis, MN).
 - b. Stevens Industries (Teutopolis, IL).
 - c. PolyVision Corporation (Suwanee, GA).

B. Substitutions:

1. It is the intent of this specification to establish performance and quality criteria consistent with pre-established standards of design and function herein described. Casework systems not meeting these minimum standards will not be accepted.
2. Where specific materials, finish options, construction details, modularity, hardware, and test data are specified herein, the casework storage system will be held in strict compliance. Substitutions will be only considered prior to bid date provided request is submitted to the Architect in writing no later than ten (10) days prior to bid date. Substitution requests shall list any and all deviations from the specified system. Requests later than ten (10) days prior to bid will not be considered. Acceptable substitutions will be identified in future Addenda.

2.02 MATERIALS

A. Core Materials:

1. Particleboard up to 7/8 inch thick: Industrial Grade average 47-pound density particleboard, ANSI A 208.1-1993, M-3.
2. Particleboard 1 inch thick and thicker: Industrial Grade average 47-pound density particle-board, ANSI A 208.1-1993, M-2.

3. MR Moisture Resistant Particleboard: Average 47-pound density particleboard, ANSI A 208.1 1-1993, M-3.
 4. Medium Density Fiberboard: Average 47-pound density grade, ANSI A 208.2.
- B. Hardboard: 1/4 inch thick prefinished hardboard, CS-251.
- C. Decorative Laminates:
1. High-pressure decorative laminate VGS (.028), NEMA Test LD 3-1995.
 2. High-pressure decorative laminate HGS (.048), NEMA Test LD 3-1995.
 3. High-pressure decorative laminate HGP (.039), NEMA Test LD 3-1995.
 4. High-pressure cabinet liner CLS (.020), NEMA Test LD 3-1995.
 5. High-pressure backer BKH (.048), (.039), (.028), NEMA Test LD3-1995.
 6. Thermally fused melamine laminate, NEMA Test LD 3-1995.
- D. Chemical-Resistant decorative laminate, NEMA Test LD 3-1995.
- E. Laminate Color Selection: Maximum 1 color per unit face and 5 colors per Project.
- F. Edging Materials:
1. 1mm PVC banding.
 2. 3mm PVC banding, machine profiled to 1/8 inch radius.
- G. Glass:
1. Wall unit full sliding glass doors: 1/4 inch laminated safety glass.
 2. Glass insert doors, hinged or sliding base, wall, or tall cabinets: 1/4 inch laminated safety glass.
 3. Sliding doors mounted in aluminum track.
 4. Trim glass inserts: Extruded rigid PVC.
- 2.03 SPECIALTY ITEMS
- A. Support Members: Furniture grade, epoxy powder coated steel in color as selected by Architect.
1. Countertop Support Brackets:
 - a. Model EH1818P Extra Heavy-Duty Countertop bracket as manufactured by Richelieu Hardware or Knee Saver Support as manufactured by Iron Shore, Inc. (Ashby, MA).
 2. Undercounter support frames.
 3. Legs.
- 2.04 CABINET HARDWARE
- A. Hinges:
1. Concealed 125-degree swing, self-closing, clip-on style, Blum No. 77M5580.
 - a. Doors up to 34 inches in height have 2 hinges per door.
 - b. Doors 35 inches to 62 inches in height have 3 hinges per door.
 - c. Doors 63 inches to 80 inches in height have 4 hinges per door.
 - d. All doors have rubber bumpers.

B. Pulls:

1. Door and drawer front pulls shall be flush-mount, semi-recessed style, ABS plastic. Pull design shall comply with the Americans with Disability Act (ADA).

C. Drawer Slides:

1. Regular, kneespace and pencil: 100-pound load rated epoxy coated steel, bottom corner mounted with smooth and quiet nylon rollers. Positive stop both directions with self-closing feature. Paper storage, 150-pound load rated epoxy coated steel slides.
2. File: Full extension, 150-pound load rated epoxy coated steel, bottom corner mounted with smooth and quiet nylon rollers. Positive stop both directions with self-closing feature.

D. Adjustable Shelf Supports:

1. Injection molded transparent polycarbonate friction fit into cabinet end panels and vertical dividers, adjustable on 32mm centers. Each shelf support has 2 integral support pins, 5mm diameter, to interface pre-drilled holes, and to prevent accidental rotation of support. The support automatically adapts to 3/4 inch or 1 inch thick shelving and provides non-tip feature for shelving. Supports may be field fixed if desired. Structural load to 1200 pounds (300 pounds per support) without failure.

E. Locks:

1. National #M49054, removable core, disc tumbler, cam style lock with strike. Furnish 2 keys. Lock for sliding 3/4 inch doors is a disc type plunger lock, sliding door type with strike. Provide grandmaster / master keying system for all casework locks on Project.
2. Automatic door bolt, Hafele #530-1604, used to secure inactive door on all locked cabinets.

F. Sliding Door Track: Anodized aluminum double channel.

G. Coat Rods: 1 inch diameter, 14-gauge chrome plated steel installed in captive mounting hardware. Provide at all wardrobe units.

H. File Suspension System: 14-gauge steel file suspension rails, epoxy powder coated. File followers, or other split bottom hardware, are not acceptable.

2.05 FABRICATION

A. Fabricate casework, countertops and related products to dimensions, profiles, and details shown.

B. Cabinet Body Construction:

1. Tops and bottoms are glued and doweled to cabinet sides and internal cabinet components such as fixed horizontals, rails and verticals. Minimum 6 dowels each joint for 24 inch deep cabinets and a minimum of 4 dowels each joint for 12 inch deep cabinets.
 - a. Tops, bottoms and sides of all cabinets are 3/4 inch thick particleboard core.

2. Cabinet backs: 1/4 inch thick prefinished hardboard. Wall and tall cabinets are provided with a 1 inch x 1-3/4 inch PVC mounting strip used to secure the cabinet to the wall.
 - a. Exposed back on fixed or movable cabinets: 3/4 inch particleboard with the exterior surface finished in VGS laminate as selected.
3. Fixed base and tall units have an individual factory-applied base, constructed of 3/4 inch exterior grade plywood. Base is 96mm (nominal 4 inch) high unless otherwise indicated on the Drawings.
4. Base units, except sink base units: Full sub-top. Sink base units are provided with open top, a welded steel/epoxy painted sink rail full width at top front edge concealed behind face rail/doors, a split back removable access panel.
5. Side panels and vertical dividers shall receive adjustable shelf hardware at 32mm line boring centers. Mount door hinges, drawer slides and pull-out shelves in the line boring for consistent alignment.
6. Exposed and semi exposed edges.
 - a. Edging: 1mm PVC match edge.
7. Adjustable shelf core: 3/4 inch thick particleboard up to 30 inches wide, 1 inch thick particleboard over 30 inches wide.
 - a. All four edges: 3mm PVC.
8. Interior finish, units with open Interiors:
 - a. Top, bottom, sides, horizontal and vertical members, and adjustable shelving faces with VGS high-pressure decorative laminate with matching prefinished back.
9. Interior finish, units with closed Interiors:
 - a. Top, bottom, sides, horizontal and vertical members, and adjustable shelving faces with thermally fused melamine laminate with matching prefinished back.
10. Exposed ends:
 - a. Faced with VGS high-pressure decorative laminate.
11. Wall unit bottom:
 - a. Faced with VGS high-pressure decorative laminate.
12. Wall and tall unit tops:
 - a. Top surface is faced with VGS high-pressure decorative laminate.
13. Balanced construction of all laminated panels is mandatory. Unfinished core stock surfaces, even on concealed surfaces (excluding edges), not permitted.

C. Drawers:

1. Sides, back and sub front: Minimum 1/2 inch thick particleboard, laminated with thermally fused melamine doweled and glued into sides. Top edge banded with 1mm PVC.

2. Drawer bottom: Minimum 1/2 inch thick particleboard laminated with thermally fused melamine, screwed directly to the bottom edges of drawer box.
3. Paper storage drawers: Minimum 3/4 inch thick particleboard sides, back, and sub front laminated with thermally fused melamine. Minimum 1/2 inch thick particleboard drawer bottoms screwed directly to the bottom edges of the drawer box. Provide PVC angle retaining bar at the rear of the drawer.

D. Door/Drawer Fronts:

1. Core: 3/4 inch thick particleboard.
2. Provide double doors in opening in excess of 24 inches wide.
3. Faces:
 - a. Exterior: VGS High-pressure decorative laminate.
 - b. Interior: High-pressure cabinet liner CLS.
4. Door/drawer edges: 1mm PVC.
5. Miscellaneous Shelving:
 - a. Core material: 3/4 inch or 1 inch particleboard.
 - b. Exterior: VGS High-pressure decorative laminate.
 - c. Edges: 3mm PVC, external edges and outside corners machine profiled to 1/8 inch radius.

2.06 DECORATIVE LAMINATE COUNTERTOPS

- A. All countertops not designated as solid surface in Construction Drawings shall be 1 1/2" thick with square-edge fronts and 4" high backsplashes. Tops shall be constructed of 3/4" particleboard with 3/4" additional front, side, and back build-ups. All countertops are to be laminated with HGS high-pressure decorative laminate with balanced backer sheeting.

PART 3 EXECUTION

3.01 INSPECTION

- A. The casework contractor must examine the job site and the conditions under which the Work under this Section is to be performed, and notify the building Owner in writing of unsatisfactory conditions. Do not proceed with Work under this Section until satisfactory conditions have been corrected in a manner acceptable to the installer.

3.02 PREPARATION

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

3.03 INSTALLATION

- A. Erect casework, plumb, level, true and straight with no distortions. Shim as required. Where laminate clad casework abuts other finished work, scribe and cut to accurate fit.
- B. Adjust casework and hardware so that doors and drawers operate smoothly without warp or bind.
- C. Repair minor damage per plastic laminate manufacturer's recommendations. Replace other damaged cabinets or materials.

3.04 CLEANING

- A. Leave cabinets broom clean inside and out. Wipe off fingerprints, pencil marks, and surface soil etc., in preparation for final cleaning by the building Owner.
- B. Remove and dispose of all packing materials and related construction debris.

3.05 COLOR SELECTION

A. Laminate Color Selection:

- 1. As selected from the full range of Wilsonart®, Nevamar®, Pionite®, and Formica® stock color charts for cabinet faces, exposed ends, open interiors, and countertops and/or as indicated on Interior Design Construction Drawings.

B. Hinge and Pull Color Selection:

- 1. As selected from stock colors of casework manufacturer and including (matched to Wilsonart®) Frosty White, Light Beige, Dove Grey, Slate Grey, Black and Chrome.

C. Miscellaneous Hardware Color Selection (support brackets, table frames, rail):

- 1. As selected from stock colors of casework manufacturer and including (matched to Wilsonart®) Frosty White, Light Beige, Dove Grey, Slate Grey and Black.

D. 1mm PVC Edge Banding Color Selection:

- 1. As selected from solid, patterned and woodgrains matching laminate colors.

E. 3mm PVC Edge Banding Color Selection:

- 1. As selected from stock colors of casework manufacturer of 3mm PVC and including (matched to Wilsonart®) Frosty White, Light Beige, Dove Grey, Slate Grey, Black.

END OF SECTION

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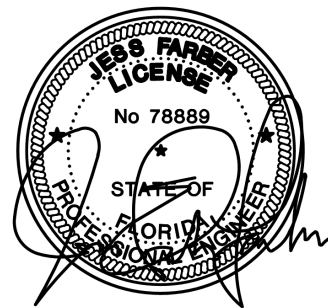
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DIVISION 20 – MECHANICAL

SECTION 200100 - GENERAL PROVISIONS - MECHANICAL

PART 1 – GENERAL:

- 1.1 The Advertisement for Bid, Instructions to Bidders, Bidding Requirements, General, Special and Supplementary Conditions, and all other Contract Documents shall apply to the Contractor's work as well as to each of their Sub-Contractor's work.
- 1.2 All manufacturers, suppliers, fabricators, contractors, etc. submitting proposals for any part of the work, services, materials or equipment to be used on or applied to this project are hereby directed to familiarize themselves with the Contract Documents. In case of conflict between these General Provisions and the General and/or Special Conditions, the Contractor shall contact the Engineer for clarification and final determination prior to the Bid.
- 1.3 The work included in this Division consists of the furnishing of all labor, equipment, transportation, excavation, backfill, supplies, material, appurtenances and services necessary for the satisfactory installation of the complete and operating Mechanical Systems indicated or specified in the Contract Documents.
- 1.4 Any materials, labor, equipment or services not mentioned specifically herein which may be necessary to complete any part of the Mechanical Systems in a substantial manner, in compliance with the requirements stated, implied or intended in the Plans and/or Specifications, shall be included in the Bid as part of this Contract.
- 1.5 It is not the intent of this Section of the Specifications to make any Contractor, other than the General Contractor responsible to the Owner. All transactions such as submittal of shop drawings, claims for extra costs, requests for equipment or materials substitution, shall be routed through the General Contractor to the Architect, then to the Engineer. Also, this Section of the Specifications shall not be construed as an attempt to arbitrarily assign responsibility of work, material, equipment or services to a particular trade or Contractor. Unless stated otherwise, the subdivision and assignment of work under the various sections shall be coordinated at the Contractors discretion.
- 1.6 The Architect and Engineer do not define the scope of individual trades, subcontractors, material suppliers and vendors. Any sheet numbering system or specification numbering system used which identifies disciplines is solely for the Architect and Engineer's convenience and is not intended to define a subcontractor's scope of work. Information regarding individual trades, subcontractors, material suppliers and vendors may be detailed, described and indicated at different locations throughout the Contract Documents. No consideration will be given to requests for change orders for failure to obtain and review the complete set of Contract Documents when preparing Bids, prices and quotations. Unless stated otherwise, the subdivision and assignment of work under the various sections shall be the responsibility of the Contractor holding the prime contract.
- 1.7 It is the intent of the Contract Documents to deliver to the Owner a new, complete and operational project once the work is complete. Although Plans and Specifications are complete to the extent possible, it shall be the responsibility of the Contractors involved to remove and/or relocate or re-attach any existing or new systems which interfere with new equipment or materials required for the complete installation without additional cost to the Owner.
- 1.8 In general, all work shall be accomplished without interruption of existing facilities operations. The Contractor shall advise the Owner at least forty-eight (48) hours prior to the interruption of any services (domestic water, heating, etc.). The Owner shall be advised of the exact time that interruption will occur and the length of time the interruption will last. Failure to comply with this

requirement may result in complete work stoppage for the Contractors involved until a complete schedule of interruptions can be developed.

1.9 Whenever utilities are interrupted, either deliberately or accidentally, the Contractor shall work continuously to restore said service. The Contractor shall provide tools, materials, skilled journeymen of Bidder/Proposer's own and other trades as necessary, premium time as needed and coordination with all applicable utilities, including payment of utility company charges (if any), all without requests for extra compensation to the Owner.

1.10 Each Bidder/Proposer shall also be governed by any unit prices and Addenda insofar as they may affect part of their work or services.

1.11 Definitions and Abbreviations:

- Contractor - Any Contractor whether bidding, proposing or working independently or under the supervision of a General Contractor, Prime Contractor, Construction Manager and who installs any type of Mechanical Work as specified in the Contract Documents or, the General Contractor.
- Engineer - The Consulting Mechanical-Electrical Engineer either consulting to the Owner, Architect, or Other, etc. In this case: CMTA, Inc., Consulting Engineers.
- Architect - The Architect of Record for the project.
- Contract Documents - All documents pertinent to the quality and quantity of work to be performed on this project. Includes, but not limited to: Plans, Specifications, Instructions to Bidders, General and Special Conditions, Addenda, Alternates, Lists of Materials, Lists of Sub-Contractors, Unit Prices, Shop Drawings, Field Orders, Change Orders, Cost Breakdowns, Schedules of Value, Periodical Payment Requests, Construction Contract with Owner, etc.
- Bidder/Proposer - Any person, agency or entity submitting a proposal to any person, agency or entity for any part of the work required under this contract.
- The Project - All of the work required under this Contract.
- Furnish - Deliver to the site in good condition and turn over to the Contractor who is to install.
- Provide - Furnish and install complete, tested and ready for operation.
- Install - Receive and place in satisfactory operation.
- Indicated - Listed in the Specifications, shown on the Plans or Addenda thereto.
- Typical or Typ.- Where indicated repeat this work, method or means each time the same or similar condition occurs whether indicated or not.
- ADA - Americans with Disabilities Act.
- ANSI - American National Standards Institute.
- ASHRAE - American Society of Heating, Refrigeration and Air Conditioning Engineers.
- ASME - American Society of Mechanical Engineers.
- IBC - International Building Code.
- NEC - National Electrical Code.
- NEMA - National Electrical Manufacturers Association.
- NFPA - National Fire Protection Association.
- OSHA - Office of Safety and Health Administration.
- SMACNA - Sheet Metal and Air Conditioning Contractors National Association.
- UL - Underwriters Laboratories.

PART 2 – INTENT AND INTERPRETATION:

2.1 It is the intention of the Contract Documents to call for a complete and operational system, including all components, accessories, finish work, etc as necessary for trouble free operation; tested and ready for operation. Anything that may be required, implied, or inferred by the Contract Documents shall be provided and included as part of the Bid.

- 2.2 All Contractors and Vendors providing a bid for this project shall review the Plans and Specifications and determine any modifications and/or adjustments necessary relative to the proposed equipment and materials with specific manufacturer's installation requirements. Include in the bid any necessary installation methods, features, options, accessories, etc. necessary to install the proposed equipment and materials, regardless of whether used as basis of design or being offered as a substitution in accordance with the specific manufacturer's installation requirements whether specifically detailed or not within the Plans and Specifications.
- 2.3 Details not usually shown or specified, but necessary for the proper installation and operation of systems, equipment, materials, etc., shall be included in the work, the same as if herein specified or indicated.
- 2.4 The Bidder/Proposer shall completely review the Contract Documents. Any interpretation as to design intent or scope shall be provided by the Engineer / Architect. Should an interpretation be required, the Bidder/Proposer shall request a clarification not less than ten (10) days prior to the submission of the proposal so that the condition may be clarified by Addendum. In the event of any conflict, discrepancy, or inconsistency develops; the interpretation of the Engineer shall be final.
- 2.5 The Contractor shall give written notice of any materials or apparatus believed inadequate or unsuitable; in violation of laws, ordinances, rules or regulations of authorities having jurisdiction; and any necessary items of work omitted a minimum of ten days prior to bid. In the absence of such written notice and by the act of submitting a bid, it shall be understood that the Contractor has included the cost of all required items in the bid, and that will be responsible for the approved satisfactory functioning of the entire system without extra compensations.

PART 3 – INDEMNIFICATION:

- 3.1 The Contractor shall hold harmless and indemnify the Engineer, employees, officers, agents and consultants from all claims, loss, damage, actions, causes of actions, expense and/or liability resulting from, brought for, or on account of any personal injury or property damage received or sustained by any person, persons, (including third parties), or any property growing out of, occurring, or attributable to any work performed under or related to this contract, resulting in whole or in part from the negligence of the Contractor, any subcontractor, any employee, agent or representative.

PART 4 – PLANS AND SPECIFICATIONS:

- 4.1 The Plans are diagrammatic only and indicate the general arrangement of the systems and are to be followed. If deviations from the layouts are necessitated by field conditions, detailed layouts of the proposed departures shall be submitted to the Engineer for approval before proceeding with the work. The Plans are not intended to show every item which may be necessary to complete the systems. All Bidder/Proposers shall anticipate that additional items may be required and submit their Bid accordingly.
- 4.2 The Plans and Specifications are intended to supplement each other. No Bidder/Proposer shall take advantage of conflict between them, or between parts of either. Should this condition exist, the Bidder/Proposer shall request a clarification not less than ten (10) days prior to the submission of the proposal so that the condition may be clarified by Addendum. In the event that such a condition arises after work is started, the interpretation of the Engineer shall be final.
- 4.3 The Plans and Specifications shall be considered to be cooperative and anything appearing in the Specifications which may not be indicated on the Plans or conversely, shall be considered as part of the Contract and must be executed the same as though indicated by both.

- 4.4 Contractor shall make all of their own measurements in the field and shall be responsible for correct fitting. The work shall be coordinated with all other branches of work in such a manner as to cause a minimum of conflict or delay.
- 4.5 The Engineer shall reserve the right to make adjustments in location of piping, ductwork, equipment, etc. where such adjustments are in the interest of improving the project.
- 4.6 Should conflict, overlap or duplication of work between the various trades become evident, this shall be called to the attention of the Engineer. In such event neither trade shall assume to be relieved of the work which is specified under their branch until instructions in writing are received from the Engineer.
- 4.7 Unless dimensioned, the Plans only indicate approximate locations of equipment, piping, ductwork, etc. Dimensions given in figures on the Plans shall take precedence over scaled dimensions and all dimensions, whether given in figures or scaled, shall be verified in the field to insure no conflict with other work.
- 4.8 Each Bidder/Proposer shall review all Plans in the Contract Documents to insure that the work they intend to provide does not create a conflict with or affect the work of others in any way. Where such effect does occur it shall be the Bidder/Proposer's responsibility to satisfactorily eliminate any such conflict or effect prior to the submission of their proposal. Each Bidder/Proposer shall in particular insure that there is adequate space to install their equipment and materials. Failure to do so shall result in the correction of such encroachment conflict or effect of any work awarded the Bidder/Proposer and shall be accomplished fully without expense to others and that they are reasonably accessible for maintenance. Check closely all mechanical and electrical closets, chases, ceiling voids, wall voids, crawl spaces, etc., to insure adequate spaces.
- 4.9 Where on the Plans a portion of the work is drawn out and the remainder is indicated in outline, or not indicated at all, the parts drawn out shall apply to all other like portions of the work. Where ornamentation or other detail is indicated by starting only, such detail shall be continued throughout the courses or parts in which it occurs and shall also apply to all other similar parts of the work, unless otherwise indicated.
- 4.10 Details not usually shown or specified, but necessary for the proper installation and operation of systems, equipment, materials, etc., shall be included in the work, the same as if herein specified or indicated.
- 4.11 Where within the Contract Documents the word "typical" or "typ." is used, it shall mean that the work method or means indicated as typical shall be repeated in and each time it occurs whether indicated or not.
- 4.12 Each Contractor shall evaluate ceiling heights specified on Architectural Plans. Where the location of equipment or systems may interfere with ceiling heights or maintenance and access of equipment or systems, the Contractor shall call this to the attention of the Engineer in writing prior to making the installation. Do not install equipment or systems in the affected area until the conflict is resolved. Any such changes shall be anticipated and requested sufficiently in advance so as to not cause extra work or cost incurred on the part of the Contractor or unduly delay the work.
- 4.13 The Contractor shall provide layout confirmation of the restroom plumbing fixtures, floor penetrations, wall location, etc. to verify installation requirements and provide the Code required clearances.

PART 5 – EXAMINATION OF SITE AND CONDITIONS:

- 5.1 Each Bidder/Proposer shall inform themselves of all of the conditions under which the work is to be performed, the site of the work, the structure of the ground, above and below grade, the obstacles that may be encountered, the availability and location of necessary facilities and all relevant matters concerning the work.
- 5.2 Each Bidder/Proposer shall also fully acquaint themselves with all existing conditions as to ingress and egress, distance of haul from supply points, routes for transportation of materials, facilities and services, availability of utilities, etc. A proposal shall cover all expenses or disbursements in connection with such matters and conditions. No allowance will be made for lack of knowledge concerning such conditions after Bids are accepted.
- 5.3 Existing concrete slab includes rebar throughout. All floor penetrations will require verification of location before core drilling to prevent cutting of rebar. All floor penetrations shall be X-rayed. Refer to plumbing drawings for addition information.

PART 6 – EQUIPMENT AND MATERIALS SUBSTITUTIONS OR DEVIATIONS:

- 6.1 When any Contractor requests approval of materials and/or equipment of different physical size, weight, capacity, function, color, access, that the design allows for it shall be understood that such substitution, if approved, will be made without additional cost to anyone other than the Contractor requesting the change regardless of changes in connections, space requirements, electrical characteristics, etc. from that indicated, electrical service, etc. In all cases where substitutions affect other trades, the Contractor requesting such substitutions shall advise all such Contractors of the change and shall compensate them for all necessary changes in their work. Any Plans, Specifications, Diagrams, etc., required to describe and coordinate such substitutions or deviations shall be professionally prepared at the responsible Contractor's expense. Review of Shop Drawings by the Engineer does not in any way absolve the Contractor of this responsibility.
- 6.2 Notwithstanding any reference in the Specifications to any article, device, product, material, fixture, form, or type of construction by name, make or catalog number, such reference shall be interpreted as establishing a standard of quality and shall not be construed as limiting competition; any devices, products, materials, fixtures, forms, or types of construction which, in the judgment of the Engineer, are equivalent to those specified are acceptable, provided the provisions of this Part are met. Requested substitutions shall be submitted to the Engineer a minimum of ten (10) days prior to Bid. If this procedure is not followed, the substitution will be rejected. If prevailing laws of cities, towns, states or countries are more stringent than these specifications regarding such substitutions, then those laws shall prevail over these requirements.
- 6.3 Wherever any equipment and material is specified exclusively only such items shall be used unless substitution is accepted in writing by the Engineer.
- 6.4 Each Bidder/Proposer shall furnish along with their proposal a list of specified equipment and materials which is to be provided. Where several makes are mentioned in the Specifications and the Contractor fails to state which they propose to furnish, the Engineer shall choose any of the makes mentioned without change in price. Inclusion in this list shall not insure that the Engineer will approve shop drawings unless the equipment, materials, etc., submitted in shop drawings are satisfactorily comparable to the items specified and/or indicated.
- 6.5 Ten (10) days prior to the submission of a proposal, each Bidder/Proposer shall give written notice to the Engineer of any materials or apparatus believed inadequate or unsuitable; in violation of laws, ordinances, rules or regulations of authorities having jurisdiction; and any necessary items of work

omitted. In the absence of such written notice, Bidder/Proposers signify that they have included the cost of all required items in the proposal and that the Bidder/Proposer will be responsible for the safe and satisfactory operation of the entire system.

PART 7 – CODES, RULES, PERMITS, FEES, INSPECTIONS, REGULATIONS, ETC.:

- 7.1 The Contractor shall give all necessary notices, obtain and pay for all permits, government sales taxes, fees, inspections and other costs, including all utility connections, meters, meter settings, taps, tap fees, extensions, etc. in connection with their work. They shall also file all necessary plans, prepare all documents and obtain all necessary approvals of all governmental departments and/or the appropriate municipality or utility company having jurisdiction, whether indicated or specified or not. They shall also obtain all required certificates of inspection for their work and deliver same to the Engineer before request for acceptance and final payment for the work.
- 7.2 Ignorance of Codes, Rules, Regulations, Laws, etc. shall not render the Contractor irresponsible for compliance. The Contractor shall also be versed in all Codes, Rules and Regulations pertinent to their part of the work prior to submission of a proposal.
- 7.3 The Contractor shall include in their work, without extra cost, any labor, materials, services, apparatus and Plans in order to comply with all applicable laws, ordinances, rules and regulations, whether or not indicated or specified.
- 7.4 All materials furnished and all work installed shall comply with the National Fire Codes of the National Fire Protection Association, with the requirements of local utility companies, or municipalities and with the requirements of all governmental agencies having jurisdiction.
- 7.5 All materials and equipment so indicated and all equipment and materials for the electrical portion of the mechanical systems shall bear the approval label of, or shall be listed by the Underwriters' Laboratories (UL), Incorporated. Each packaged assembly shall be approved as a package. Approval of components of a package shall not be acceptable.
- 7.6 All plumbing work is to be constructed and installed in accordance with applicable codes, Plans and Specifications which have been approved in their entirety and/or reflect any changes requested by the State Department of Health. Plumbing work shall not commence until such Plans are in the possession of the Plumbing Contractor.
- 7.7 All Heating, Ventilation and Air Conditioning work shall be accomplished in accordance with the Building Code and amendments thereto, the latest standards recognized by the American Society of Heating, Refrigerating and Air Conditioning and the National Fire Protection Association.
- 7.8 The Contractor shall furnish three (3) copies of all Final Inspection Certificates obtained to the Engineer when work is complete. Final payment for work will be contingent upon compliance with this requirement.
- 7.9 Where minimum code requirements are exceeded in the Design, the Design shall govern.
- 7.10 The Contractor shall insure that their work is accomplished in accord with the OSHA Standards and that they conduct their work and the work of their personnel in accord with same.
- 7.11 All work relating to the handicapped shall be in accord with regulations currently enforced by the Authority Having Jurisdiction and the American Disabilities Act.

- 7.12 All work in relation to domestic water systems shall, in addition to all other Codes, Rules, Regulations and Standards, be in compliance with the requirements of the local agency governing the installations.
- 7.13 All work in relation to the installation of sanitary or storm sewers shall, in addition to all other Codes, Rules, Regulations and Standards, be in compliance with the local agency governing the installations.
- 7.14 Discharge of any toxic, odorous or otherwise noxious materials into the atmosphere or any system shall be subject to regulations of the Environmental Protection Agency (EPA) and/or the air pollution control commission. If in doubt, contact the State Department for Environmental Protection.
- 7.15 Where conflict arises between any code and the Plans and/or Specifications, the code shall apply except in the instance where the Plans and Specifications exceed the requirements of the code. Any changes required as a result of these conflicts shall be brought to the attention of the Engineer at least ten (10) days prior to bid date, otherwise the Contractor shall make the required changes at their own expense.

PART 8 – QUALIFICATIONS OF CONTRACTOR/WORKERS:

- 8.1 All Mechanical Contractors and their subcontractors bidding this project must have been a licensed company for a minimum of three (3) years to qualify to Bid this project. Individual employee experience does not supercede this requirement.
- 8.2 All mechanical subcontractors bidding the mechanical work must have completed one project of 70% this subcontract cost size and two projects of 50% this subcontract cost size.
- 8.3 All mechanical work shall be accomplished by qualified workers competent in the area of work for which they are responsible. Untrained and incompetent workers, as evidenced by their workmanship, shall be summarily relieved of their responsibilities in areas of incompetency. The Engineer shall reserve the right to determine the quality of workmanship of any workers and unqualified or incompetent workers shall refrain from work in areas not deemed satisfactory. Requests for relief of a workers shall be made through the normal channels of Architect, Contractor, etc.
- 8.4 The Contractor shall hold all required licenses in the State which the work is to be performed.
- 8.5 All plumbing work shall be accomplished by Journeymen Plumbers under the direct supervision of a Master Plumber as defined under State Plumbing Law Regulations and Code. Proof and Certification may be requested by the Engineer.
- 8.6 The installation of all Heating, Ventilating and Air-Conditioning Systems (HVAC) by any Contractor, whether in existing or new building construction shall be performed by a Licensed Master HVAC Contractor. This includes any Contractor installing HVAC systems, piping and ductwork.
- 8.7 All sheet metal, insulation and pipe fitting work shall be installed by workers normally engaged in this type work.
- 8.8 All automatic control systems shall be installed by workers normally engaged or employed in this type work.
- 8.9 All special systems (Medical Gas, Automatic Sprinkler Equipment, etc.) shall be installed only by workers normally engaged in such services. Exception to this specification may only be made in writing by the Engineer.

- 8.10 All electrical work shall be accomplished by Licensed Journeymen electricians under the direct supervision of a licensed Electrician. All applicable codes, utility company regulations, laws and permitting authority of the locality shall be fully complied with by the Contractor.

PART 9 – SUPERVISION OF WORK:

- 9.1 The Contractor shall personally supervise the work for which they are responsible or have a competent superintendent, approved by the Engineer, on the work at all times during progress with full authority to act on behalf of the Contractor.

PART 10 – CONDUCT OF WORKERS:

- 10.1 The Contractor shall be responsible for the conduct of all workers under their supervision. Misconduct on the part of any worker to the extent of creating a safety hazard, or endangering the lives and property of others, shall result in the prompt relief of that worker. The consumption of alcoholic beverages or other intoxicants, narcotics, barbiturates, hallucinogens or debilitating drugs on the job site is strictly forbidden.

PART 11 – COOPERATION AND COORDINATION WITH OTHER TRADES:

- 11.1 The Contractor shall give full cooperation to all other trades and shall furnish in writing with copies to the Engineer, any information necessary to permit the work of other trades to be installed satisfactorily and with the least possible interference or delay.
- 11.2 Where any work is to be installed in close proximity to, or will interfere with work of other trades, each shall cooperate in working out space conditions to make a satisfactory adjustment. At all restricted ceiling cavity locations, at the unit connections or if so directed by the Engineer, the Contractor shall prepare composite working drawings and sections at a suitable scale not less than 1/4" = 1'-0", clearly indicating how their work is to be installed in relation to the work of other trades, or so as not to cause any interference with work of other trades. Make the necessary changes in the work to correct the condition without extra charge.
- 11.3 The Contractor shall furnish to other trades, as required, all necessary templates, patterns, setting plans, and shop details for the proper installation of work and for the purpose of coordinating adjacent work.

PART 12 – GUARANTEES AND WARRANTIES:

- 12.1 The Contractor shall guarantee all equipment, apparatus, materials, and workmanship entering into their Contract to the best of its respective kind and shall replace all parts at their own expense, which are proven defective within the time frame outlined in the General Conditions of the Contract. The effective date of completion of the work shall be the date of the Architect's/Engineer's Statement of Substantial Completion. Items of equipment which have longer guarantees, as called for in these Specifications, shall have warranties and guarantees completed in order, and shall be in effect at the time of final acceptance of the work by the Engineer. The Contractor shall present the Engineer with such warranties and guarantees at the time of final acceptance of the work. The Engineer shall then submit these warranties, etc. to the Owner. The Owner reserves the right to use equipment installed by the Contractor prior to date of final acceptance. Such use of equipment shall not invalidate the guarantee except that the Owner shall be liable for any damage to equipment during this period, due to negligence of their operator or other employees. Refer to other sections for any special or extra warranty requirements.
- 12.2 Provide all warranty certificates to Owner. All warranties begin starting at the substantial completion date, submit warranty certificates accordingly.

PART 13 – CHANGES IN MECHANICAL WORK:

13.1 REFER TO GENERAL AND SPECIAL CONDITIONS.

PART 14 – CLAIMS FOR EXTRA COST:

14.1 REFER TO GENERAL AND SPECIAL CONDITIONS.

PART 15 – MATERIALS AND WORKMANSHIP:

- 15.1 All equipment, materials and articles incorporated in the work shall be new and of comparable quality to that specified. Each Bidder/Proposer shall determine that the materials and/or equipment they propose to furnish can be brought into the building(s) and installed within the space available. In certain cases, it may be necessary to remove and replace walls, floors and/or ceilings and/or disassemble/reassemble the materials and equipment and this work shall be the responsibility of the Contractor, whether specifically initiated or not. All equipment shall be installed so that all parts are readily accessible for inspection, maintenance, replacement of fans, motors, coils, filters, etc. Extra compensation will not be allowed for relocation of equipment for accessibility or for dismantling equipment to obtain entrance into the building(s). Insure, through coordination that no other Contractor seals off access to space required for equipment materials, etc.
- 15.2 Materials and equipment shall bear Underwriters' Laboratories label where such a standard has been established, where applicable.
- 15.3 Use extreme care in the selection of equipment and its installation to insure that noise and vibration are kept at a minimum. The Engineer's determination shall be final and corrections to such discrepancies shall be made at the cost of the Contractor.
- 15.4 Each length of pipe, fitting, trap, fixture and device used in the plumbing or drainage systems shall be stamped or indelibly marked with the weight or quality thereof and with the manufacturer's mark or name.
- 15.5 All equipment shall bear the manufacturer's name and address. All electrically operated equipment shall bear a name plate indicating required horsepower, voltage, phase and ampacity. Pumps and fans shall have a data plate indicating horsepower, pressure and flow rate.

PART 16 – HAZARDOUS MATERIALS:

- 16.1 The Contractor is hereby advised that it is possible that asbestos and/or other hazardous materials are or were present in this building or site.
- 16.2 Any worker, occupant, visitor, inspector, etc., who encounters any material of whose content they are not certain shall promptly report the existence and location of that material to the Contractor and/or Owner. The Contractor shall, as a part of their work, insure that their workers are aware of this potential and what they are to do in the event of suspicion. The Contractor shall also keep uninformed persons from the premises during construction. Furthermore, the Contractor shall insure that no one comes near to or in contact with any such material or fumes therefrom until its content can be ascertained to be non-hazardous.
- 16.3 CMTA, Inc., Consulting Engineers, have no expertise in the determination of the presence of hazardous materials. Therefore, no attempt has been made by them to identify the existence or location of any such material. Furthermore, CMTA nor any affiliate thereof will neither offer nor make any recommendations relative to the removal, handling or disposal of such material.

- 16.4 If the work interfaces, connects or relates in any way with or to existing components which contain or bear any hazardous material, asbestos being one, then, it shall be the Contractor's sole responsibility to contact the Owner and so advise them immediately.
- 16.5 The Contractor by execution of the contract for any work and/or by the accomplishment of any work thereby agrees to bring no claim relative to hazardous materials for negligence, breach of contract, indemnity, or any other such item against CMTA, its principals, employees, agents or consultants. Also, the Contractor further agrees to defend, indemnify and hold CMTA, its principals, employees, agents and consultants, harmless from any such related claims which may be brought by any subcontractors, suppliers or any other third parties.
- 16.6 No asbestos or mercury containing materials shall be installed in this project.

PART 17 – TEMPORARY SERVICES:

- 17.1 The Contractor shall arrange any temporary water, electrical and other services which may be required to accomplish the work. Refer also to General and Special Conditions.
- 17.2 All temporary services shall be removed by Contractor prior to completion of work.

PART 18 – SURVEY AND MEASUREMENTS:

- 18.1 The Contractor shall lay out their work and be responsible for all necessary lines, levels, elevations, measurements, etc. The Contractor must verify the figures shown on the Plans before laying out the work and will be held responsible for any error resulting from failure to do so.
- 18.2 The Contractor shall base all measurements, both horizontal and vertical from established bench marks. All work shall agree with these established lines and levels. Verify all measurements at the site and check the correctness of same as related to the work.
- 18.3 Should the Contractor discover any discrepancy between actual measurements and those indicated which prevents following good practice or the intent of the contract documents, the Contractor shall promptly notify the Engineer and shall not proceed with this work until the Contractor has received instructions from the Engineer on the disposition of the work.
- 18.4 Refer to Part 4 and drawings for additional information.

PART 19 – PROTECTION OF EQUIPMENT:

- 19.1 The Contractor shall be entirely responsible for all material and equipment they furnish in connection with their work and special care shall be taken to properly protect all parts thereof from damage during the construction period. Such protection shall be by a means acceptable to the Engineer. All piping, etc., shall be properly plugged or capped during construction in a manner approved by the Engineer. Equipment damaged, stolen or vandalized while stored on site, either before or after installation, shall be repaired or replaced by the Contractor at their expense. All ductwork with open ends shall be covered with plastic during construction.

PART 20 – REQUIRED CLEARANCES FOR ELECTRICAL EQUIPMENT:

- 20.1 The NEC has specific required clearances above, in front, and around electrical gear, panels etc. The Contractor shall not install any piping, ductwork, etc., in the required clearance. If any appurtenance is located in the NEC required clearance, it shall be relocated at no additional cost. Coordinate with the Electrical Contractor prior to any work.

PART 21 - EQUIPMENT SUPPORT:

- 21.1 Each piece of equipment, apparatus, piping, or conduit suspended from the ceiling or mounted above the floor level shall be provided with suitable structural support, pipe stand, platform or carrier in accordance with the best recognized practice. Such supporting or mounting means shall be provided by the Contractor for all equipment and piping. Exercise extreme care that structural members of building are not overloaded by such equipment. Provide any required additional bracing, cross members, angles, support, etc. Do not support items from roof/floor deck or bridging.

PART 22 – DUCT AND PIPE MOUNTING HEIGHTS:

- 22.1 All exposed or concealed ductwork, piping, etc., shall be held as high as possible unless otherwise noted and coordinated with all other trades. Exposed piping and ductwork shall, insofar as possible, run perpendicular or parallel to the building structure. Refer to Plans for minimum heights of ducts and piping above ceiling.

PART 23 – BROKEN LINES AND PROTECTION AGAINST FREEZING:

- 23.1 No conduits, piping, etc. carrying water or any other fluid subject to freezing shall be installed in any part of the building where danger of freezing may exist without adequate protection being given by the Contractor whether or not insulation is specified or indicated on the particular piping. All damages resulting from broken and/or leaking lines shall be replaced or repaired at the Contractor's own expense. Do not install piping across or near openings to the outside whether or not they are carrying static or moving fluids. Insulation on piping does not necessarily insure that freezing will not occur. If in doubt, contact the Engineer.

PART 24 – WEATHERPROOFING:

- 24.1 Where any work pierces waterproofing including waterproof concrete, the method of installation shall be as specified and approved by the Architect and Engineer before work is performed. The Contractor shall furnish all necessary sleeves, caulking and flashing required to make openings permanently watertight.
- 24.2 Wherever work penetrates roofing, it shall be done in a manner that will not diminish or void the roofing guarantee or warranty in any way. Coordinate all such work with the roofing installer.

PART 25 – FINAL CONNECTIONS TO EQUIPMENT:

- 25.1 The Contractor shall finally connect mechanical services (water, sanitary, gas, air, etc.), to any terminal equipment, medical or hospital equipment, etc., provided under this and/or other divisions of the work. Various equipment connections indicated are based upon “basis of design” equipment selections. Should alternate equipment be purchased by the Owner or General Contractor, then this Contractor shall make the necessary provisions in the Bid for any and all differences. Change Orders shall not be considered for any differences due to alternate equipment purchase. Such connections shall be made in strict accord with current codes, safety regulations and the equipment manufacturer’s recommendations. If in doubt, contact the Engineer prior to installation.

PART 26 – ACCESSIBILITY:

- 26.1 The Contractor shall be responsible for the sufficiency of the size of shafts and chases, the adequate clearance in double partitions and ceilings for the proper installation of their work. They shall cooperate with all others whose work is in the same space. Such spaces and clearances shall, however, be kept to the minimum size required.

- 26.2 The Contractor shall locate and install all equipment so that it may be serviced, and maintained as recommended by the manufacturer. Allow ready access and removal of the entire unit and/or parts such as valves, filters, fan belts, motors, prime shafts, controls, coils, etc.
- 26.3 Whether shown on the Plans or not, the Contractor shall provide in the Bid access panels for each concealed shut-off valve, motorized control damper, manual air damper or other device requiring service as shown on Engineer's Plans or as required. Locations of these panels shall be identified in sufficient time to be installed in the normal course of work. Change orders for access panels will not be accepted.

PART 27 – SCAFFOLDING, RIGGING AND HOISTING:

- 27.1 The Contractor shall furnish all scaffolding, rigging, hoisting and services necessary for erection and delivery onto the premises of any equipment and apparatus furnished. All such temporary appurtenances shall be set up in strict accord with OSHA Standards and Requirements. Remove same from premises when no longer required.

PART 28 – CLEANING:

- 28.1 The Contractor shall, at all times, keep the area of their work presentable to the public and clear from rubbish and debris caused by their operations; and at the completion of the work, they shall remove all rubbish, debris, all of their tools, equipment, temporary work and surplus materials from and about the premises, and shall leave the area clean and ready for use. If the Contractor does not attend to such cleaning upon request, the Engineer may cause cleaning to be done by others and charge the cost of same to the Contractor. The Contractor shall be responsible for all damage from fire which originates in, or is propagated by, accumulations of their rubbish or debris.
- 28.2 After completion of all work and before final acceptance of the work, the Contractor shall thoroughly clean all equipment and materials and shall remove all foreign matter such as grease, dirt, plaster, labels, stickers, etc., from the exterior of piping, equipment, fixtures and all other associated or adjacent fabrication.
- 28.3 Ductwork and piping shall be kept clean at all times. Ductwork stored on the job site shall be placed a minimum of 4" above the floor and shall be completely covered in plastic. Installed ductwork shall be protected with plastic. Do not install the ductwork or insulation (pipe or duct) if the building is not "dried-in". If this is required, the entire lengths of duct shall be covered in plastic to protect. The Owner/Engineer shall periodically inspect that these procedures are followed. If deemed unacceptable, the Contractor shall be required to clean the duct system utilizing a NADCA certified Contractor.
- 28.4 Refer to drawings for additional information.

PART 29 – TEMPORARY USE OF EQUIPMENT:

- 29.1 The permanent heating and plumbing equipment, may be used for temporary services, with the consent of the Owner and Engineer. Should the permanent systems be used for this purpose the Contractors shall make all temporary connections required at their expense. They shall also make any replacement required due to damage wear and tear, etc., leaving the same in original condition.
- 29.2 Permission to use the permanent equipment does not relieve the Contractors from the responsibility for any damages to the building construction and/or equipment which might result because of its use.
- 29.3 Warranties shall begin at substantial completion regardless of their temporary use or not.

- 29.4 A pre-start-up conference shall be held with the Architect, Owner, General Contractor and the Mechanical Contractor. Equipment shall not be started until after this meeting.
- 29.5 Existing HVAC Units:
- Coordinate filter requirements with Owner. Contractor to utilize “construction” filters to prevent dust from getting into unit. In each unit, install one set of filter media at substantial completion. Leave one set of filter media in boxes in appropriate mechanical room as a spare set for the Owner. All other filters shall be used by the Contractor during construction. Dispose of all construction filter media.
 - On the outside of all return or outside air openings install a minimum of four sets of fiberglass filter media, such as cheesecloth, to be utilized as pre-filters for the “construction” filters. Install first set upon start-up and then install multiple sets when filter media is dirty. Dispose of all dirty construction filters. Change filters as often as necessary to keep units from becoming dirty at no additional cost.
 - At substantial completion of the project the entire unit shall be cleaned to present a before construction condition for the Owner and all filters shall be replaced with new.

PART 30 – NOISE, VIBRATION OR OSCILLATION:

- 30.1 All work shall operate under all conditions of load without any sound or vibration which is objectionable in the opinion of the Engineer. In case of moving machinery, sound or vibration noticeable outside of room in which it is installed, or annoyingly noticeable inside its own room, will be considered objectionable. Sound or vibration conditions considered objectionable by the Engineer shall be corrected in an approved manner by the Contractor at their expense.
- 30.2 All equipment subject to vibration and/or oscillation shall be mounted on vibration supports whether indicated or not suitable for the purpose of minimizing noise and vibration transmission, and shall be isolated from external connections such as piping, ducts, etc. by means of flexible connectors, vibration absorbers, or other approved means. Unitary equipment, such as room units, exhaust fans, etc., shall be rigidly braced and mounted to wall, floor or ceiling as required and tightly gasketed and sealed to mounting surface to prevent air leakage and to obtain quiet operation. Flush and surface mounted equipment such as diffusers, grilles, etc., shall be gasketed and affixed tightly to their mounting surface.
- 30.3 The Contractor shall provide supports for all equipment they furnish. Supports shall be liberally sized and adequate to carry the load of the equipment and the loads of attached equipment, piping, etc. All equipment shall be securely fastened to the structure either directly or indirectly through supporting members by means of bolts or equally effective means. If strength of supporting structural members is questionable, contact Engineer.

PART 31 – EQUIPMENT/CONTROLS STARTUP & VERIFICATION:

- 31.1 The Contractor and their Subcontractors shall include in the bid to provide equipment and controls startup and verification for ALL Mechanical Systems specified for this project. Also refer to the commissioning specifications for additional requirements.
- 31.2 A pre-start-up conference shall be held with the Owner, General Contractor, Mechanical Contractor, Electrical Contractor, Controls Contractor, and Test and Balance Contractor. The purpose of this meeting will be discuss the goals, procedures, etc. for start-up of the existing HVAC system and replacement equipment.
- 31.3 Specific startup/verification specifications are included throughout the Mechanical Specifications. In general, as part of the verification process, equipment suppliers shall perform start-up by their factory

authorized technicians, not third party contractors, and shall complete and submit start-up reports/checklists. The Contractor shall have appropriate trades on site to correct all deficiencies noted by the factory representative. For each deficiency noted, documentation of corrective action (including date and time) shall be submitted to the Engineer and Owner. Where factory start-up is not specified for a particular piece of equipment or system, the Contractor shall be responsible to perform start-up. All information shall be completed by the Contractor and submitted to the Owner/Engineer prior to acceptance of the equipment.

- 31.4 The manufacturer's recommended startup procedures and checklists will be acceptable for use in the project. All startup/verification process shall be thoroughly documented by the Contractor and shall include the time and date when performed.
- 31.5 The Contractor shall "zip-tie" a start-up report to each piece of equipment in a clear plastic cover. Once start-up completion is verified by the Engineer the Contractor shall remove all reports and consolidate them into close-out documentation. The Contractor shall be responsible for completion of System Verification Checklist (SVC) / Manufacturer's Checklists.

PART 32 – INSPECTION, APPROVALS AND TESTS:

- 32.1 Before requesting a final review of the installation from the Architect and/or Engineer, each Contractor shall thoroughly inspect their installations to assure that the work is complete in every detail and that all requirements of the Contract Documents have been fulfilled. Failure to accomplish this may result in charges from the Architect and/or Engineer for unnecessary and undue work on their part.
- 32.2 The Contractor shall provide as a part of this Contract any required Agency inspection, licensed and qualified to provide such services. All costs incidental to the provisions of inspections shall be borne by the Contractor.
- 32.3 The Contractor shall advise each Inspecting Agency in writing, with an informational copy of the correspondence to the Architect and/or Engineer, when they anticipate commencing the work. Inspections shall be scheduled for rough-in as well as finished work. The rough-in inspections shall be divided into as many inspections as may be necessary to cover all rough-in without fail. Failure of the Inspecting Agency to inspect the work in a timely manner and submit the related reports may result in the Contractor having to expose concealed work not so inspected. Such exposure will be at the expense of the responsible Contractor.
- 32.4 Approval by an Agency Inspector does not relieve the Contractor from the responsibilities of furnishing equipment having a quality of performance equivalent to the requirements set forth in these Plans and Specifications. All work under this contract is subject to the review of the Architect and/or Engineer, whose decision is binding.
- 32.5 Before final acceptance, the Contractor shall furnish the original and three (3) copies of the certificates of final approval by the Agency Inspector to the Engineer with one copy of each to the appropriate government agencies, as applicable. Final payment for the work shall be contingent upon completion of this requirement.

PART 33 - ABOVE-CEILING AND FINAL PUNCH LISTS:

- 33.1 The Contractor shall review each area and prepare and complete their own punch list for each of the subcontractors as required for the Project Schedule.

- 33.2 Fourteen (14) days notice shall be given to the Engineer for review of above ceiling work that will be concealed by tile or other materials. Fourteen (14) days notice shall be given to the Engineer for review of below ceiling work and final inspection.
- 33.3 When all work from the Contractor's punch list is complete at each of the major Project Stages and prior to completing ceiling installations (or at the final punch list stage), the Contractor shall request that the Engineer develop a punch list. This request is to be made in writing seven (7) days prior to the proposed date. After all corrections have been made from the Engineer's punch list, the Contractor shall review and initial off on each item. This signed-off punch list shall be submitted to the Engineer. The Engineer shall return to the site once to review each punch list and all work prior to the ceilings being installed and at the final punch list review. The Contractor's representative may be requested at the inspections.
- 33.4 If additional visits are required by the Engineer to review work not completed by this review, the Engineer shall be reimbursed directly by the Contractor by check or money order (due net 10 days from date of each additional visit) at a rate of \$125.00 per hour plus travel expense for extra trips required to complete either of the above ceiling, below ceiling or final punch lists.

PART 34 – OPERATING INSTRUCTIONS:

- 34.1 Upon completion of all work and all tests, each Contractor shall furnish the necessary skilled labor and helpers for operating the systems and equipment for a period of three (3) days of eight (8) hours each, or as otherwise specified. Refer to Section HVAC EQUIPMENT for additional requirements. During this period, instruct the Owner or their representatives fully in the operations, adjustment, and maintenance of all equipment furnished. Give at least seven (7) days written notice to the Owner, Architect and Engineer in advance of this training period. The Engineer may attend any such training sessions or operational demonstrations. The Contractor shall certify in writing to the Engineer that such demonstrations have taken place, noting the date, time and names of the Owner's representatives that were present.
- 34.2 Each Contractor shall furnish three complete bound sets for approval to the Engineer instructions for operating and maintaining all systems and equipment included in this contract. All instructions shall be submitted in draft form, for approval, prior to final issue. Manufacturer's advertising literature or catalogs will not be acceptable for operating and maintenance instructions. Refer to Specification Section SHOP DRAWINGS for additional detail.
- 34.3 Each Contractor, in the above mentioned instructions, shall include the maintenance schedule for the principal items of equipment furnished under this contract and a detailed, easy to read parts list and the name and address of the nearest source of supply.

PART 35 – RECORD DRAWINGS:

- 35.1 The Contractor shall insure that any deviations from the Design are as they occur recorded in red, erasable pencil on record drawings kept at the jobsite. The Engineer shall review the record documents from time to time to insure compliance with this specification. Compliance shall be a contingency of final payment. Pay particular attention to the location of under floor sanitary and water lines, shut-off valves, cleanouts and other appurtenances important to the maintenance and operation of Mechanical Systems. Also, pay particular attention to Deviations in the Control Systems and all exterior utilities. Keep information in a set of drawings set aside at the job site especially for this purpose and deliver to the Engineer upon completion of the work.

END OF SECTION.

DIVISION 20 – MECHANICAL

SECTION 200200 - SCOPE OF THE MECHANICAL WORK

PART 1 – GENERAL:

- 1.1 The Contractor's attention is directed to the General and Special Conditions, GENERAL PROVISIONS – MECHANICAL and to all other Contract Documents as they apply to this branch of the work. Attention is also directed to all other sections of the Contract Documents which affect the work of this section and which are hereby made a part of the work specified in this section.
- 1.2 The Mechanical work for this Contract shall include all labor, materials, equipment, fixtures, excavation, backfill and related items required to completely install, test, place in service and deliver to the Owner the complete mechanical systems in accordance with the accompanying plans and all provisions of these specifications. This work shall primarily include, but is not necessarily limited to the following paragraphs.
- 1.3 All applicable services and work specified in GENERAL PROVISIONS - MECHANICAL.
- 1.4 Provide all required motor starters, etc. not provided under the electrical sections.
- 1.5 Thorough instruction of the Owner's maintenance personnel in the operation and maintenance of all mechanical equipment.
- 1.6 Thorough coordination of the installation of all piping, ductwork, equipment and any other material with other trades to insure that no conflict in installation.
- 1.7 Approved supervision of the mechanical work.
- 1.8 Procurement of all required inspections, including fees for all inspection services and submission of final certificates of inspection to the Engineers.
- 1.9 Excavation, backfilling, cutting, patching, sleeving, concrete work, etc., required to construct the mechanical systems.
- 1.10 Equipment and controls start-up, verification and documentation as specified.
- 1.11 Record drawings, final inspection certificates, test results, O & M documentation, warranty certification, spare parts and other specified closeout documentation.
- 1.12 Pipe, duct and equipment identifications.
- 1.13 Preinstallation meetings.
- 1.14 Domestic hot, cold and recirculating hot water system.
- 1.15 Soil, waste and vent systems.
- 1.16 All plumbing equipment, fixtures and fittings.
- 1.17 100% automatic sprinkler systems.
- 1.18 Complete heating, ventilation and air conditioning systems.

- 1.19 All mechanical exhaust systems.
- 1.20 All insulation associated with mechanical systems.
- 1.21 Medical gas revision.
- 1.22 All required pressure testing, flushing, purging, pressure and flow testing requirements.
- 1.23 Final coordination and connection of all mechanical equipment furnished by others (e.g., kitchen equipment, appliances, medical equipment).
- 1.24 All required controls, including self checkout and commissioning.
- 1.25 Commissioning per HCA standards.

PART 2 – SCOPE OF WORK NARRATIVE:

2.1 FIRE PROTECTION

- 2.1.1 The existing facility contains a fire sprinkler system. The existing sprinkler systems will be reworked and modified as required to accommodate the building renovations - including the installation of tamper-resistant sprinkler heads (Tyco Raven “institutional” heads) in all Patient Care Areas. New semi-recessed “quick response” sprinkler heads will be provided for other areas.
- 2.1.2 The systems shall be designed per NFPA 13. The existing central fire protection systems and infrastructure (water supply piping and risers) are assumed to be adequate and will not be modified or replaced in this Scope.

2.2 PLUMBING

- 2.2.1 General: Refer to the drawings. Plumbing work (re-work), core drilling, and new piping installed (below slab), above the existing second floor ceilings will be required. Modify existing sanitary drainage systems to connect to new fixtures. Sanitary piping shall be replaced with new piping, mains, etc as necessary for a complete and functioning sanitary sewer system. The existing water risers will remain. Water risers in the renovated area shall be re-used to the extent possible.
- 2.2.2 Water Heating: Hot water shall be produced from the Hospital water heaters located in the Mechanical Room. Domestic hot water shall be tied into the existing vertical riser distribution with new hot water piping connection and hot water recirculation piping connections.
- 2.2.3 Sanitary, Waste & Vent Piping: The sanitary piping will require cleanouts at every pipe direction change. All cleanouts in patient areas to have tamper proof screws. All piping shall be cast iron as specified.

2.3 HVAC

- 2.3.1 Existing Conditions: The existing HVAC system(s) serving the renovated areas shall remain. The terminal units utilize pneumatic controls and shall be replaced.
- 2.3.2 The renovation area shall be served by individual terminal units. The terminal units shall include stand alone, DDC controls, compatible for future Bac Net interface with the existing hospital’s Andover system.

- 2.3.3 Building Ventilation: The existing AHU provides the required ventilation air charge rates.
- 2.3.4 Ductwork: The existing HVAC (supply and exhaust) in the renovation area shall be cleaned.
- 2.3.5 Exhaust: The existing central exhaust systems shall remain and be reused. All of the exhaust ductwork shall be cleaned. Ductwork modifications will occur as needed in the renovated areas.
- 2.3.6 Alternate Price: Provide an Andover DDC Control system for the replacement terminal units. This DDC system shall interface to the existing hospital control system.

END OF SECTION.

DIVISION 20 – MECHANICAL

SECTION 200300 - SHOP DRAWINGS, MAINTENANCE MANUALS AND PARTS LISTS

PART 1 – GENERAL:

- 1.1 The Contractor's attention is directed to the General and Special Conditions, GENERAL PROVISIONS – MECHANICAL and to all other Contract Documents as they apply to this branch of the work. Attention is also directed to all other sections of the Contract Documents which affect the work of this section and which are hereby made a part of the work specified in this section.
- 1.2 The Contractor shall prepare and submit to the Engineer, through the Prime Contractor and the Architect within thirty (30) days after the date of the Contract, required copies of all shop drawings, certified equipment drawings, installation, operating and maintenance instructions, samples, wiring diagrams, etc. on all items of equipment specified hereinafter. Refer to Division 1 requirements for shop drawing submittal requirements.
- 1.3 Provide all shops in electronic/PDF format. The Engineer's comments will be returned in electronic format.
- 1.4 Each shop drawing and/or manufacturers descriptive literature shall have the proper notation indicated on it and shall be clearly referenced to the specifications, schedules, fixture numbers, etc., so that the Engineer may readily determine what the Contractor proposes to furnish. All data and information schedules indicated or specified shall be noted on each copy of each submittal.
- 1.5 Submittal data shall include specification data including metal gauges, finishes, accessories, etc. Also, the submittal data shall include certified performance data, wiring diagrams, dimensional data, and a spare parts list. Submittal data shall be reviewed by the Engineer before any equipment or materials is ordered or any work is begun in the area requiring the equipment.
- 1.6 All submittal data shall have the stamp of approval of the Contractor submitting the data as well as the Prime Contractor and the Architect to show that the drawings have been reviewed by the Contractor. Any drawings submitted without these stamps of approval may not be considered and will be returned for proper resubmission.
- 1.7 The Contractor shall make any corrections or changes required by the Engineer and shall re-submit for final review as outlined above.
- 1.8 It shall be noted that review of shop drawings by the Engineer applies only to conformance with the design concept of the project and general compliance with the information given in the Contract Documents. In all cases, the Contractor alone shall be responsible for furnishing the proper quantity of equipment and/or materials required, for seeing that all equipment fits the available space in a satisfactory manner and that piping, electrical and all other connections are suitably located. The Contractor shall also coordinate piping side connections and maintenance access.
- 1.9 The Engineer's review of shop drawings, schedules or other required submittal data shall not relieve the Contractor from responsibility for adaptability of the item to the project; compliance with applicable codes, rules, regulations and information that pertains to fabrication and installation; dimensions, weight and quantities; electrical characteristics; and coordination of the work with all other trades involved in this project.
- 1.10 Prior to ordering any materials or rough-in of any kind, the Mechanical Contractor shall be responsible for final coordination of all electrical requirements (i.e. voltage, phase, circuit breaker, wire sizing, etc.) with the Electrical Contractor. There will be no change in the Contract Amount for

any discrepancies. A final coordination meeting shall be held with the Architect, Owner, Engineer, Prime Contractor, Mechanical Contractor, Electrical Contractor and their sub-contractors.

- 1.11 Equipment shall not be ordered and no final rough-in connections, etc., shall be accomplished until reviewed equipment shop drawings are in the hands of the Contractor. It shall be the Contractor's responsibility to obtain reviewed shop drawings and to make all connections, etc. in the neatest and most workmanlike manner possible. The Contractor shall coordinate with all the other trades having any connections, roughing-in, etc. to the equipment.
- 1.12 If the Contractor fails to comply with the requirements set forth above, the Engineer shall have the option of selecting any or all items listed in the Specifications or on the Drawings; and the Contractor shall be required to furnish all materials in accordance with this list.
- 1.13 Colors for equipment in other than mechanical spaces shall be selected from the Manufacturer's standard and factory optional colors unless noted otherwise on the Plans. Color samples shall be furnished with the shop drawing submission for such equipment.
- 1.14 All submittals for mechanical equipment shall include all information specified and scheduled. This shall include air and water pressure drops, RPM, noise data, face velocities, horsepower, voltage motor type, steel or aluminum construction, and all accessories clearly marked.
- 1.15 All items listed in the schedules shall be submitted for review in a tabular form similar to the equipment schedule. All items submitted shall be designated with the same identifying tag as specified on each sheet.
- 1.16 Any submittals received in an unorganized manner without options to be provided specifically noted and with incomplete data will be returned for resubmittal.

PART 2 – SHOP DRAWINGS:

- 2.1 Shop Drawings, descriptive literature, technical data and required schedules shall be submitted on the following:

- Access Doors
- Ductwork Accessories/Volume Dampers
- Exhaust Fans
- Fire Protection Sprinkler System (2.2.3)
- Firestopping (2.2.4)
- Floor Drains
- Ductwork & Fittings
- Insulation
- Terminal Units
- Plumbing Equipment
- Plumbing Fixtures, Fittings and Trim
- Register, Grilles, Diffusers
- System Verification Check Lists
- Temperature Controls & Components (2.2.2)
- Valves
- Medical Gas System Certification

(Refer to the corresponding Special Notes.)

2.2 Special Notes:

- 2.2.1 For all items above, upon substantial completion of the project, the Contractor shall deliver to the Engineer (in addition to the required Shop Drawings) three (3) complete copies of operation and maintenance instructions and parts lists for each item marked (2.1) above. Where available, documents shall include at least:
- Detailed operating instructions
 - Detailed maintenance instructions including preventive maintenance schedules.
 - Addresses and phone numbers indicating where parts may be purchased.
 - Expanded parts drawings, parts lists, service manuals, schematics, wiring diagrams.
 - Master air filter list including equipment identification, filter size, filter quantity, and supplier contact information.
- 2.2.2 Shop drawings for the Temperature Control Systems shall include detailed, scaled plans and schematic diagrams indicating the function and operation of the system. Refer to Specification Section – CONTROLS for additional requirements.
- 2.2.3 Shop drawings for the Building Fire Protection System shall be prepared and stamped by a Certified Contractor and shall meet the criteria of the authority having jurisdiction and submitted to the Engineer. After the Engineer's review, they shall be submitted by the Contractor to the proper state authorities along with the required agency review fee. Refer to Specification Section – FIRE PROTECTION for additional requirements.
- 2.2.4 The Contractor shall submit project specific UL listed firestopping installation drawings to the authority having jurisdiction where required for their approval as required.

END OF SECTION.

DIVISION 20 – MECHANICAL

SECTION 200400 - DEMOLITION AND SALVAGE

PART 1 – GENERAL:

- 1.1 The Contractor's attention is directed to the General and Special Conditions, GENERAL PROVISIONS - MECHANICAL and to all other Contract Documents as they apply to this branch of the work. Attention is also directed to all other sections of the Contract Documents which affect the work of this section and which are hereby made a part of the work specified in this section.
- 2.1 It is the intent of this Section to completely remove all components of any existing mechanical system indicated in the mechanical drawings and items associated with the required architectural demolition specified in the Contract Documents. Also, any mechanical systems that will be open to view, or will interfere with the operations of the completed building, or which will, in any way, interfere with project construction shall be removed. The Contractor shall field verify existing conditions prior to bid.

PART 2 – PLUMBING DEMOLITION:

- 2.1 The general scope of the plumbing system demolition is indicated on the drawings. Where plumbing fixtures, equipment, etc. are removed, also remove all associated branch piping, hangers, insulation, concrete pads, controls, etc. Where plumbing fixtures are removed, all piping and services shall be removed in accordance with the current Building and Plumbing Codes.
- 2.2 Refer to the demolition drawings for piping which shall be demolished or shall remain. If other piping is found during construction which is not indicated on the drawings, the fixtures the piping serves must be identified. If it serves fixtures which are being demolished, the piping shall be removed back to the nearest mains and capped. Verify this work with the Engineer prior to demolition.
- 2.3 The Contractor shall be responsible for the removal and/or relocation of any plumbing equipment, concrete pads, piping, drain lines, vent lines, valves, fittings, etc., which may in the course of construction, interfere with the installation of any new and/or relocated Architectural, Mechanical or Electrical Systems specified in the Contract Documents. This work shall be performed at no increase in the contract price.
- 2.4 Unless otherwise indicated, the Contractor shall be responsible for patching and repairing all holes, etc. in the ceilings, walls, roof and floors where plumbing equipment is removed by qualified tradesmen.
- 2.5 All underslab sanitary pipes abandoned in place shall be made safe in compliance with the Plumbing Code. No other piping is allowed to be abandoned.
- 2.6 All plumbing equipment not indicated to be reused shall be removed.

PART 3 – HVAC DEMOLITION:

- 3.1 The general scope of the HVAC system demolition is indicated on the drawings. Where HVAC units are removed, also remove all associated ductwork, branch piping, hangers, insulation, controls, etc.
- 3.2 Refer to the demolition drawings for equipment piping and ductwork to be demolished or which shall remain. If other equipment, piping or ductwork is found during construction which is not indicated on the drawings, it must be determined if these systems serve other areas not being renovated. If the equipment piping and ductwork serve only renovated areas, the system shall be demolished. Verify this work with the Engineer prior to demolition.

- 3.3 Remove all temperature controls, panels, accessories, etc. that are accessible or become accessible during construction that serves demolished systems. Cap airtight any pneumatic control tubing at nearest main.
- 3.4 The Contractor shall be responsible for the removal and/or relocation of any HVAC piping, equipment, fittings, valves, etc. which may, in the course of construction, interfere with the installation of any new and/or relocated Architectural, Structural, Mechanical or Electrical Systems specified in the Contract Documents at no increase in the contract price.
- 3.5 Unless otherwise indicated, the Contractor shall be responsible for the patching and repairing of all holes, etc. in the ceiling, wall, roof and floors where HVAC equipment is removed by qualified tradesmen.
- 3.6 Where piping and ductwork systems are partially demolished, cap systems air and water tight and insulate. All capping of duct systems shall be done with 22 gauge sheet metal and insulated. Seal with duct sealant.

PART 4 – SALVAGE:

- 4.1 It is the intent of this section to deliver to the Owner all components which may be economically reused by them. The Contractor shall make every effort to remove reusable components without damage.
- 4.2 Components to be delivered to the Owner shall be specifically identified by the Owner's representative prior to beginning the demolition. The Contractor shall prepare a letter of transmittal of all salvaged items and obtain the Owner's signature and date of receipt.
- 4.3 Items not identified become the property of the Contractor and are to be removed from the site and disposed of properly.

END OF SECTION.

DIVISION 20 – MECHANICAL

SECTION 201100 - SLEEVING, CUTTING, PATCHING, REPAIRING AND FIRESTOPPING

PART 1 – GENERAL:

- 1.1 The Contractor's attention is directed to the General and Special Conditions, GENERAL PROVISIONS – MECHANICAL and to all other Contract Documents as they apply to this branch of the work. Attention is also directed to all other sections of the Contract Documents which affect the work of this section and which are hereby made a part of the work specified in this section.
- 1.2 The Contractor shall be responsible for all openings, sleeves, trenches, etc., that may be required in floors, roofs, ceilings, walls, etc., and shall coordinate all such work with the General Contractor and all other trades. Coordinate with the General Contractor, any openings which they are to provide before submitting a bid proposal in order to avoid conflict and disagreement during construction. Improperly located openings shall be reworked at the expense of the Contractor.
- 1.3 The Contractor shall plan their work ahead and shall place sleeves, frames or forms through all walls, floors and ceilings during the initial construction, where it is necessary for piping, ductwork, conduit, etc., to route through; however, when this is not coordinated, the Contractor shall then do all cutting and patching required for the installation of their work, or pay other trades for doing this work when so directed by the Engineer. Any damage caused to the building by this Contractor shall be corrected or rectified at their expense.
- 1.4 The Contractor shall notify other trades in due time where they will require openings or chases in new concrete, masonry, etc. Set all concrete inserts and sleeves for their work. Failing to coordinate, Contractor shall cut openings for the work and patch same as required at their expense with qualified tradesman.
- 1.5 The Contractor shall be responsible for properly shoring, bracing, supporting, etc., any existing and/or new construction to guard against cracking, settling, collapsing, displacing or weakening while openings are being made. Any damage occurring to the existing and/or new structures, due to failure to exercise proper precautions or due to action of the elements shall be promptly and properly corrected to the satisfaction of the Engineer.
- 1.6 All work improperly performed or not performed as required in this section, shall be corrected by the General Contractor at the responsible Contractor's expense.
- 1.7 Coordinate all floor slab core drilling, including X-ray requirements.
- 1.8 Refer to Architectural drawings and specifications for all UL listed requirements, assemblies, and details.

PART 2 – SLEEVES:

- 2.1 Cast iron or Schedule 40 steel sleeves shall be installed through all walls where pipe enters the building below grade. Sleeves shall be flush with each face of the wall and shall be sufficiently larger than the entering pipe to permit thorough caulking between pipe and sleeve for water proofing. Horizontal sleeves passing through exterior walls or where there is a possibility of water leakage and damage shall be caulked watertight. Utilize "Link-Seal" at these locations.
- 2.2 In all cases, sleeves shall be at least two pipe sizes larger than nominal pipe diameter plus insulation. Sleeves through walls and floors shall be cut off flush with inside surface unless otherwise indicated.

- 2.3 Vertical sleeves in roofs shall be flashed and counterflashed with lead (4 lb.) or 16 oz. copper and welded or soldered to piping, lapped over sleeve and properly weather sealed. Where sleeves pass through roof construction, sleeves shall extend minimum of 12" above the roof.

PART 3 – CUTTING:

- 3.1 All openings in plaster, gypsum board or similar materials, shall be framed by means of plaster frames, casing beads, or angle members as required. The intent of this requirement is to provide smooth, even termination of wall, floor and ceiling finishes as well as to provide a fastening means for devices, etc.
- 3.2 The Mechanical Contractor shall coordinate all openings in all walls with the General Contractor; and, unless otherwise indicated in the Contract Documents, shall provide lintels for all openings required for the mechanical work such as louvers, exhaust fans, etc. Prime paint all lintels. Lintels shall be sized as follows:
- 3.2.1 New Openings under 48" in width: Provide one 3½"x3½"x3/8" steel angle for each 4" of masonry width. Lintel shall have 8" bearing on each end.
- 3.2.2 New Openings over 48" in width: Consult with Structural Engineer.
- 3.3 No cutting shall be performed at location that will weaken the structure and unnecessary cutting must be avoided. If in doubt, contact the Engineer.
- 3.4 Pipe openings in slabs and walls shall be cut with core drill. Hammer devices will not be permitted. Edges of trenches and large openings shall be scribe-cut with a masonry saw.

PART 4 – PATCHING AND REPAIRING:

- 4.1 Patching and repairing made necessary by work performed under this Division shall be included as a part of the work and shall be done by skilled workers of the trade. The work shall be performed in strict accordance with the provisions herein before specified to match adjacent surfaces and in a manner acceptable to the Engineer.
- 4.2 Where portions of existing sites, lawns, shrubs, paving, etc. are disturbed for installation of work of this Division, such items shall be repaired and/or replaced back to original or better condition to the satisfaction of the Engineer.
- 4.3 Whether indicated or not, provide code approved, full sized fire dampers at all locations where ductwork penetrates fire rated walls. Fire stop rating shall meet or exceed the rating of the wall. Provide an approved access panel at each fire damper located and sized so as to allow hand reset of each fire dampers. All such fire dampers and access panels shall be readily accessible without damage to finishes. Refer to Architectural Plans for locations of fire rated walls. All access doors shall be 16"x16" or as high as ductwork permits and 16" in length.
- 4.4 Piping and ductwork passing through floors, ceilings and walls in finished areas shall be fitted with chrome plated brass escutcheon trim pieces of sufficient outside diameter to amply cover the sleeved openings and an inside diameter to closely fit the pipe/duct around which it is installed.
- 4.5 Flanged metal collars shall be provided around all ducts, flues, pipes, etc. at all wall penetrations; both sides. Penetrations through any wall will require the installation of flanged collars. Openings shall not be any larger than 2" in any direction than the piping/duct passing through the wall. Openings larger than this requirement shall also be infilled to match adjacent construction. Fill void with insulation for sound reduction.

PART 5 – FIRESTOPPING:

- 5.1 Provide shop drawings indicating penetration detail for each type of wall and floor construction. Shop drawings must be specific for each individual type of penetration (one hour fire rated gypsum wall board with insulated metal pipe penetration, etc.) Provide copies to the authority having jurisdiction if required.
- 5.2 All mechanical pipes and ducts penetrating fire rated floors and walls shall be firestopped by this Contractor. All firestopping products and assemblies installed shall be UL listed.
- 5.3 Where the installation of conduit, ducts, piping, etc. requires the penetration of fire or smoke rated walls, ceilings or floors, the space around such conduit, duct, pipe, etc., shall be tightly filled with an approved non-combustible fire insulating material satisfactory to maintain the rating integrity of the wall, floor or ceilings affected.
- 5.4 Where the installation of ductwork requires the penetration of non-rated floors, the space around the duct or pipe shall be tightly filled with an approved non-combustible material.
- 5.5 The manufacturer of the firestopping materials shall provide on site training for the installing Contractor. The training session shall demonstrate to the Contractor the proper installation techniques for all the firestopping materials.
- 5.6 Firestopping materials include (but are not limited to) wraps, strips, caulks, moldable putties, restricting collars with steel hose clamps, damming materials, composite sheets, fire dam caulks, steel sleeves, etc.
- 5.7 The following indicates the 3M penetration details for uninsulated pipe penetration of various wall and floor construction types (the list is not inclusive):
 - One, two or three hour fire rated concrete floor - 3M #5300-MPC8.
 - One, two or three hour fire rated solid or block concrete wall - 3M #5300-MPC16 or 3M #5300-MPC26.
 - One hour fire rated gypsum wallboard - 3M #5300-MPC7.
 - Two hour fire rated gypsum wallboard - 3M #5300-MPC7.
- 5.8 The following indicates the 3M penetration details for insulated pipe penetrations of various wall and floor construction types (the list is not inclusive):
 - One, two and three hour fire rated concrete floor - 3M #5300-IMP2.
 - One, two and three hour concrete block wall - 3M #5300-IMP2.
 - One hour fire rated gypsum wallboard - 3M #5300-IMP4.
 - Two hour fire rated gypsum wallboard - 3M #IMP7.
- 5.9 HVAC ducts penetrating a one or two hour fire rated wall or floor shall be firestopped per 3M #5300-HVD1.
- 5.10 Multiple pipes penetrating fire rated floors and walls may be firestopped as a group. Submit details for specific applications if this method of firestopping is chosen.

END OF SECTION.

DIVISION 20 – MECHANICAL

SECTION 201300 - PIPE, PIPE FITTINGS AND SUPPORT

PART 1 – GENERAL:

- 1.1 The Contractor's attention is directed to the General and Special Conditions, GENERAL PROVISIONS - MECHANICAL and to all other Contract Documents as they apply to this branch of the work. Attention is also directed to all other sections of the Contract Documents which affect the work of this section and which are hereby made a part of the work specified in this section.
- 1.2 Each Contractor's attention is also directed to Specification Section HANGERS, CLAMPS, ATTACHMENTS, ETC.
- 1.3 Unless otherwise indicated, all materials shall be new and of the best grade and quality for the type specified. Materials shall comply with the "Buy American Act".
- 1.4 Where piping is not indicated on the plans, but is obviously or apparently required, contact the Engineer prior to submission of the bid.
- 1.5 All piping shall be capped or plugged during erection as required to keep clean and debris and moisture free.
- 1.6 The piping indicated shall be installed complete and shall be of the size indicated. When a pipe size is not indicated, the Contractor shall request the pipe size from the Engineer. Where a section of piping is not indicated but is obviously required for completion of the system, the Contractor shall provide same at no additional cost to the project.
- 1.7 All piping shall be installed straight and true, parallel or perpendicular to the building construction. Piping shall be installed so as to allow for expansion without damage to the building finishes, structure, pipe, equipment, etc., use offsets, U-bends or expansion joints as required. No mitered joints or field fabricated pipe bends shall be accepted. Pipe shall clear all windows, doors, louvers and other building openings.
- 1.8 All pipes shall be supported in a neat and workmanlike manner and wherever possible, parallel runs of horizontal piping shall be grouped together on hangers. Vertical risers shall be supported at each floor line with approved steel pipe riser clamps. Spacing of pipe supports shall not exceed eight (8) foot intervals for pipes 3" and smaller and ten (10) foot intervals on all other piping. Small vertical pipes (1" and less) shall be bracketed to walls, structural members, etc. at four (4) foot intervals so as to prevent vibration or damage by occupants.
- 1.9 Insulated piping shall be supported on a rigid insulation block at each hanger so as to prevent crushing of insulation by hangers. Hangers shall pass completely around the insulation jacket and a steel protective saddle shall be applied to prevent compression of the insulation. Refer to Specification Section INSULATION - MECHANICAL.
- 1.10 The use of wire or perforated metal to support pipes will not be permitted. Hanging pipes from other pipes shall not be permitted.
- 1.11 Support piping with standard pipe hangers with C-clamp connection to main structural members, use angle steel cross pieces between main structural members where required to provide rigid support.
- 1.12 Where piping rests directly on a hanger, clip, bracket or other means of support, the support element shall be of the same material as the pipe, (e.g., copper to copper, ferrous to ferrous, etc.) or shall be

- electrically isolated one from the other so as to prevent pipe damage by electrolysis. Pay particular attention and do not allow copper pipe to rest on ferrous structural members, equipment, etc. without electrolytic isolation. This includes temporary support required during Construction.
- 1.13 In general, piping shall be installed concealed except in mechanical rooms, etc. unless otherwise indicated, and shall be installed underground or beneath concrete slabs only where indicated. All lines at ceilings shall be held as high as possible and shall run so as to avoid conflicts with other trades, and to facilitate the Owner's use and maintenance. Location of pipe in interior partitions shall be carefully coordinated with whoever will construct the partitions after the piping is in place. Where exposed risers occur they shall be kept as close to walls as possible.
 - 1.14 Pipe shall be cut accurately to measurements established at the building by the Contractor and worked into place without springing or forcing. All pipes shall be reamed to full pipe diameter before joining and before assembling. All lengths of pipe shall be set vertically and tapped with a hammer to remove scale and dust and inspected to insure that no foreign matter is lodged therein.
 - 1.15 All hot and cold water piping shall be kept a sufficient distance apart so as to prevent heat transfer between them. Cold water piping shall also be kept apart from refrigerant hot gas lines.
 - 1.16 Piping carrying water or other fluids subject to freezing shall not be installed in locations subject to freezing. If in doubt, consult Engineer.
 - 1.17 Pay particular attention to conflict of piping with other work. Do not install until conflict is resolved. If in doubt, consult Engineer.
 - 1.18 Piping materials in each system shall, to the extent practicable, be of the same material. Frequent changes of material (for example, from copper to steel) shall be avoided and in no case shall be accomplished without use of insulating unions and permission of the Engineers.
 - 1.19 Dielectric unions shall be provided at all connections of dissimilar materials.
 - 1.20 Nipples shall be of the same material, composition and weight classification as pipe with which installed.
 - 1.21 Apply approved pipe dope for service intended to all male threaded joints. The dope shall be listed for intended use.
 - 1.22 Eccentric reducers shall be used where required to permit proper drainage and venting of pipe lines; bushings shall not be permitted.
 - 1.23 High points of closed loop piping systems shall have manual air vents as required unless automatic air vents are specifically indicated. Pipe to suitable drainage point.
 - 1.24 Installation of pipe shall be in such a manner as to provide complete drainage of the system, whether detailed or not on plans. Drain valves shall be provided at all drainage points on pipes. Drain valves shall be ½" size ball valves with 3/4" hose thread end and vacuum breaker. Label each drain valve.
 - 1.25 Where plastic piping penetrates a fire rated assembly, it shall be replaced with a threaded metal adapter and metal pipe or whatever means necessary to maintain the separation rating in accordance with local plumbing and fire codes.
 - 1.26 Plastic piping or any material with a flame and smoke spread rating not approved for plenum use shall not be permitted in supply, return, relief or exhaust plenums.

- 1.27 All increases in vent size at roof shall be by means of service weight cast iron increasers.
- 1.28 Non-metallic piping shall be installed in strict accordance with the manufacturer's instructions. If no such instructions are available, consult Engineer.
- 1.29 When running any type of pipe below a footing, perpendicular to the footing, the area underneath the footing and in the zone of influence shall be backfilled with concrete. The zone of influence is the area within a 45 degree angle projecting down from the top edge of footing on all sides of the footing.
- 1.30 When running any type of pipe below a footing, parallel to the footing, the area underneath the zone of influence shall be backfilled with 4" of crushed stone or sand bedding under the pipe. Each pipe section shall be anchored into unexcavated earth on both ends with deadman anchor system. The remainder of the trench in the zone of influence shall be backfilled with cementitious flowable fill. The zone of influence is the area within a 45 degree angle projecting down from the top edge of the footing on all sides of the footing.
- 1.31 Piping for all drainage systems shall be installed to permit flow, trapping, and venting in accord with current codes and best practice.
- 1.32 The entire domestic hot, cold and recirculating hot water piping system shall be sterilized in strict accord with requirements of the Department of Health Codes, Rules and Regulations for the State in which the work is being accomplished.
- 1.33 The entire sanitary waste and vent piping system within the building shall be air-tight. If any sewer gases are present within the building, it shall be the Contractor's responsibility to locate and correct any leaks and retest as required. Any sewer odor issues that occur during the Warranty Period shall be corrected by the Contractor.
- 1.34 When connecting to an existing piping systems (hot water, domestic, etc.), the Contractor shall include cost to drain the existing piping system and refill with water/closed loop chemicals to match existing fluid. If the building is occupied, and the drain down will affect services to these occupied areas, then the systems shall be drained and refilled after hours at a time acceptable to the Owner. Refer to Specification Section PIPE FILLING, CLEANING, FLUSHING, PURGING AND CHEMICAL TREATMENT.

PART 2 – UNIONS, FLANGES AND WELDED TEES:

- 2.1 Screwed unions, soldered unions or bolted flanges shall be provided as required to permit removal of equipment, valves and piping accessories from the piping system. Keep adequate clearances for coil removal, rodding, tube replacement, motor lubrication, filter replacement, etc. Flanged joints shall be assembled with appropriate flanges, gaskets and bolting. The clearance between flange faces shall be such that the connections can be gasketed and bolted tight without imposing undue strain on the piping system.
- 2.2 Dielectric insulating unions or couplings shall be used wherever the adjoining materials being connected are of dissimilar metals such as connections between copper and steel pipe.
- 2.3 Tee connections for welded pipe shall be assembled with welding fittings. Where the size of the side outlet is such that a different connection technique than on the run is required, a weldolet, sockolet, or threadolet type fitting may be used for the branch in place of reducing tees only where the branch is 2/3 the run size or smaller. Weld-o-let, thread-o-let and T-drill branch connections are acceptable.

PART 3 – SPECIFICATIONS STANDARDS:

- 3.1 All piping and material shall be new, comply with the “Buy American Act” and shall conform to the following minimum applicable standards:
- Steel pipe; Schedule 40; ASTM A-53.
 - Copper tube; Type K, L, M; ASTM B88-62; Type DWV ASTM B306-62.
 - Cast iron soil pipe; ASA A-40.1 and CS 188-59.
 - Cast iron drainage fittings; ASA B16.12.
 - Cast iron screwed fittings; ASA B16.4.
 - Welding fittings; ASA B16.9.
 - Cast brass and wrought copper fittings; ASA B16.18.
 - Cast brass drainage fittings; ASA B16.23.
 - PVC pipe; Schedule 40; ASTM D-1785.

PART 4 – PIPE TESTING:

- 4.1 Piping shall be tested before being insulated or concealed in any manner. Where leaks or defects develop, required corrections shall be made and tests repeated until systems are proven satisfactory.
- 4.2 Water piping systems shall be subjected to a hydrostatic test of one hundred fifty pounds. The system shall be proven tight after a twenty-four (24) hour test.
- 4.3 The house drain line, interior storm sewers, interior rain water conductors, and all soil, waste and vent piping shall be subjected to a hydrostatic test of not less than a 10-foot head or an air test of not less than 5 lbs. per sq. inch using a mercury column gauge and shall hold for 15 minutes.
- 4.4 Exterior sewer lines to the termination point outside the building shall be subject to a ten-foot hydrostatic test or an approved smoke test. These lines shall be subjected to a second test after 2 feet of backfill has been properly installed.
- 4.5 After fixtures have been installed, the entire plumbing system, exclusive of the house sewer, shall be subjected to an air pressure test equivalent to one inch water column and proven tight. The Contractor responsible shall furnish and install all of the test tees required, including those for isolating any portion of the system for tests.
- 4.6 The Contractor shall perform all additional tests that may be required by the Department of Health or other governing agency.
- 4.7 Any leaks or imperfections found shall be corrected and a new test run until satisfactory results are obtained. The cost of repair or restoration of surfaces damaged by leaks in any system shall be borne by the Contractor.

PART 5 – PITCH OF PIPING:

- 5.1 All piping systems shall be installed so as to drain to a low point. Certain minimum pitches shall be required for this drainage. For proper flow and/or for proper operation, the following pitches shall be required:
- 5.2 Interior Soil, Waste and Vent Piping: 1/4” per foot in direction of flow where possible but in no case less than 1/8” per foot.
- 5.3 Roof Leaders: 1/8” per foot where possible.

- 5.4 Condensate Drain Lines From Cooling Equipment: Not less than ¼" per foot in direction of flow.
- 5.5 Steam and Condensate Return Mains: One (1) inch in 20 feet in direction of flow.
- 5.6 All Other Lines: Provide ample pitch to a low point to allow 100 percent drainage of the system.

PART 6 – PLUMBING PIPING APPLICATIONS:

6.1 Soil, Waste and Vent Piping (Above Slab)

- 6.1.1 Service weight hubless cast iron pipe (ASTM a 888 AND CISPI Standard 301) with manufacturer's approved heavy duty couplings, conforming to ASTM C 1540, Husky SD 4000 or equal.
- 6.1.2 Service weight cast iron hub and spigot piping with compression gasket joints. (ASTM A 74) (ASTIM C 564)

6.2 Roof Leaders and Storm Lines (Above Slab)

- 6.2.1 Service weight hubless cast iron pipe (ASTM a 888 AND CISPI Standard 301) with manufacturer's approved heavy duty couplings, conforming to ASTM C 1540, Husky SD 4000 or equal.
- 6.2.2 Service weight cast iron hub and spigot piping with compression gasket joints. (ASTM A 74) (ASTIM C 564)
- 6.2.3 Service weight hubless cast iron pipe with manufacturer's approved bands. Horizontal pipe and fittings 4" and larger, shall be suitably braced to prevent horizontal movement. Provide bracing in accordance to CIPI 301-00. Provide "Holdrite" bracing system or approved equal.

6.3 Domestic Cold, Hot and Recirculating Hot Water Piping (Above Slab)

- 6.3.1 Type "L" hard copper tubing with wrought copper fittings with lead free solder equivalent in performance to 95/5. (Maximum lead content of solder and flux is 2%).
- 6.4 Domestic Cold, Hot and Recirculating Hot Water Piping (Below Slab): Type "K" hard or soft copper tubing with wrought copper fittings and brazed joints. There shall be no joints beneath slabs.

6.5 Fire Protection - Refer to Specification Section – FIRE PROTECTION.

PART 7 – HVAC PIPING APPLICATIONS

7.1 HVAC Hydronic Piping:

- 7.1.1 System Types:
- Hot Water
- 7.1.2 2" and Smaller: Schedule 40 black steel pipe with screwed fittings or Type "L" hard copper tubing with wrought copper fittings and 95/5 solder.
- 7.1.3 2½" and Larger: Schedule 40 black steel pipe with 125# welded or flanged joints. Weldolets may be used for branch line connections to pipe mains. Type "L" hard copper piping with wrought copper fittings and 95/5 solder may be installed.

7.2 Air Vent Discharge Lines: Type "L" soft copper; wrought copper fittings, 95/5 solder. Pipe to a suitable drainage location.

END OF SECTION.

DIVISION 20 – MECHANICAL

SECTION 202100 - VALVES

PART 1 – GENERAL:

- 1.1 The Contractor's attention is directed to the General and Special Conditions, GENERAL PROVISIONS - MECHANICAL and to all other Contract Documents as they apply to this branch of the work. Attention is also directed to all other sections of the Contract Documents which affect the work of this section and which are hereby made a part of the work specified in this section.
- 1.2 Each Contractor shall provide all valves required to control, maintain and direct flow of all fluid systems indicated or specified. This shall include, but may not be limited to all valves of all types including balancing valves, air vents, drain valves, check valves, special valves for special systems, etc., for all Mechanical Systems.
- 1.3 ACCEPTABLE MANUFACTURERS: Nibco, Crane, Milwaukee, Apollo, Kitz, Grinnell, Kennedy, Watts, Keystone, Hammond.
- 1.4 The following type valves shall not be acceptable: Zinc, plastic, fiber or non-metallic.
- 1.5 Each type of valve shall be of one manufacturer, i.e., ball valves, one manufacturer, butterfly valves, one manufacturer, check valves, one manufacturer, etc.
- 1.6 All valves shall comply with current Federal, State and Local Codes. All valves shall be new and of first quality. All valves shall be designed and rated for the service to which they are applied. Zinc, plastic, fiber or non-metallic valves shall not be acceptable.
- 1.7 Contractor shall provide colored tape on ceiling tile where valves are located above ceiling. Provide access panels where valves are located above hard ceiling.

PART 2 – DOMESTIC WATER APPLICATIONS:

- 2.1 Gate Valve (2" and under): Use ball valves as specified.
- 2.2 Globe Valves (2" and under): Globe Valves shall have bronze body, bonnet and disc holder. Globe valve shall have union bonnet, integral seat, teflon or stainless steel renewable disc and be rated for 150 psi working pressure. Globe valve shall be Nibco T-235 for threaded ends or Nibco S-235 for solder ends.
- 2.3 Check Valve (2" and under): Check valve shall have bronze body, disc and hinge. check valve shall be Y-pattern type, horizontal swing, renewable disc and rated for 150 psi working pressure. Check valve shall be Nibco T-413 for threaded ends or Nibco S-413 for solder ends.
- 2.4 Two Piece Ball Valve (2" and under): Ball valve shall have bronze body, ball and reinforced, water tight seat. Valve shall be two piece construction. Valve shall be "full-port" type. Valve handle shall only require quarter turn to go from full open to full close. The handle shall be removable with vinyl grip. Valve shall be rated for 180 degrees F water temperature and 150 psi working pressure. Ball valve shall be Nibco T-585 for threaded ends and Nibco S-585 for solder ends.
- 2.5 Strainers (2" and under): Watts 77S Series "Y" type strainer with cast iron body and threaded ends. Screen shall be 20 mesh stainless steel. Strainer shall be provided with cleanout plug and be rated for 200 psi working pressure.

- 2.6 Vacuum Breakers: Watts #288A atmospheric type vacuum breaker with brass body. Vacuum breaker shall be rated for 210 degrees F and 125 psi working pressure and shall meet ASSE Standard 1001.
- 2.7 Double Check Valve: Double check valve shall have bronze body construction and be provided with inlet strainer, two (2) gate valves for isolation and three (3) test ports. Assembly shall be rated for 110 degrees F water temperature and 175 psi water pressure. Assembly must meet requirements of AWWA Standard C506. For sizes 2" and less, provide Watts #900 (or equal) with threaded ends. For sizes 2½" and larger, provide Watts #709 (or equal) with flange ends.
- 2.8 Balancing Valve: Bell & Gossett "Circuit Setter" Model CB or equal balancing valve. All valves to be of bronze body/brass ball construction with glass and carbon filled TFE seat rings. Valves to have differential pressure read-out ports across valve seat area. Read-out ports to be fitted with internal EPT inserts and check valves. Valve bodies to have 1/4" NPT tapped drain/purge port. Valves to have memory stop feature to allow valve to be closed for service and then reopened to set point without disturbing balance position. All valves to have calibrated nameplates to assure specific valve settings. Valves shall be designed for positive shut-off.

PART 3 – HVAC APPLICATIONS:

- 3.1 Gate Valve (2" and under): Use ball valves as specified.
- 3.2 Globe Valve (2" and under): Globe valve shall have bronze body, bonnet and disc holder. Globe valve shall have union bonnet, integral seat, teflon or stainless steel renewable disc and be rated for 200 psi working pressure. Globe valve shall be Nibco T-235 for threaded ends or Nibco S-235 for solder ends.
- 3.3 Check Valves (2" and less): Check valve shall have bronze body, disc and hinge. Check valve shall be Y-pattern type horizontal swing, renewable disc and rated for 200 psi working pressure. Check valve shall be Nibco T-413 for threaded ends or Nibco S-413 for solder ends.
- 3.4 Two Piece Ball Valves (2" and under): Ball valve shall have bronze body, ball and reinforced, watertight seat. Valve shall be two piece construction. Valve shall be "full port" type. Valve handle shall only require quarter turn to go from full open to full close. The handle shall be removable with vinyl grip. Valve shall be rated for 250 degrees F water temperature and 200 psi working pressure. Ball valve shall be Nibco T-585 for threaded ends and Nibco S-585 for solder ends. Provide extended handles for all ball valves installed in insulated piping systems.
- 3.5 Strainers (2" and under): Watts 77S Series "Y" type strainer with cast iron body and threaded ends. Screen shall be 20 mesh stainless steel. Strainer shall be provided with cleanout plug and be rated for 200 psi working pressure.
- 3.6 Balancing Valve (4" and less): Balancing valve shall have bronze or cast iron body. Valves to have differential pressure readout ports across valve seat area with integral check valves. Valve shall be equipped with memory stop. Valves to have threaded ends for sizes 3" and less, flanged ends for larger sizes. Valve to be provided with performed molded insulation casing. Design working pressure and temperature to be 200 psi at 250 degrees F balancing valve shall be similar to Bell & Gossett Model CB.
- 3.7 Flexible Connection: Construction to be of annular corrugated stainless steel close-pitch hose with stainless steel overbraid. The corrugated metal hose, braid(s), and a stainless steel ring-ferrule/band (material gauge not less than .048") must be integrally seal-welded using a 100% circumferential, full-penetration TIG weld. End fittings shall be flat-face plate steel flanges with 150# ANSI drilling and outside diameter. Fittings must be attached using a 100% circumferential TIG weld. Braided stainless

steel pump connector(s) must be suitable for operating temperatures up to 850 degrees F. The rated working pressure of the braided metal hose must have a minimum 4:1 safety factor. Each braided stainless steel pump connector shall be individually leak tested by the manufacturer using air-under-water or hydrostatic pressure. Flanged pump connectors shall be prepared for shipment using cut-to-length spacers, securely positioned between the flanges to prevent axial compression damage and maintain the manufactured length. Spacers must be removed prior to system start up.

- 3.8 Automatic Air Vent: Armstrong Model 79 automatic air vent for vertical mounting with brass body and polypropylene float. Vent to be rated for 150 psi working pressure and 240 degrees F working temperature. Pipe discharge to nearest floor drain.
- 3.9 Manual Air Vent: Armstrong Model 505A manual air vent with brass body. Install with 12" length of 1/4" soft copper discharge piping.

END OF SECTION.

DIVISION 20 – MECHANICAL

SECTION 202200 - INSULATION - MECHANICAL

PART 1 – GENERAL:

- 1.1 The Contractor's attention is directed to the General and Special Conditions, GENERAL PROVISIONS - MECHANICAL and to all other Contract Documents as they apply to this branch of the work. Attention is also directed to all other sections of the Contract Documents which affect the work of this section and which are hereby made a part of the work specified in this section.
- 1.2 Work under this section shall include all labor, equipment, accessories, materials and services required to furnish and install all insulation, fittings and finishes for all mechanical systems specified herein and/or as indicated.
- 1.3 Application of insulation materials shall be performed in accordance with manufacturer's written recommendations. Where thickness of insulation is not specified, use applicable thickness recommended by manufacturer for specific use.
- 1.4 Insulation shall be installed by a company regularly engaged in the application of insulation and any work deemed unacceptable by the Engineer shall be removed and properly installed at the expense of the Contractor.
- 1.5 The Contractor shall photograph any installations prior to concealment. This includes duct risers in chases and at rooftop equipment.

PART 2 – ACCEPTABLE MANUFACTURERS:

- 2.1 Johns Manville, Keene Corp., Knauf, Owens-Corning, Armstrong World Industries.

PART 3 – FIRE RATINGS AND STANDARDS:

- 3.1 Insulations, jackets, facings, adhesives, mastics, tapes, fitting materials, etc. shall have composite fire and smoke hazard ratings as tested by ASTM E-84, NFPA 255 and UL 723 procedures not exceeding Flame Spread 25, Smoke Developed 50 and Fuel Contributed 50.
- 3.2 All products and their packaging shall bear a label indicating above requirements are not exceeded.

PART 4 – GENERAL APPLICATION REQUIREMENTS:

- 4.1 "Concealed", where used herein, shall mean hidden from sight as in trenches, chases, furred spaces, pipe shafts, or above hung finished ceilings. "Exposed" shall mean that piping or equipment is not "concealed" as defined above. Piping and equipment in service tunnels, mechanical equipment rooms, storage areas, or unfinished rooms is to be considered "exposed".
- 4.2 Insulation shall be applied on clean, dry surfaces in a neat and workmanlike manner reflecting the best current practices in the trade. Insulation shall not be applied to piping, ductwork or equipment until tested, inspected and released for insulation.
- 4.3 Where more than one thickness of insulation is required, joints (both longitudinal and transverse) shall be staggered.
- 4.4 All insulation shall be continuous through walls, ceiling openings and sleeves. However, insulation shall be broken through fire walls. All covered pipe and ductwork is to be located a sufficient

distance from walls, other pipe, ductwork and other obstacles to permit the application of the full thickness of insulation specified. If necessary, extra fittings and pipe are to be used. No noticeable deformation of insulation or discontinuity of vapor seal, where required, will be accepted. Coordinate work with plumbers, pipe fitters, etc. to assure hanger locations agree with location of insulation inserts.

- 4.5 Existing and/or new insulation removed and/or damaged during course of construction shall be repaired or replaced by the Contractor at their expense.
- 4.6 Vapor barrier jackets shall be applied with a continuous unbroken vapor seal. Do not use staples through the jacket. NO EXCEPTIONS!
- 4.7 All insulation shall be installed with joints butted firmly together.
- 4.8 The Contractor shall insure that all insulation (piping, ductwork, equipment, etc.) is completely continuous along all conduits, equipment, connection routes, etc. carrying cold fluids (air, water, other) and that condensation can, in no way, collect in or on the insulation, equipment, conduits, etc. Any such occurrence of condensation collection and/or damage therefrom shall be repaired solely at the expense of the Contractor.
- 4.9 Unless otherwise specified or allowed, closed cell type insulation shall not be acceptable.

PART 5 – PIPING SYSTEMS:

- 5.1 Seal insulation and jacket at all points where insulation terminates at unions, flanges, valves and equipment. This applies to hot water lines only as cold water lines require continuous insulation and vapor barrier.
- 5.2 Pipe insulation shall extend around valve bodies to above drain pans in hydronic equipment over pumps, etc. to insure no condensation drip or collection.
- 5.3 Valves, flanges and unions shall only be insulated when installed on cold fluid piping whose surface temperature will be at or below the dew point temperature of the ambient air.
- 5.4 Insulation shall not extend through fire and smoke walls. Pack sleeve at fire and smoke wall with approved fire retardant packing similar to mineral wool.
- 5.5 Metal insulation shields and inserts are required at all pipe hangers where the piping is insulated. Metal shields shall be constructed of galvanized steel, formed to a 180 degree arc. Insulation shields shall be the following size:

<u>Pipe Size</u>	<u>Shield Gauge</u>	<u>Shield Length</u>
2" and less	20	12"
2 ½"- 4"	18	12"
5"- 10"	16	18"

- 5.6 Insulated pipes 2" in diameter and larger shall be additionally supported with wood inserts of sufficient compressive strength to carry the weight of the pipe and fluid. Inserts shall extend beyond extend beyond the hanger and shall be at least 6" in length.
- 5.7 Provide premolded PVC insulated fitting covers on all pipe fittings, flanges, valves and pipe terminations. Fittings shall be insulated by applying the proper factory precut insulation insert to the pipe fitting. The ends of the insulation insert shall be tucked snugly into the throat of the fitting and the edges adjacent to the pipe insulation tufted and tucked in, fully insulating the pipe fitting. The

proper thickness of insulation must be applied to keep the jacket temperature less than 150°F. An approved vapor retarder mastic compatible with the PVC shall be applied around the edges of the adjoining pipe insulation and on the fitting cover throat overlap seam. The PVC fitting cover shall then be applied and secured with pressure sensitive tape along the circumferential edges. The tape shall extend over the adjacent pipe insulation and have an overlap on itself at least 2" on the downward side. On fittings where the operating temperature is below 50°F, two or more layers of the insulation inserts shall be applied with the first layer being secured with a few wrappings of fiber glass yarn to eliminate voids. One additional insert shall be used for each additional 1" of pipe insulation above 1-1/2". All joints shall be fully sealed.

5.8 PIPE INSULATION MATERIAL: Insulation shall be Owens-Corning model 25ASJ/SSL or approved equivalent fiberglass pipe insulation with an all service jacket. The insulation shall be a heavy density, pipe insulation with a K factor not exceeding 0.27 Btu per inch/h.ft² °F at 75°F mean temperature. The insulation shall be wrapped with a vapor barrier jacket. The jacket shall have an inside foil surface with self sealing lap and a water vapor permeability of 0.02 perm/inch. All circumferential joints shall be vapor sealed with butt strips. All insulation shall be installed in strict accordance with the manufacturer's recommendations. The following pipes shall be insulated with the thickness of insulation as noted.

- 5.8.1 Domestic Cold Water: 1/2" thick insulation
- 5.8.2 Domestic Hot Water Lines: 1" thick insulation
- 5.8.3 Domestic Recirc. Lines: 1" thick insulation

PART 6 – DUCTWORK SYSTEMS:

- 6.1 Duct sizes indicated are the net free area inside clear dimensions; where ducts are internally lined, overall dimensions shall be increased accordingly.
- 6.2 Duct insulation shall extend completely to all registers, grilles, diffusers, and louver outlets, etc., to insure no condensation drip or collection.
- 6.3 EXTERNAL INSULATION FOR SUPPLY AIR DUCTWORK: Owens/Corning, All Service Fiberglass Duct Wrap, "Faced Duct Wrap - Type 75" or approved equivalent, 2" thick fiberglass duct wrap, factory laminated to a reinforced foil kraft vapor barrier facing (FRK) with a 2" stapling flange at one edge. The installed R value shall be a minimum of 5.0. Flame spread 25, smoke developed 50, vapor barrier performance 0.02 perms per inch.

END OF SECTION.

DIVISION 20 – MECHANICAL

SECTION 202300 - THERMOMETERS, PRESSURE GAUGES AND OTHER MONITORING INSTRUMENTS

PART 1 – GENERAL:

- 1.1 The Contractor's attention is directed to the General and Special Conditions, GENERAL PROVISIONS - MECHANICAL and to all other Contract Documents as they apply to this branch of the work. Attention is also directed to all other sections of the Contract Documents which affect the work of this section and which are hereby made a part of the work specified in this section.
- 1.2 The Contractor shall include all thermometers, pressure gauges and/or compound gauges at the locations indicated. All pressure gauges and/or compound gauges shall be provided with ¼ turn ball valves to allow the gauge to be removed and replaced without shutting down system.

PART 2 – THERMOMETERS AND PRESSURE GAUGES:

- 2.1 Gauges and thermometers shall be Miljoco, Marsh, Terrice, or Weksler.
- 2.2 All thermometers and pressure gauges shall be readable from a standing position on the floor. Mount thermometers in approved wells. Do not make direct contact of base with fluid in pipe. Pressure gauges and thermometers subject to vibration shall be mounted remotely away from vibrating pipe surface, etc. with flexible tubing.
- 2.3 Digital thermometers shall be solar powered industrial thermometer. The range shall be -50°F/300°F with an accuracy of 1% or 1°, whichever is greater. The display shall be a 3/8" LCD digit. Use where specifically indicated on the drawings.
- 2.4 Water thermometers shall be blue-reading spirit liquid-in-glass type with 9" scale, powder coated cast aluminum case and stem socket of length as required by system. Accuracy to be plus or minus 1 scale division. Lens to be plastic. Hot water thermometer shall have a 30°F to 240°F range and chilled water and geothermal water thermometer shall have a 0°F to 120°F range.
- 2.5 Pressure gauges shall be Bourdon Type, circular, 4-1/2" face, black letters on white face graduated in 2 PSI or less and shall be manufactured for service intended. Provide with pig tail connectors and gauge cocks. Accuracy to be plus or minus 1%. Water pressure and low pressure steam gauges shall have 0 to 100 PSI range and medium/high pressure steam gauges shall have 0 to 200 PSI range.
- 2.6 Provide direct mount Bimetal dial thermometers in HVAC ductwork. Thermometer shall be 3" diameter, with polycarbonate plastic lens and stainless steel case. Air temperature range shall be 25°F to 125°F.

END OF SECTION.

DIVISION 20 – MECHANICAL

SECTION 202400 - IDENTIFICATIONS, TAGS, CHARTS, ETC.

PART 1 – GENERAL:

- 1.1 The Contractor's attention is directed to the General and Special Conditions, GENERAL PROVISIONS - MECHANICAL and to all other Contract Documents as they apply to this branch of the work. Attention is also directed to all other sections of the Contract Documents which affect the work of this section and which are hereby made a part of the work specified in this section.
- 1.2 Refer to FIRE PROTECTION AND MEDICAL GAS PIPING requirements specified in the respective specification section.

PART 2 – TAGS AND CHARTS:

- 2.1 All emergency shutoff valves shall be identified with a permanent engraved tag hung from the valve with 1-inch high lettering. Emergency shutoff valves shall be identified as any valve whose closure could create an emergency condition in the facility (i.e. water, domestic hot water, main HVAC valves, etc.).
- 2.2 Provide typewritten valve charts indicating each valve identifier, the valves service, normal position and its location. Also furnish one electronic copy on CD in "*.xls" format. One (1) copy of this chart shall be mounted in suitable frame(s) with clear plastic covers in a conspicuous location in each of the major mechanical rooms.
- 2.3 Label all control panels and disconnect switches with service and equipment served.

PART 3 – PIPING IDENTIFICATION:

- 3.1 All piping installed shall be identified according to the chart hereinafter specified. Provide stenciled markers and arrows indicating direction of flow on all piping installed under this contract. Markers and arrows shall be painted on the piping using machine cut stencils. All letters shall be sprayed using fast drying lacquer paint. All markers and arrows shall be properly oriented so that descriptive name may be easily read from the floor. Piping shall be identified on twenty (20) foot centers. All piping shall be minimally identified once above all room ceilings and where it passes thru walls or floors. Setmark or equivalent manufactured marking system shall be used in mechanical rooms.
- 3.2 The following table describes the size of the color field and size of the identification letters which shall be used for pipes of different outside pipe diameters.

<u>Outside Diameter</u>	<u>Label Length</u>	<u>Letter Size</u>
3/4" – 1 1/4"	8"	1/2"
1 1/2" – 2"	8"	3/4"
2 1/2" – 6"	12"	1 1/4"
8" – 10"	24"	2 1/2"

- 3.3 The following chart describes the pipe service and label identification which shall be used for various pipes.

<u>PIPE</u>	<u>ABBREVIATION</u>
Hot Water Supply	H.W.S.
Hot Water Return	H.W.R.
Domestic Cold Water	D.C.W.

Domestic Hot Water	D.H.W.
Recirculated Hot Water	R.H.W.
Fire Protection	SPRINKLER
Sanitary Sewer Piping	SAN
Sanitary Vent Piping	VENT
Storm Sewer Piping	STORM
Heating Hot Water Supply	HWS
Heating Hot Water Return	HWR

PART 4 – PAINTING OF PIPING:

- 4.1 All new insulated and uninsulated piping in the existing first floor mechanical room, shall be completely painted by this contractor to match the existing color scheme.
- 4.2 All piping shall be painted in accordance with the Owner's color coding. Verify colors with the Owner prior to painting. Paint all pipes evenly in a workmanlike manner. Apply a minimum of two coats of paint for sufficient coverage.

<u>PIPE</u>	<u>PIPE COLOR CODE</u>	<u>ABBREVIATION</u>
Fire Protection	Red w/White Letters	SPRINKLER

- 4.3 Where a pipe is not specifically identified in this table, painting and marking shall be in accordance with the most recent ANSI Standards.

PART 5 – EQUIPMENT IDENTIFICATION:

- 5.1 Unless otherwise specified, all equipment shall be identified. The titles shall be short and concise and abbreviations may be used as long as the meaning is clear. In finished rooms and mechanical rooms, equipment shall be identified neatly and conspicuously with engraved black lamacoid plates (or equivalent) with 1" high white letters on the front of each piece of equipment.
- 5.2 All mechanical equipment and associated starters/disconnects shall have the electrical panel number and circuit number identified on a lamacoid plate. Coordinate with the Electrical Contractor.

PART 6 – DUCTWORK IDENTIFICATION:

- 6.1 All ductwork shall be identified as to the service of the duct and direction of flow. Include equipment designator on SA & RA ductwork. The letters shall be at least two inches high and the flow arrow shall be at least six inches long. The letters and flow arrow shall be made by precut stencils and black oil base paint with aerosol can. Concealed ducts also need to be identified.

<u>DUCTWORK</u>	<u>ABBREVIATION</u>
Supply Air Ductwork	SA + Equipment Identifier
Return Air Ductwork	RA + Equipment Identifier
Exhaust Air Ductwork	EA + Equipment Identifier

PART 7 – ACCESS THROUGH LAY-IN CEILINGS:

- 7.1 Mark each lay-in ceiling panel which is nearest access to equipment, valves, dampers, filters, duct heaters, etc., with colored tape labels located on the ceiling grid.

END OF SECTION.

DIVISION 20 – MECHANICAL

SECTION 202500 - HANGERS, CLAMPS, ATTACHMENTS, ETC.

PART 1 – GENERAL:

- 1.1 The Contractor's attention is directed to the General and Special Conditions, GENERAL PROVISIONS - MECHANICAL and to all other Contract Documents as they apply to this branch of the work. Attention is also directed to all other sections of the Contract Documents which affect the work of this section and which are hereby made a part of the work specified in this section.
- 1.2 Each Contractor's attention is also directed to Specification Section PIPE, PIPE FITTINGS AND SUPPORT.
- 1.3 This section includes, but is not limited to, furnishing and installing supports, anchors, and accessories for piping, ductwork, equipment, etc. Furnishing and installing shall be by each trade for the completion of their work as directed in this Section.

PART 2 – MATERIALS AND EQUIPMENT:

- 2.1 Hangers, Clamps, Attachments Schedule:
 - ACCEPTABLE MANUFACTURERS: Grinnell, Elcen, Fee & Mason.
 - All hangers, clamps and attachments shall be manufactured products.
 - Pipe Rings (2" pipe and smaller) – adjustable swivel split ring or split pipe ring.
 - Pipe Clevis (2.5" pipe and larger) – adjustable wrought clevis type.
 - Pipe Clevis (All pipe sizes) – steel clevis for insulated pipe.
 - Riser Clamps (All pipe sizes) – extension pipe or riser clamp.
 - Beam Clamps (All pipe sizes) – malleable beam clamp with extension piece.
 - Brackets (All pipe sizes) – medium weight steel brackets.
 - Concrete Inserts (All pipe sizes) – wrought or wedge type inserts.
 - Concrete Fasteners (All pipe sizes) – self-drilling concrete inserts.
 - Rod Attachments (All pipe sizes) – extension piece, rod coupling, forged steel turnbuckle
 - U-bolts (All pipe sizes) – standard u-bolt.
 - Welded Pipe Saddles (All pipe sizes) – pipe covering protection saddle sized for thickness of insulation.
 - Pipe Roll (All pipe sizes) – adjustable swivel pipe roll.
 - Protection Saddle (All pipe sizes) – 180 degree coverage, sheet metal pipe protection saddle.
 - Hanger Rods (All pipe sizes) – Steel, diameter of hanger threading.
 - Concrete Channel Inserts (All pipe sizes) – continuous heavy duty slot inserts unistrut.
 - Adjustable Spot Inserts (All pipe sizes) – continuous heavy duty spot insert unistrut.
 - Miscellaneous steel such as steel angles, rods, bars, channels, etc used in framing for supports, fabricated brackets, anchors, etc. shall conform to ASTM-A-7.

PART 3 – INSTALLATION:

- 3.1 Supporting and hanging shall be done so that excessive load will not be placed on any one hanger so as to allow for proper pitch and expansion of piping.
- 3.2 Hangers and supports shall be placed as near as possible to joints, turns and branches.
- 3.3 Utilize beam clamps for fastening to steel joists and beams. Expansion anchors in masonry construction.

- 3.4 Piping shall be top mounted on trapeze type hangers with each pipe individually clamped to trapeze hanger. Do not support piping or ductwork from bridging angles.
- 3.5 Trapeze hangers are not allowed, unless specifically approved by the Engineer.
- 3.6 Install all miscellaneous steel other than designed building structural members as required to provide means of securing hangers, supports, etc., where piping does not pass directly below or cross structural elements.
- 3.7 Piping shall not be supported by the equipment to which it is connected. Support all piping so as to remove any load or stress from the equipment.
- 3.8 Where piping, etc., is routed vertically, approved riser clamps, brackets or other means shall be utilized at approximately 10'-0" center to center minimum. An approved adjustable base stand or fitting on concrete support base shall be utilized at the base of the vertical run.
- 3.9 Where piping is routed along walls, knee braced angle frames, etc. pipe brackets with saddles, clamps, and rollers mounted on structural brackets fastened to walls or columns shall be used.
- 3.10 Support all ceiling hung equipment with approved vibration isolators.
- 3.11 Where copper tubing is specified, hangers shall be of copper clad type when piping is uninsulated.
- 3.12 Uninsulated piping hung from above shall be supported with ring and clevis type pipe hangers. Uninsulated piping mounted on trapeze (when allowed) and wall bracket type support shall be held in place with U-bolts. U-bolts shall allow for axial movement in the piping.
- 3.13 All insulated piping shall be supported with clevis type and pipe roll hangers. Hangers shall be sized to allow the pipe insulation to pass through the hangers. Install insulation protection saddles at all hanger locations. Welded pipe saddles shall be installed at all hangers on piping 5" and larger. The pipe saddles shall be sized for the thickness of insulation used. Hangers shall fit snugly around outside of insulation saddles.
- 3.14 Under no conditions will perforated band iron or steel wire driven hangers be permitted.
- 3.15 Support steel and copper piping at a minimum of eight (8) foot intervals for piping 3" and smaller and ten (10) foot intervals for larger piping. Provide additional support at end of the branches and change of direction.
- 3.16 Support plastic pipe at intervals not to exceed four (4) feet and at the end of the branches and at the change of direction and shall be installed as to permit freedom of movement. Vertical piping shall be supported at their bases and all upward movement shall not be restricted. Hangers shall be at least one (1) inch wide and shall not compress, distort, cut or abrade the piping to allow free movement at all times.
- 3.17 Where fireproofing is dislodged/damaged from the building structure due to Contractor's installation of hangers, clamps, etc., it shall be the Contractor's responsibility to repair all dislodged/damaged fireproofing to original fireproofing rating. This shall also include all work performed by their contractors sub-contractors.
- 3.18 Insure that all bolts and nuts are tightened.

END OF SECTION.

DIVISION 20 – MECHANICAL

SECTION 202600 - MECHANICAL/ELECTRICAL VIBRATION CONTROLS AND SEISMIC RESTRAINTS

PART 1 – GENERAL

- 1.1 The Contractor's attention is directed to the General and Special Conditions, GENERAL PROVISIONS - MECHANICAL and to all other Contract Documents as they apply to this branch of the work. Attention is also directed to all other sections of the Contract Documents which affect the work of this section and which are hereby made a part of the work specified in this section.
- 1.2 ACCEPTABLE MANUFACTURERS: Mason Industries, Vibration Eliminator Co., Inc., Vibration Isolation Co., Inc.
- 1.3 All Seismic restraint devices; isolators, calculations and seismic design shall be provided by a single vibration isolator manufacturer as listed above.
- 1.4 This Section includes vibration isolators, vibration isolation bases, and seismic restraints and snubbers for mechanical and electrical equipment, duct and piping systems.
- 1.5 PROJECT CONDITIONS
 - 1.5.1 Seismic Design Category: C
 - 1.5.2 Seismic calculations, design and installation for Mechanical Systems shall be per IBC and ASCE 7.
 - 1.5.3 Component Importance Factor is 1.5 for the following Mechanical Systems (All other Mechanical Systems shall have a Component Importance Factor of 1.0):
 - 1.5.3.1 Fire Protection System, and all other complete system components required to operate these systems,
 - 1.5.3.2 Also, the interrelationship of components and their effect on each other shall be considered so that the failure of any essential or non-essential architectural, mechanical or electrical component shall not cause the failure of another essential architectural, mechanical or electrical component.
 - 1.5.4 Duct restraints are not required if conditions of ASCE 7, Chapter B Paragraph 13.6.7 are met.
 - 1.5.5 Piping restraints are not required if conditions of ASCE 7, Chapter B Paragraph 13.6.8 are met.
- 1.6 APPLICABLE CODES AND STANDARDS
 - 1.6.1 The IBC and ASCE 7.
 - 1.6.2 NFPA-13 and 14 for fire protection systems.
- 1.7 SUBMITTALS
 - 1.7.1 Product Data: Indicate types, styles, materials, and finishes for each type of isolator and seismic restraint specified. Include load deflection curves.

1.8 SEISMIC RESTRAINT SUBMITTALS

- 1.8.1 Shop Drawings: Show designs and calculations, prepared and stamped by a licensed professional engineer, for the following:
- 1.8.2 Design Calculations: Delegated design calculations for design and selection of seismic restraints for equipment (including fire pump and related equipment), duct and piping systems (including risers), shall be stamped by a licensed professional engineer. Refer to Section Project Conditions 1.5 for requirements.
- 1.8.3 Analysis must include calculated dead loads, static seismic loads and capacity of materials utilized for connections to equipment and structure. Analysis must detail anchoring methods, bolt diameter, embedment and/ or welded length. All seismic restraint devices shall be designed to accept, without failure, the forces detailed in listed building codes acting through the equipment center of gravity. Overturning moments may exceed forces at ground level.
- 1.8.4 Seismic Restraint Details: Detail fabrication and attachment of restraints and Snubbers.
- 1.8.5 Concrete Pad Details: Show required concrete pad size and location for equipment. Show locations of required pad anchors and stud wedge anchors.
- 1.8.6 Where wall, floors, slabs, or supplementary steel work are used for seismic restraint locations, details of acceptable attachment methods for ducts, conduit and pipe must be included and approved before the condition is accepted for installation. Restraint manufacturers' submittals must include spacing, static loads and seismic loads at all attachment and support points.

1.9 SEISMIC RESTRAINT QUALITY ASSURANCE

- 1.9.1 Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in the jurisdiction where the Project is located and who has a minimum of 5 years experience in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of vibration isolation bases and seismic restraints that are similar to those indicated for this Project in material, design, and extent.

PART 2 – PRODUCTS

2.1 VIBRATION ISOLATORS

- 2.1.1 Rubber Isolator Mounts: Double-deflection type, with molded, oil-resistant rubber or neoprene isolator elements, with encapsulated top-and baseplates. Factory drilled and tapped top plate for bolted equipment mounting. Factory-drilled baseplate for bolted connection to structure. Color-code to indicate capacity range.
- 2.1.2 Restraint Spring Isolators: Vertically restrained, freestanding, laterally stable, steel open-spring-type isolators.
- 2.1.3 Housing: Welded steel or ductile iron. Factory-drilled baseplate for bolting to structure and bonded to a 1/4 -inch-(6mm) thick, rubber isolator pad attached to the baseplate underside. Provide adjustable equipment mounting and leveling bolt.
- 2.1.4 Outside Spring Diameter: Not less than 80 percent of the compressed height of spring at rated load.
- 2.1.5 Minimum Additional Travel: 50 percent of the required deflection at rated load.

- 2.1.6 Lateral Stiffness: More than 0.8 times the rated vertical stiffness.
- 2.1.7 Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
- 2.1.8 Finishes: Baked enamel for metal components on isolators for interior use. Hot-dip galvanized for metal components on isolators for exterior use.
- 2.1.9 Vertical Limit Stops: Where required or shown, provide resilient vertical limit stops to prevent spring extension due to wind loads or when weight is removed.
- 2.1.10 Rubber Hangers: Double-deflection type, with molded, oil-resistant rubber or neoprene isolator elements bonded to formed-steel housings with threaded connections for hanger rods. Color-code to indicate capacity range.
- 2.1.11 Spring Hangers: Combination spring and elastomeric hanger with coil spring and elastomeric insert in compression.
- 2.1.12 Frame: Formed steel, fabricated for connection to threaded rods and to allow for 30 degrees of angular hanger rod misalignment without binding or reducing isolation efficiency.
- 2.1.13 Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
- 2.1.14 Minimum Additional Travel: 50 percent of the required deflection at rated load.
- 2.1.15 Elastomeric Element: Molded, oil-resistant rubber or neoprene.
- 2.1.16 All-directional acoustical pipe anchor shall consist of two sizes of steel tubing separated by a minimum ½" thick 60 durometer neoprene. Vertical restraint shall be provided by similar material arranged to prevent vertical travel in either direction. Allowable loads on the isolation material should not exceed 500 psi and the design shall be balanced for equal resistance in any direction.
- 2.1.17 Seismic solid braces shall consist of steel angles or channels to resist seismic loads with minimum safety factor of 2 and arranged to provide all directional restraint. Seismic solid brace end connection shall be steel assemblies that swivel to the final installation angle and utilize two through bolts to provide proper attachment. Seismic solid brace assembly shall have anchorage pre-approval "R" number OSHPD in the state of California verifying the maximum certified load ratings.
- 2.1.18 Housekeeping pad anchors shall consist of a ductile iron casting that is tapered and hexagonal, smaller at its base than at its top. The upper portion shall have holes for rebar to pass through. The anchor should be continuously threaded from top to bottom for the attachment of soleplates. Housekeeping anchors shall be attached to the structural slab using stud wedge anchors.
- 2.1.19 Stud wedge anchors shall be manufactured from full diameter wire, not from undersized wire that was "rolled up" to create the thread. The stud anchor shall also have a safety shoulder, which fully support the wedge ring under load. The stud anchors shall have an evaluation report number from the I.C.B.O. Evaluation Service, Inc. verifying its allowable loads.
- 2.1.20 Female wedge anchors are preferred in floor locations so isolators or equipment can be slid into place after the anchors are installed. Anchors shall be manufactured from full diameter wire, and shall have a safety shoulder to fully support the wedge ring under load. Female wedge anchors shall have evaluation report number from the I.C.B.O. Evaluation Service, Inc. verifying to its allowable loads.

2.2 SEISMIC CONTROLS

- 2.2.1 Thrust Restraints: Combination spring and elastomeric restraints with coil spring and elastomeric insert in compression. Factory set for thrust.
- 2.2.2 Frame: Formed steel, fabricated for connection to threaded rods and to allow for 30 degrees of angular hanger rod misalignment without binding or reducing isolation efficiency.
- 2.2.3 Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
- 2.2.4 Minimum Additional Travel: 50 percent of the required deflections at rated load.
- 2.2.5 Elastomeric Element: Molded, oil-resistant rubber or neoprene.
- 2.2.6 Finishes: Baked enamel for metal components. Color-code to indicate capacity range.
- 2.2.7 Seismic cable restraints shall consist of galvanized steel aircraft cables sized to resist seismic loads with a minimum safety factor of two and arranged to provide all-directional restraint. Cable end connections shall be steel assemblies that swivel to final installation angle and utilize two clamping bolts to provide proper cable engagement. Cables must not be allowed to bend across sharp edges.
- 2.2.8 Manufactured Seismic Snubbers: All-directional, double-acting snubbers
- 2.2.9 Construction: Interlocking steel members restrained by ¾-inch-(19-mm-) thick, replaceable, shock-absorbing neoprene insert. Maintain 1/8inch (3mm) clearance in all directions between rigid and resilient surfaces.
- 2.2.10 Fabricated Seismic Snubbers: Welded structural-steel designed and fabricated to restrain equipment or vibration isolation bases from excessive movement during a seismic event. Design to resist gravity forces identified by authorities having jurisdiction.
- 2.2.11 Construction: Welded steel shapes conforming to ASTM A 36 (ASTM A 36M)
- 2.2.12 Resilient Components: ¾ inch-(19-mm-) thick, replaceable, shock-absorbing neoprene insert.
- 2.2.13 Flexible Stainless Steel Hose: Hoses shall be installed on equipment side of shut-off valves horizontally and parallel to the equipment shafts wherever possible.
- 2.2.13.1 Construction: Stainless steel braid and carbon steel fittings.
- 2.2.13.2 Connection: Less than 3": Male nipples.

PART 3 – EXECUTION

3.1 INSTALLATION

- 3.1.1 Install and anchor vibration-, sound-, and seismic-control products according to manufacturer's written instructions and authorities having jurisdiction.
- 3.1.2 Anchor interior mounts, isolators, hangers, and snubbers to vibration isolation bases. Bolt isolator baseplates to structural floors as required by authorities having jurisdiction.

3.1.3 Isolate duct as follows:

3.1.3.1 Provide spring and neoprene hanger or floor spring mount on all duct discharge runs for a distance of 50' from the connected equipment. Spring deflection shall be a minimum of 0.75".

3.1.3.2 Provide precompressed spring and neoprene hanger or floor spring mount on all duct runs having air velocity of 1000 fpm or more. Spring deflection shall be a minimum of 0.75".

3.1.4 Isolated piping as follows:

3.1.4.1 Horizontal pipe isolation: The first three pipe hangers in the main lines near the mechanical equipment shall be precompressed spring and neoprene type. Floor supported piping shall rest on spring type isolators. If piping is connected to equipment located in basements and hangs from ceilings under occupied spaces the first three hangers shall have 0.75" deflection for pipe sizes up to and including 3", 1 1/2" deflection for pipe sizes up to and including 6", and 2 1/2" deflection thereafter.

3.1.4.2 Riser isolation: Risers shall be suspended from spring and neoprene hangers or supported by floor spring isolators, all-directional acoustic pipe anchor, and pipe guide. steel springs shall be a minimum of 0.75" except in those expansion locations where additional deflection is required to limit load changes to +25% of the initial load. Submittals must include riser diagrams and calculations showing anticipated expansion and contraction at each support point, initial and final loads on the building structure, spring deflection changes and seismic loads. Submittal data shall include certification that the riser system has been examined for excessive stresses and that none will exist in the proposed design.

3.2 SEISMIC CONTROL

3.2.1 All mechanical systems are to be seismically restrained. Equipment buried underground is excluded but entry of services through the foundation wall is included. Equipment referred to below is typical (equipment not listed is still included in this specification).

3.2.2 All fire protection piping shall be braced in accordance with NFPA 13 and 14. In addition all fire protection equipment is considered life safety equipment and shall be seismically restrained using seismic force levels according to the building codes listed.

3.2.3 Ductwork, where seismically restrained, must be reinforced. Reinforcement shall consist of all additional angel on top of the ductwork that is attached to the support hanger rods. Ductwork is to be attached to the support hanger rods. Ductwork is to be attached to both upper angle and lower trapeze.

3.2.4 Snubbers: Install the required number of seismic snubbers on each spring-mounted piece of equipment. Locate snubber as close as possible to the vibration isolators and bolt to supporting structure.

3.2.5 Manufacturer shall provide installation instructions, drawings and trained field supervision to insure proper installation and performance. Visit the project site before installation is begun and instruct installers in correct installation procedures for vibration isolation, seismic restraints and concrete pads. Observe installation of other work related to vibration isolation and seismic work, including concrete pad installations; and, after completion of other related work (but before equipment startup), shall furnish written report to Contractor listing observed inadequacies for proper operation and performance of vibration isolation work. Report shall cover the following:

- 3.2.5.1 Equipment installations (performed as work of other sections) on vibration isolators and Seismic restraints.
- 3.2.5.2 Piping connections including flexible connections.
- 3.2.5.3 Ductwork connections including provisions for flexible connections.
- 3.2.5.4 Passage of piping and ductwork which is to be isolated through walls and floors.
- 3.2.5.5 Installation of isolators and seismic restraints on duct and piping systems.
- 3.2.6 Do not start-up equipment until inadequacies have been corrected in manner acceptable to Vibration Isolator and Seismic Controls Manufacturer.
- 3.2.7 Spacing for restraints shall be as follows, except where lesser spacing is required to limit anchorage loads:
 - 3.2.7.1 Ductwork and electrical services (conduit, bus ducts, cable trays, and ladder trays) transverse restraints shall occur at 30' intervals (or at both ends of the duct run if less than specified interval) and longitudinal restraints shall occur at 60' intervals (with at least one restraint per duct run). Transverse restraints shall be installed at each duct/electrical services turn and at each end of a duct/electrical run.
 - 3.2.7.2 Walls including gypsum board non-bearing partitions, which have ducts running through them, may replace a typical transverse brace. Provide channel framing around ducts and solid blocking between the duct and frame.

END OF SECTION.

DIVISION 20 - MECHANICAL

SECTION 203100 - TESTING, BALANCING, LUBRICATION AND ADJUSTMENTS

PART 1 – GENERAL:

- 1.1 The Contractor's attention is directed to the General and Special Conditions, GENERAL PROVISIONS - MECHANICAL and to all other Contract Documents as they apply to this branch of the work. Attention is also directed to all other sections of the Contract Documents which affect the work of this section and which are hereby made a part of the work specified in this section.
- 1.2 The Engineer, or authorized representative, shall be notified by the Contractor twenty-four (24) hours in advance of any tests called for in these Specifications or required by others.
- 1.3 Only after written approval, signed by the Engineer, shall the Contractor apply insulation or paint or allow the work to be furred-in. This written approval, however, does not relieve the Contractor of the responsibilities for any failure during the guarantee period. The expense of all tests shall be borne by the Contractor, along with all temporary equipment, materials, gauges, etc. required for tests.

PART 2 - HEATING, VENTILATING AND AIR CONDITIONING TESTING:

- 2.1 The test and balance of this system shall be by a Contractor who employs only the services of a certified AABC or independent NEBB firm whose sole business is to perform test and balance services. The Test and Balance contractor shall report all deficiencies to the Engineer.
- 2.2 The test and balance contractor shall bid directly to the General Contractor.
- 2.3 Mechanical Contractor shall provide all start-up documents to Test and Balance Contractor prior to any test and balance services.
- 2.4 The Mechanical Contractor shall test all piping before being insulated or concealed in any manner. Where leaks or defects develop, required corrections shall be made and tests repeated until systems are proven satisfactory. Water piping systems shall be subjected to a hydrostatic test as specified and shall be proven tight after a twenty-four (24) hour test.
- 2.5 All motors, bearings, etc. shall be checked and lubricated as required during start-up procedures. All automatic, pressure regulating and control valves shall be adjusted. Excessive noise or vibration shall be eliminated.
- 2.6 System balancing, where required, shall be performed only by persons skilled in this work. The system shall be balanced as often as necessary to obtain desired system operation and results.
- 2.7 All fan belts shall be adjusted for proper operation of fans.
- 2.8 Testing shall occur after completion of the ceiling systems installation.
- 2.9 All deficiencies observed by the Test and Balance Contractor shall be reported immediately to the Engineer and Mechanical Contractor.
- 2.10 Refer to Specification Section – CONTROLS – DIRECT DIGITAL for additional requirements.
- 2.11 Refer to Specification Section – GENERAL PROVISIONS – MECHANICAL for startup requirements.

- 2.12 PRIOR TO DEMOLITION (REFER TO DRAWINGS): Provide pre-construction test services information for the following systems: existing AHU along with supply, return and exhaust airflows. Information required is for the existing AHU supply, return and outside air flow rates and AHU static pressure profiles. Provide airflow for each exhaust fan with static profile. Measure CFM of each grilles, register and diffuser in project renovation area. Provide 15 duct static pressure and airflow measurements at all branch mains connected at the AHU intake/return plenums. Provide main heating hot water supply water flow and main system heating hot water supply pressure.
- 2.13 Provide a preliminary test report to the Engineer immediately after the system is air balanced, or any initial phases are balanced. This report may be hand written. Any systems that are not found to operate within the design tolerances by the Test and Balance Contractor shall be immediately be reported to the Engineer via telephone call to attempt to determine a resolution while the Test and Balance Contractor is still on site. Additional compensation will not be accepted for additional trips.
- 2.14 Anticipate visiting the site again after the Engineer has reviewed the report. The Engineer may request up to two (2) additional site visits for onsite troubleshooting where additional measurements may be required.
- 2.15 For the purpose of placing the Heating, Ventilating and Air Conditioning systems in operation according to design conditions and certifying same, final testing and balancing shall be performed in complete accordance with AABC Standards for Total System Balance, Volume Six (2002), for air and hydronic systems as published by the Associated Air Balance Council.
- 2.16 The following systems shall be tested and balanced:
- The supply, return and outside air duct systems associated with the existing AHUs. Provide static pressure profiles thru each system. Static pressure profiles shall include all sections from the return duct inlet and supply duct outlet of the air handling unit. Show accurate representation of return, relief, outdoor and economizer damper locations. On units equipped with return air fans; show location and profile of the return fan.
 - Measure and verify the minimum outside air flow at the minimum OA damper. Measure the resulting differential pressure across the damper and record it on the placard located on the unit.
 - The renovated area shall have supply and return duct air leakage measurements provided testing per Specification Section SHEET METAL.
 - Each EF shall have exhaust duct air leakage measurements provided per Specification Section SHEET METAL.
 - Verify calibrations of the duct static pressure sensors for all VAV AHUs.
 - The terminal unit hot water coils.
 - Set the minimum and maximum air flow rates for each VAV and CAV box.
 - Balance all supply, return and exhaust air grille to within 10% of design air flow rate.
 - Balance all supply, return and exhaust air grilles to within 5% air change required spaces such as patient rooms, exam, etc.
 - Balance all exhaust air fans and record inlet static pressure.
- 2.17 Set the flow rate for each balancing valve in the recirculating domestic hot water system at 0.10 GPM/fixture total. If flow rates are not indicated, contact the engineer for each balance valve GPM.
- 2.18 Instruments used for testing and balancing of air and hydronic systems shall have been calibrated within a period of six months prior to balancing. All final test analysis reports shall include a letter of certification listing instrumentation used and last date of calibration.
- 2.19 Test and Balance agency shall provide sizing of fan or motor sheaves required for proper balance. The Mechanical Contractor shall purchase and install all sheaves and belts as required. This includes new and existing equipment.

- 2.20 Three (3) copies of the complete test reports shall be submitted to the Consulting Engineer prior to final acceptance of the project. Preliminary test reports shall be submitted when requested.
- 2.21 The Contractor shall provide and coordinate work to provide sufficient time before final completion date so that tests and balancing can be accomplished and provide immediate labor and tools to make corrections when required without undue delay.
- 2.22 The Contractor shall put all heating, ventilating and air conditioning systems and equipment and rangehood system into full operation and shall continue the operation of same during each working day of testing and balancing.
- 2.23 The Test and Balance Contractor shall be present during the Engineer’s final inspection of the building, or a separate project review date. The Engineer may request confirmation of the air balance report by asking for new measurements to be taken at that time. Any information in the test and balance report may be asked to be reconfirmed.

END OF SECTION.

DIVISION 20 – MECHANICAL

SECTION 202100 - VALVES

PART 1 – GENERAL:

- 1.1 The Contractor's attention is directed to the General and Special Conditions, GENERAL PROVISIONS - MECHANICAL and to all other Contract Documents as they apply to this branch of the work. Attention is also directed to all other sections of the Contract Documents which affect the work of this section and which are hereby made a part of the work specified in this section.
- 1.2 Each Contractor shall provide all valves required to control, maintain and direct flow of all fluid systems indicated or specified. This shall include, but may not be limited to all valves of all types including balancing valves, air vents, drain valves, check valves, special valves for special systems, etc., for all Mechanical Systems.
- 1.3 ACCEPTABLE MANUFACTURERS: Nibco, Crane, Milwaukee, Apollo, Kitz, Grinnell, Kennedy, Watts, Keystone, Hammond.
- 1.4 The following type valves shall not be acceptable: Zinc, plastic, fiber or non-metallic.
- 1.5 Each type of valve shall be of one manufacturer, i.e., ball valves, one manufacturer, butterfly valves, one manufacturer, check valves, one manufacturer, etc.
- 1.6 All valves shall comply with current Federal, State and Local Codes. All valves shall be new and of first quality. All valves shall be designed and rated for the service to which they are applied. Zinc, plastic, fiber or non-metallic valves shall not be acceptable.
- 1.7 Contractor shall provide colored tape on ceiling tile where valves are located above ceiling. Provide access panels where valves are located above hard ceiling.

PART 2 – DOMESTIC WATER APPLICATIONS:

- 2.1 Gate Valve (2" and under): Use ball valves as specified.
- 2.2 Globe Valves (2" and under): Globe Valves shall have bronze body, bonnet and disc holder. Globe valve shall have union bonnet, integral seat, teflon or stainless steel renewable disc and be rated for 150 psi working pressure. Globe valve shall be Nibco T-235 for threaded ends or Nibco S-235 for solder ends.
- 2.3 Check Valve (2" and under): Check valve shall have bronze body, disc and hinge. check valve shall be Y-pattern type, horizontal swing, renewable disc and rated for 150 psi working pressure. Check valve shall be Nibco T-413 for threaded ends or Nibco S-413 for solder ends.
- 2.4 Two Piece Ball Valve (2" and under): Ball valve shall have bronze body, ball and reinforced, water tight seat. Valve shall be two piece construction. Valve shall be "full-port" type. Valve handle shall only require quarter turn to go from full open to full close. The handle shall be removable with vinyl grip. Valve shall be rated for 180 degrees F water temperature and 150 psi working pressure. Ball valve shall be Nibco T-585 for threaded ends and Nibco S-585 for solder ends.
- 2.5 Strainers (2" and under): Watts 77S Series "Y" type strainer with cast iron body and threaded ends. Screen shall be 20 mesh stainless steel. Strainer shall be provided with cleanout plug and be rated for 200 psi working pressure.

- 2.6 Vacuum Breakers: Watts #288A atmospheric type vacuum breaker with brass body. Vacuum breaker shall be rated for 210 degrees F and 125 psi working pressure and shall meet ASSE Standard 1001.
- 2.7 Double Check Valve: Double check valve shall have bronze body construction and be provided with inlet strainer, two (2) gate valves for isolation and three (3) test ports. Assembly shall be rated for 110 degrees F water temperature and 175 psi water pressure. Assembly must meet requirements of AWWA Standard C506. For sizes 2" and less, provide Watts #900 (or equal) with threaded ends. For sizes 2½" and larger, provide Watts #709 (or equal) with flange ends.
- 2.8 Balancing Valve: Bell & Gossett "Circuit Setter" Model CB or equal balancing valve. All valves to be of bronze body/brass ball construction with glass and carbon filled TFE seat rings. Valves to have differential pressure read-out ports across valve seat area. Read-out ports to be fitted with internal EPT inserts and check valves. Valve bodies to have 1/4" NPT tapped drain/purge port. Valves to have memory stop feature to allow valve to be closed for service and then reopened to set point without disturbing balance position. All valves to have calibrated nameplates to assure specific valve settings. Valves shall be designed for positive shut-off.

PART 3 – HVAC APPLICATIONS:

- 3.1 Gate Valve (2" and under): Use ball valves as specified.
- 3.2 Globe Valve (2" and under): Globe valve shall have bronze body, bonnet and disc holder. Globe valve shall have union bonnet, integral seat, teflon or stainless steel renewable disc and be rated for 200 psi working pressure. Globe valve shall be Nibco T-235 for threaded ends or Nibco S-235 for solder ends.
- 3.3 Check Valves (2" and less): Check valve shall have bronze body, disc and hinge. Check valve shall be Y-pattern type horizontal swing, renewable disc and rated for 200 psi working pressure. Check valve shall be Nibco T-413 for threaded ends or Nibco S-413 for solder ends.
- 3.4 Two Piece Ball Valves (2" and under): Ball valve shall have bronze body, ball and reinforced, watertight seat. Valve shall be two piece construction. Valve shall be "full port" type. Valve handle shall only require quarter turn to go from full open to full close. The handle shall be removable with vinyl grip. Valve shall be rated for 250 degrees F water temperature and 200 psi working pressure. Ball valve shall be Nibco T-585 for threaded ends and Nibco S-585 for solder ends. Provide extended handles for all ball valves installed in insulated piping systems.
- 3.5 Strainers (2" and under): Watts 77S Series "Y" type strainer with cast iron body and threaded ends. Screen shall be 20 mesh stainless steel. Strainer shall be provided with cleanout plug and be rated for 200 psi working pressure.
- 3.6 Balancing Valve (4" and less): Balancing valve shall have bronze or cast iron body. Valves to have differential pressure readout ports across valve seat area with integral check valves. Valve shall be equipped with memory stop. Valves to have threaded ends for sizes 3" and less, flanged ends for larger sizes. Valve to be provided with performed molded insulation casing. Design working pressure and temperature to be 200 psi at 250 degrees F balancing valve shall be similar to Bell & Gossett Model CB.
- 3.7 Flexible Connection: Construction to be of annular corrugated stainless steel close-pitch hose with stainless steel overbraid. The corrugated metal hose, braid(s), and a stainless steel ring-ferrule/band (material gauge not less than .048") must be integrally seal-welded using a 100% circumferential, full-penetration TIG weld. End fittings shall be flat-face plate steel flanges with 150# ANSI drilling and outside diameter. Fittings must be attached using a 100% circumferential TIG weld. Braided stainless

steel pump connector(s) must be suitable for operating temperatures up to 850 degrees F. The rated working pressure of the braided metal hose must have a minimum 4:1 safety factor. Each braided stainless steel pump connector shall be individually leak tested by the manufacturer using air-under-water or hydrostatic pressure. Flanged pump connectors shall be prepared for shipment using cut-to-length spacers, securely positioned between the flanges to prevent axial compression damage and maintain the manufactured length. Spacers must be removed prior to system start up.

- 3.8 Automatic Air Vent: Armstrong Model 79 automatic air vent for vertical mounting with brass body and polypropylene float. Vent to be rated for 150 psi working pressure and 240 degrees F working temperature. Pipe discharge to nearest floor drain.
- 3.9 Manual Air Vent: Armstrong Model 505A manual air vent with brass body. Install with 12" length of 1/4" soft copper discharge piping.

END OF SECTION.

DIVISION 20 – MECHANICAL

SECTION 202200 - INSULATION - MECHANICAL

PART 1 – GENERAL:

- 1.1 The Contractor's attention is directed to the General and Special Conditions, GENERAL PROVISIONS - MECHANICAL and to all other Contract Documents as they apply to this branch of the work. Attention is also directed to all other sections of the Contract Documents which affect the work of this section and which are hereby made a part of the work specified in this section.
- 1.2 Work under this section shall include all labor, equipment, accessories, materials and services required to furnish and install all insulation, fittings and finishes for all mechanical systems specified herein and/or as indicated.
- 1.3 Application of insulation materials shall be performed in accordance with manufacturer's written recommendations. Where thickness of insulation is not specified, use applicable thickness recommended by manufacturer for specific use.
- 1.4 Insulation shall be installed by a company regularly engaged in the application of insulation and any work deemed unacceptable by the Engineer shall be removed and properly installed at the expense of the Contractor.
- 1.5 The Contractor shall photograph any installations prior to concealment. This includes duct risers in chases and at rooftop equipment.

PART 2 – ACCEPTABLE MANUFACTURERS:

- 2.1 Johns Manville, Keene Corp., Knauf, Owens-Corning, Armstrong World Industries.

PART 3 – FIRE RATINGS AND STANDARDS:

- 3.1 Insulations, jackets, facings, adhesives, mastics, tapes, fitting materials, etc. shall have composite fire and smoke hazard ratings as tested by ASTM E-84, NFPA 255 and UL 723 procedures not exceeding Flame Spread 25, Smoke Developed 50 and Fuel Contributed 50.
- 3.2 All products and their packaging shall bear a label indicating above requirements are not exceeded.

PART 4 – GENERAL APPLICATION REQUIREMENTS:

- 4.1 "Concealed", where used herein, shall mean hidden from sight as in trenches, chases, furred spaces, pipe shafts, or above hung finished ceilings. "Exposed" shall mean that piping or equipment is not "concealed" as defined above. Piping and equipment in service tunnels, mechanical equipment rooms, storage areas, or unfinished rooms is to be considered "exposed".
- 4.2 Insulation shall be applied on clean, dry surfaces in a neat and workmanlike manner reflecting the best current practices in the trade. Insulation shall not be applied to piping, ductwork or equipment until tested, inspected and released for insulation.
- 4.3 Where more than one thickness of insulation is required, joints (both longitudinal and transverse) shall be staggered.
- 4.4 All insulation shall be continuous through walls, ceiling openings and sleeves. However, insulation shall be broken through fire walls. All covered pipe and ductwork is to be located a sufficient

distance from walls, other pipe, ductwork and other obstacles to permit the application of the full thickness of insulation specified. If necessary, extra fittings and pipe are to be used. No noticeable deformation of insulation or discontinuity of vapor seal, where required, will be accepted. Coordinate work with plumbers, pipe fitters, etc. to assure hanger locations agree with location of insulation inserts.

- 4.5 Existing and/or new insulation removed and/or damaged during course of construction shall be repaired or replaced by the Contractor at their expense.
- 4.6 Vapor barrier jackets shall be applied with a continuous unbroken vapor seal. Do not use staples through the jacket. NO EXCEPTIONS!
- 4.7 All insulation shall be installed with joints butted firmly together.
- 4.8 The Contractor shall insure that all insulation (piping, ductwork, equipment, etc.) is completely continuous along all conduits, equipment, connection routes, etc. carrying cold fluids (air, water, other) and that condensation can, in no way, collect in or on the insulation, equipment, conduits, etc. Any such occurrence of condensation collection and/or damage therefrom shall be repaired solely at the expense of the Contractor.
- 4.9 Unless otherwise specified or allowed, closed cell type insulation shall not be acceptable.

PART 5 – PIPING SYSTEMS:

- 5.1 Seal insulation and jacket at all points where insulation terminates at unions, flanges, valves and equipment. This applies to hot water lines only as cold water lines require continuous insulation and vapor barrier.
- 5.2 Pipe insulation shall extend around valve bodies to above drain pans in hydronic equipment over pumps, etc. to insure no condensation drip or collection.
- 5.3 Valves, flanges and unions shall only be insulated when installed on cold fluid piping whose surface temperature will be at or below the dew point temperature of the ambient air.
- 5.4 Insulation shall not extend through fire and smoke walls. Pack sleeve at fire and smoke wall with approved fire retardant packing similar to mineral wool.
- 5.5 Metal insulation shields and inserts are required at all pipe hangers where the piping is insulated. Metal shields shall be constructed of galvanized steel, formed to a 180 degree arc. Insulation shields shall be the following size:

<u>Pipe Size</u>	<u>Shield Gauge</u>	<u>Shield Length</u>
2" and less	20	12"
2 ½"- 4"	18	12"
5"- 10"	16	18"

- 5.6 Insulated pipes 2" in diameter and larger shall be additionally supported with wood inserts of sufficient compressive strength to carry the weight of the pipe and fluid. Inserts shall extend beyond the hanger and shall be at least 6" in length.
- 5.7 Provide premolded PVC insulated fitting covers on all pipe fittings, flanges, valves and pipe terminations. Fittings shall be insulated by applying the proper factory precut insulation insert to the pipe fitting. The ends of the insulation insert shall be tucked snugly into the throat of the fitting and the edges adjacent to the pipe insulation tufted and tucked in, fully insulating the pipe fitting. The

proper thickness of insulation must be applied to keep the jacket temperature less than 150°F. An approved vapor retarder mastic compatible with the PVC shall be applied around the edges of the adjoining pipe insulation and on the fitting cover throat overlap seam. The PVC fitting cover shall then be applied and secured with pressure sensitive tape along the circumferential edges. The tape shall extend over the adjacent pipe insulation and have an overlap on itself at least 2" on the downward side. On fittings where the operating temperature is below 50°F, two or more layers of the insulation inserts shall be applied with the first layer being secured with a few wrappings of fiber glass yarn to eliminate voids. One additional insert shall be used for each additional 1" of pipe insulation above 1-1/2". All joints shall be fully sealed.

5.8 PIPE INSULATION MATERIAL: Insulation shall be Owens-Corning model 25ASJ/SSL or approved equivalent fiberglass pipe insulation with an all service jacket. The insulation shall be a heavy density, pipe insulation with a K factor not exceeding 0.27 Btu per inch/h.ft² °F at 75°F mean temperature. The insulation shall be wrapped with a vapor barrier jacket. The jacket shall have an inside foil surface with self sealing lap and a water vapor permeability of 0.02 perm/inch. All circumferential joints shall be vapor sealed with butt strips. All insulation shall be installed in strict accordance with the manufacturer's recommendations. The following pipes shall be insulated with the thickness of insulation as noted.

- 5.8.1 Domestic Cold Water: 1/2" thick insulation
- 5.8.2 Domestic Hot Water Lines: 1" thick insulation
- 5.8.3 Domestic Recirc. Lines: 1" thick insulation

PART 6 – DUCTWORK SYSTEMS:

- 6.1 Duct sizes indicated are the net free area inside clear dimensions; where ducts are internally lined, overall dimensions shall be increased accordingly.
- 6.2 Duct insulation shall extend completely to all registers, grilles, diffusers, and louver outlets, etc., to insure no condensation drip or collection.
- 6.3 EXTERNAL INSULATION FOR SUPPLY AIR DUCTWORK: Owens/Corning, All Service Fiberglass Duct Wrap, "Faced Duct Wrap - Type 75" or approved equivalent, 2" thick fiberglass duct wrap, factory laminated to a reinforced foil kraft vapor barrier facing (FRK) with a 2" stapling flange at one edge. The installed R value shall be a minimum of 5.0. Flame spread 25, smoke developed 50, vapor barrier performance 0.02 perms per inch.

END OF SECTION.

DIVISION 20 – MECHANICAL

SECTION 202300 - THERMOMETERS, PRESSURE GAUGES AND OTHER MONITORING INSTRUMENTS

PART 1 – GENERAL:

- 1.1 The Contractor's attention is directed to the General and Special Conditions, GENERAL PROVISIONS - MECHANICAL and to all other Contract Documents as they apply to this branch of the work. Attention is also directed to all other sections of the Contract Documents which affect the work of this section and which are hereby made a part of the work specified in this section.
- 1.2 The Contractor shall include all thermometers, pressure gauges and/or compound gauges at the locations indicated. All pressure gauges and/or compound gauges shall be provided with ¼ turn ball valves to allow the gauge to be removed and replaced without shutting down system.

PART 2 – THERMOMETERS AND PRESSURE GAUGES:

- 2.1 Gauges and thermometers shall be Miljoco, Marsh, Terrice, or Weksler.
- 2.2 All thermometers and pressure gauges shall be readable from a standing position on the floor. Mount thermometers in approved wells. Do not make direct contact of base with fluid in pipe. Pressure gauges and thermometers subject to vibration shall be mounted remotely away from vibrating pipe surface, etc. with flexible tubing.
- 2.3 Digital thermometers shall be solar powered industrial thermometer. The range shall be -50°F/300°F with an accuracy of 1% or 1°, whichever is greater. The display shall be a 3/8" LCD digit. Use where specifically indicated on the drawings.
- 2.4 Water thermometers shall be blue-reading spirit liquid-in-glass type with 9" scale, powder coated cast aluminum case and stem socket of length as required by system. Accuracy to be plus or minus 1 scale division. Lens to be plastic. Hot water thermometer shall have a 30°F to 240°F range and chilled water and geothermal water thermometer shall have a 0°F to 120°F range.
- 2.5 Pressure gauges shall be Bourdon Type, circular, 4-1/2" face, black letters on white face graduated in 2 PSI or less and shall be manufactured for service intended. Provide with pig tail connectors and gauge cocks. Accuracy to be plus or minus 1%. Water pressure and low pressure steam gauges shall have 0 to 100 PSI range and medium/high pressure steam gauges shall have 0 to 200 PSI range.
- 2.6 Provide direct mount Bimetal dial thermometers in HVAC ductwork. Thermometer shall be 3" diameter, with polycarbonate plastic lens and stainless steel case. Air temperature range shall be 25°F to 125°F.

END OF SECTION.

DIVISION 20 – MECHANICAL

SECTION 202400 - IDENTIFICATIONS, TAGS, CHARTS, ETC.

PART 1 – GENERAL:

- 1.1 The Contractor's attention is directed to the General and Special Conditions, GENERAL PROVISIONS - MECHANICAL and to all other Contract Documents as they apply to this branch of the work. Attention is also directed to all other sections of the Contract Documents which affect the work of this section and which are hereby made a part of the work specified in this section.
- 1.2 Refer to FIRE PROTECTION AND MEDICAL GAS PIPING requirements specified in the respective specification section.

PART 2 – TAGS AND CHARTS:

- 2.1 All emergency shutoff valves shall be identified with a permanent engraved tag hung from the valve with 1-inch high lettering. Emergency shutoff valves shall be identified as any valve whose closure could create an emergency condition in the facility (i.e. water, domestic hot water, main HVAC valves, etc.).
- 2.2 Provide typewritten valve charts indicating each valve identifier, the valves service, normal position and its location. Also furnish one electronic copy on CD in "*.xls" format. One (1) copy of this chart shall be mounted in suitable frame(s) with clear plastic covers in a conspicuous location in each of the major mechanical rooms.
- 2.3 Label all control panels and disconnect switches with service and equipment served.

PART 3 – PIPING IDENTIFICATION:

- 3.1 All piping installed shall be identified according to the chart hereinafter specified. Provide stenciled markers and arrows indicating direction of flow on all piping installed under this contract. Markers and arrows shall be painted on the piping using machine cut stencils. All letters shall be sprayed using fast drying lacquer paint. All markers and arrows shall be properly oriented so that descriptive name may be easily read from the floor. Piping shall be identified on twenty (20) foot centers. All piping shall be minimally identified once above all room ceilings and where it passes thru walls or floors. Setmark or equivalent manufactured marking system shall be used in mechanical rooms.
- 3.2 The following table describes the size of the color field and size of the identification letters which shall be used for pipes of different outside pipe diameters.

<u>Outside Diameter</u>	<u>Label Length</u>	<u>Letter Size</u>
3/4" – 1 1/4"	8"	1/2"
1 1/2" – 2"	8"	3/4"
2 1/2" – 6"	12"	1 1/4"
8" – 10"	24"	2 1/2"

- 3.3 The following chart describes the pipe service and label identification which shall be used for various pipes.

<u>PIPE</u>	<u>ABBREVIATION</u>
Hot Water Supply	H.W.S.
Hot Water Return	H.W.R.
Domestic Cold Water	D.C.W.

Domestic Hot Water	D.H.W.
Recirculated Hot Water	R.H.W.
Fire Protection	SPRINKLER
Sanitary Sewer Piping	SAN
Sanitary Vent Piping	VENT
Storm Sewer Piping	STORM
Heating Hot Water Supply	HWS
Heating Hot Water Return	HWR

PART 4 – PAINTING OF PIPING:

- 4.1 All new insulated and uninsulated piping in the existing first floor mechanical room, shall be completely painted by this contractor to match the existing color scheme.
- 4.2 All piping shall be painted in accordance with the Owner's color coding. Verify colors with the Owner prior to painting. Paint all pipes evenly in a workmanlike manner. Apply a minimum of two coats of paint for sufficient coverage.

<u>PIPE</u>	<u>PIPE COLOR CODE</u>	<u>ABBREVIATION</u>
Fire Protection	Red w/White Letters	SPRINKLER

- 4.3 Where a pipe is not specifically identified in this table, painting and marking shall be in accordance with the most recent ANSI Standards.

PART 5 – EQUIPMENT IDENTIFICATION:

- 5.1 Unless otherwise specified, all equipment shall be identified. The titles shall be short and concise and abbreviations may be used as long as the meaning is clear. In finished rooms and mechanical rooms, equipment shall be identified neatly and conspicuously with engraved black lamacoid plates (or equivalent) with 1" high white letters on the front of each piece of equipment.
- 5.2 All mechanical equipment and associated starters/disconnects shall have the electrical panel number and circuit number identified on a lamacoid plate. Coordinate with the Electrical Contractor.

PART 6 – DUCTWORK IDENTIFICATION:

- 6.1 All ductwork shall be identified as to the service of the duct and direction of flow. Include equipment designator on SA & RA ductwork. The letters shall be at least two inches high and the flow arrow shall be at least six inches long. The letters and flow arrow shall be made by precut stencils and black oil base paint with aerosol can. Concealed ducts also need to be identified.

<u>DUCTWORK</u>	<u>ABBREVIATION</u>
Supply Air Ductwork	SA + Equipment Identifier
Return Air Ductwork	RA + Equipment Identifier
Exhaust Air Ductwork	EA + Equipment Identifier

PART 7 – ACCESS THROUGH LAY-IN CEILINGS:

- 7.1 Mark each lay-in ceiling panel which is nearest access to equipment, valves, dampers, filters, duct heaters, etc., with colored tape labels located on the ceiling grid.

END OF SECTION.

DIVISION 20 – MECHANICAL

SECTION 202500 - HANGERS, CLAMPS, ATTACHMENTS, ETC.

PART 1 – GENERAL:

- 1.1 The Contractor's attention is directed to the General and Special Conditions, GENERAL PROVISIONS - MECHANICAL and to all other Contract Documents as they apply to this branch of the work. Attention is also directed to all other sections of the Contract Documents which affect the work of this section and which are hereby made a part of the work specified in this section.
- 1.2 Each Contractor's attention is also directed to Specification Section PIPE, PIPE FITTINGS AND SUPPORT.
- 1.3 This section includes, but is not limited to, furnishing and installing supports, anchors, and accessories for piping, ductwork, equipment, etc. Furnishing and installing shall be by each trade for the completion of their work as directed in this Section.

PART 2 – MATERIALS AND EQUIPMENT:

- 2.1 Hangers, Clamps, Attachments Schedule:
 - ACCEPTABLE MANUFACTURERS: Grinnell, Elcen, Fee & Mason.
 - All hangers, clamps and attachments shall be manufactured products.
 - Pipe Rings (2" pipe and smaller) – adjustable swivel split ring or split pipe ring.
 - Pipe Clevis (2.5" pipe and larger) – adjustable wrought clevis type.
 - Pipe Clevis (All pipe sizes) – steel clevis for insulated pipe.
 - Riser Clamps (All pipe sizes) – extension pipe or riser clamp.
 - Beam Clamps (All pipe sizes) – malleable beam clamp with extension piece.
 - Brackets (All pipe sizes) – medium weight steel brackets.
 - Concrete Inserts (All pipe sizes) – wrought or wedge type inserts.
 - Concrete Fasteners (All pipe sizes) – self-drilling concrete inserts.
 - Rod Attachments (All pipe sizes) – extension piece, rod coupling, forged steel turnbuckle
 - U-bolts (All pipe sizes) – standard u-bolt.
 - Welded Pipe Saddles (All pipe sizes) – pipe covering protection saddle sized for thickness of insulation.
 - Pipe Roll (All pipe sizes) – adjustable swivel pipe roll.
 - Protection Saddle (All pipe sizes) – 180 degree coverage, sheet metal pipe protection saddle.
 - Hanger Rods (All pipe sizes) – Steel, diameter of hanger threading.
 - Concrete Channel Inserts (All pipe sizes) – continuous heavy duty slot inserts unistrut.
 - Adjustable Spot Inserts (All pipe sizes) – continuous heavy duty spot insert unistrut.
 - Miscellaneous steel such as steel angles, rods, bars, channels, etc used in framing for supports, fabricated brackets, anchors, etc. shall conform to ASTM-A-7.

PART 3 – INSTALLATION:

- 3.1 Supporting and hanging shall be done so that excessive load will not be placed on any one hanger so as to allow for proper pitch and expansion of piping.
- 3.2 Hangers and supports shall be placed as near as possible to joints, turns and branches.
- 3.3 Utilize beam clamps for fastening to steel joists and beams. Expansion anchors in masonry construction.

- 3.4 Piping shall be top mounted on trapeze type hangers with each pipe individually clamped to trapeze hanger. Do not support piping or ductwork from bridging angles.
- 3.5 Trapeze hangers are not allowed, unless specifically approved by the Engineer.
- 3.6 Install all miscellaneous steel other than designed building structural members as required to provide means of securing hangers, supports, etc., where piping does not pass directly below or cross structural elements.
- 3.7 Piping shall not be supported by the equipment to which it is connected. Support all piping so as to remove any load or stress from the equipment.
- 3.8 Where piping, etc., is routed vertically, approved riser clamps, brackets or other means shall be utilized at approximately 10'-0" center to center minimum. An approved adjustable base stand or fitting on concrete support base shall be utilized at the base of the vertical run.
- 3.9 Where piping is routed along walls, knee braced angle frames, etc. pipe brackets with saddles, clamps, and rollers mounted on structural brackets fastened to walls or columns shall be used.
- 3.10 Support all ceiling hung equipment with approved vibration isolators.
- 3.11 Where copper tubing is specified, hangers shall be of copper clad type when piping is uninsulated.
- 3.12 Uninsulated piping hung from above shall be supported with ring and clevis type pipe hangers. Uninsulated piping mounted on trapeze (when allowed) and wall bracket type support shall be held in place with U-bolts. U-bolts shall allow for axial movement in the piping.
- 3.13 All insulated piping shall be supported with clevis type and pipe roll hangers. Hangers shall be sized to allow the pipe insulation to pass through the hangers. Install insulation protection saddles at all hanger locations. Welded pipe saddles shall be installed at all hangers on piping 5" and larger. The pipe saddles shall be sized for the thickness of insulation used. Hangers shall fit snugly around outside of insulation saddles.
- 3.14 Under no conditions will perforated band iron or steel wire driven hangers be permitted.
- 3.15 Support steel and copper piping at a minimum of eight (8) foot intervals for piping 3" and smaller and ten (10) foot intervals for larger piping. Provide additional support at end of the branches and change of direction.
- 3.16 Support plastic pipe at intervals not to exceed four (4) feet and at the end of the branches and at the change of direction and shall be installed as to permit freedom of movement. Vertical piping shall be supported at their bases and all upward movement shall not be restricted. Hangers shall be at least one (1) inch wide and shall not compress, distort, cut or abrade the piping to allow free movement at all times.
- 3.17 Where fireproofing is dislodged/damaged from the building structure due to Contractor's installation of hangers, clamps, etc., it shall be the Contractor's responsibility to repair all dislodged/damaged fireproofing to original fireproofing rating. This shall also include all work performed by their contractors sub-contractors.
- 3.18 Insure that all bolts and nuts are tightened.

END OF SECTION.

DIVISION 20 – MECHANICAL

SECTION 202600 - MECHANICAL/ELECTRICAL VIBRATION CONTROLS AND SEISMIC RESTRAINTS

PART 1 – GENERAL

- 1.1 The Contractor's attention is directed to the General and Special Conditions, GENERAL PROVISIONS - MECHANICAL and to all other Contract Documents as they apply to this branch of the work. Attention is also directed to all other sections of the Contract Documents which affect the work of this section and which are hereby made a part of the work specified in this section.
- 1.2 ACCEPTABLE MANUFACTURERS: Mason Industries, Vibration Eliminator Co., Inc., Vibration Isolation Co., Inc.
- 1.3 All Seismic restraint devices; isolators, calculations and seismic design shall be provided by a single vibration isolator manufacturer as listed above.
- 1.4 This Section includes vibration isolators, vibration isolation bases, and seismic restraints and snubbers for mechanical and electrical equipment, duct and piping systems.
- 1.5 PROJECT CONDITIONS
 - 1.5.1 Seismic Design Category: C
 - 1.5.2 Seismic calculations, design and installation for Mechanical Systems shall be per IBC and ASCE 7.
 - 1.5.3 Component Importance Factor is 1.5 for the following Mechanical Systems (All other Mechanical Systems shall have a Component Importance Factor of 1.0):
 - 1.5.3.1 Fire Protection System, and all other complete system components required to operate these systems,
 - 1.5.3.2 Also, the interrelationship of components and their effect on each other shall be considered so that the failure of any essential or non-essential architectural, mechanical or electrical component shall not cause the failure of another essential architectural, mechanical or electrical component.
 - 1.5.4 Duct restraints are not required if conditions of ASCE 7, Chapter B Paragraph 13.6.7 are met.
 - 1.5.5 Piping restraints are not required if conditions of ASCE 7, Chapter B Paragraph 13.6.8 are met.
- 1.6 APPLICABLE CODES AND STANDARDS
 - 1.6.1 The IBC and ASCE 7.
 - 1.6.2 NFPA-13 and 14 for fire protection systems.
- 1.7 SUBMITTALS
 - 1.7.1 Product Data: Indicate types, styles, materials, and finishes for each type of isolator and seismic restraint specified. Include load deflection curves.

1.8 SEISMIC RESTRAINT SUBMITTALS

- 1.8.1 Shop Drawings: Show designs and calculations, prepared and stamped by a licensed professional engineer, for the following:
- 1.8.2 Design Calculations: Delegated design calculations for design and selection of seismic restraints for equipment (including fire pump and related equipment), duct and piping systems (including risers), shall be stamped by a licensed professional engineer. Refer to Section Project Conditions 1.5 for requirements.
- 1.8.3 Analysis must include calculated dead loads, static seismic loads and capacity of materials utilized for connections to equipment and structure. Analysis must detail anchoring methods, bolt diameter, embedment and/ or welded length. All seismic restraint devices shall be designed to accept, without failure, the forces detailed in listed building codes acting through the equipment center of gravity. Overturning moments may exceed forces at ground level.
- 1.8.4 Seismic Restraint Details: Detail fabrication and attachment of restraints and Snubbers.
- 1.8.5 Concrete Pad Details: Show required concrete pad size and location for equipment. Show locations of required pad anchors and stud wedge anchors.
- 1.8.6 Where wall, floors, slabs, or supplementary steel work are used for seismic restraint locations, details of acceptable attachment methods for ducts, conduit and pipe must be included and approved before the condition is accepted for installation. Restraint manufacturers' submittals must include spacing, static loads and seismic loads at all attachment and support points.

1.9 SEISMIC RESTRAINT QUALITY ASSURANCE

- 1.9.1 Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in the jurisdiction where the Project is located and who has a minimum of 5 years experience in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of vibration isolation bases and seismic restraints that are similar to those indicated for this Project in material, design, and extent.

PART 2 – PRODUCTS

2.1 VIBRATION ISOLATORS

- 2.1.1 Rubber Isolator Mounts: Double-deflection type, with molded, oil-resistant rubber or neoprene isolator elements, with encapsulated top-and baseplates. Factory drilled and tapped top plate for bolted equipment mounting. Factory-drilled baseplate for bolted connection to structure. Color-code to indicate capacity range.
- 2.1.2 Restraint Spring Isolators: Vertically restrained, freestanding, laterally stable, steel open-spring-type isolators.
- 2.1.3 Housing: Welded steel or ductile iron. Factory-drilled baseplate for bolting to structure and bonded to a 1/4 -inch-(6mm) thick, rubber isolator pad attached to the baseplate underside. Provide adjustable equipment mounting and leveling bolt.
- 2.1.4 Outside Spring Diameter: Not less than 80 percent of the compressed height of spring at rated load.
- 2.1.5 Minimum Additional Travel: 50 percent of the required deflection at rated load.

- 2.1.6 Lateral Stiffness: More than 0.8 times the rated vertical stiffness.
- 2.1.7 Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
- 2.1.8 Finishes: Baked enamel for metal components on isolators for interior use. Hot-dip galvanized for metal components on isolators for exterior use.
- 2.1.9 Vertical Limit Stops: Where required or shown, provide resilient vertical limit stops to prevent spring extension due to wind loads or when weight is removed.
- 2.1.10 Rubber Hangers: Double-deflection type, with molded, oil-resistant rubber or neoprene isolator elements bonded to formed-steel housings with threaded connections for hanger rods. Color-code to indicate capacity range.
- 2.1.11 Spring Hangers: Combination spring and elastomeric hanger with coil spring and elastomeric insert in compression.
- 2.1.12 Frame: Formed steel, fabricated for connection to threaded rods and to allow for 30 degrees of angular hanger rod misalignment without binding or reducing isolation efficiency.
- 2.1.13 Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
- 2.1.14 Minimum Additional Travel: 50 percent of the required deflection at rated load.
- 2.1.15 Elastomeric Element: Molded, oil-resistant rubber or neoprene.
- 2.1.16 All-directional acoustical pipe anchor shall consist of two sizes of steel tubing separated by a minimum ½" thick 60 durometer neoprene. Vertical restraint shall be provided by similar material arranged to prevent vertical travel in either direction. Allowable loads on the isolation material should not exceed 500 psi and the design shall be balanced for equal resistance in any direction.
- 2.1.17 Seismic solid braces shall consist of steel angles or channels to resist seismic loads with minimum safety factor of 2 and arranged to provide all directional restraint. Seismic solid brace end connection shall be steel assemblies that swivel to the final installation angle and utilize two through bolts to provide proper attachment. Seismic solid brace assembly shall have anchorage pre-approval "R" number OSHPD in the state of California verifying the maximum certified load ratings.
- 2.1.18 Housekeeping pad anchors shall consist of a ductile iron casting that is tapered and hexagonal, smaller at its base than at its top. The upper portion shall have holes for rebar to pass through. The anchor should be continuously threaded from top to bottom for the attachment of soleplates. Housekeeping anchors shall be attached to the structural slab using stud wedge anchors.
- 2.1.19 Stud wedge anchors shall be manufactured from full diameter wire, not from undersized wire that was "rolled up" to create the thread. The stud anchor shall also have a safety shoulder, which fully support the wedge ring under load. The stud anchors shall have an evaluation report number from the I.C.B.O. Evaluation Service, Inc. verifying its allowable loads.
- 2.1.20 Female wedge anchors are preferred in floor locations so isolators or equipment can be slid into place after the anchors are installed. Anchors shall be manufactured from full diameter wire, and shall have a safety shoulder to fully support the wedge ring under load. Female wedge anchors shall have evaluation report number from the I.C.B.O. Evaluation Service, Inc. verifying to its allowable loads.

2.2 SEISMIC CONTROLS

- 2.2.1 Thrust Restraints: Combination spring and elastomeric restraints with coil spring and elastomeric insert in compression. Factory set for thrust.
- 2.2.2 Frame: Formed steel, fabricated for connection to threaded rods and to allow for 30 degrees of angular hanger rod misalignment without binding or reducing isolation efficiency.
- 2.2.3 Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
- 2.2.4 Minimum Additional Travel: 50 percent of the required deflections at rated load.
- 2.2.5 Elastomeric Element: Molded, oil-resistant rubber or neoprene.
- 2.2.6 Finishes: Baked enamel for metal components. Color-code to indicate capacity range.
- 2.2.7 Seismic cable restraints shall consist of galvanized steel aircraft cables sized to resist seismic loads with a minimum safety factor of two and arranged to provide all-directional restraint. Cable end connections shall be steel assemblies that swivel to final installation angle and utilize two clamping bolts to provide proper cable engagement. Cables must not be allowed to bend across sharp edges.
- 2.2.8 Manufactured Seismic Snubbers: All-directional, double-acting snubbers
- 2.2.9 Construction: Interlocking steel members restrained by ¾-inch-(19-mm-) thick, replaceable, shock-absorbing neoprene insert. Maintain 1/8inch (3mm) clearance in all directions between rigid and resilient surfaces.
- 2.2.10 Fabricated Seismic Snubbers: Welded structural-steel designed and fabricated to restrain equipment or vibration isolation bases from excessive movement during a seismic event. Design to resist gravity forces identified by authorities having jurisdiction.
- 2.2.11 Construction: Welded steel shapes conforming to ASTM A 36 (ASTM A 36M)
- 2.2.12 Resilient Components: ¾ inch-(19-mm-) thick, replaceable, shock-absorbing neoprene insert.
- 2.2.13 Flexible Stainless Steel Hose: Hoses shall be installed on equipment side of shut-off valves horizontally and parallel to the equipment shafts wherever possible.
- 2.2.13.1 Construction: Stainless steel braid and carbon steel fittings.
- 2.2.13.2 Connection: Less than 3": Male nipples.

PART 3 – EXECUTION

3.1 INSTALLATION

- 3.1.1 Install and anchor vibration-, sound-, and seismic-control products according to manufacturer's written instructions and authorities having jurisdiction.
- 3.1.2 Anchor interior mounts, isolators, hangers, and snubbers to vibration isolation bases. Bolt isolator baseplates to structural floors as required by authorities having jurisdiction.

3.1.3 Isolate duct as follows:

3.1.3.1 Provide spring and neoprene hanger or floor spring mount on all duct discharge runs for a distance of 50' from the connected equipment. Spring deflection shall be a minimum of 0.75".

3.1.3.2 Provide precompressed spring and neoprene hanger or floor spring mount on all duct runs having air velocity of 1000 fpm or more. Spring deflection shall be a minimum of 0.75".

3.1.4 Isolated piping as follows:

3.1.4.1 Horizontal pipe isolation: The first three pipe hangers in the main lines near the mechanical equipment shall be precompressed spring and neoprene type. Floor supported piping shall rest on spring type isolators. If piping is connected to equipment located in basements and hangs from ceilings under occupied spaces the first three hangers shall have 0.75" deflection for pipe sizes up to and including 3", 1 1/2" deflection for pipe sizes up to and including 6", and 2 1/2" deflection thereafter.

3.1.4.2 Riser isolation: Risers shall be suspended from spring and neoprene hangers or supported by floor spring isolators, all-directional acoustic pipe anchor, and pipe guide. steel springs shall be a minimum of 0.75" except in those expansion locations where additional deflection is required to limit load changes to +25% of the initial load. Submittals must include riser diagrams and calculations showing anticipated expansion and contraction at each support point, initial and final loads on the building structure, spring deflection changes and seismic loads. Submittal data shall include certification that the riser system has been examined for excessive stresses and that none will exist in the proposed design.

3.2 SEISMIC CONTROL

3.2.1 All mechanical systems are to be seismically restrained. Equipment buried underground is excluded but entry of services through the foundation wall is included. Equipment referred to below is typical (equipment not listed is still included in this specification).

3.2.2 All fire protection piping shall be braced in accordance with NFPA 13 and 14. In addition all fire protection equipment is considered life safety equipment and shall be seismically restrained using seismic force levels according to the building codes listed.

3.2.3 Ductwork, where seismically restrained, must be reinforced. Reinforcement shall consist of all additional angel on top of the ductwork that is attached to the support hanger rods. Ductwork is to be attached to the support hanger rods. Ductwork is to be attached to both upper angle and lower trapeze.

3.2.4 Snubbers: Install the required number of seismic snubbers on each spring-mounted piece of equipment. Locate snubber as close as possible to the vibration isolators and bolt to supporting structure.

3.2.5 Manufacturer shall provide installation instructions, drawings and trained field supervision to insure proper installation and performance. Visit the project site before installation is begun and instruct installers in correct installation procedures for vibration isolation, seismic restraints and concrete pads. Observe installation of other work related to vibration isolation and seismic work, including concrete pad installations; and, after completion of other related work (but before equipment startup), shall furnish written report to Contractor listing observed inadequacies for proper operation and performance of vibration isolation work. Report shall cover the following:

- 3.2.5.1 Equipment installations (performed as work of other sections) on vibration isolators and Seismic restraints.
- 3.2.5.2 Piping connections including flexible connections.
- 3.2.5.3 Ductwork connections including provisions for flexible connections.
- 3.2.5.4 Passage of piping and ductwork which is to be isolated through walls and floors.
- 3.2.5.5 Installation of isolators and seismic restraints on duct and piping systems.
- 3.2.6 Do not start-up equipment until inadequacies have been corrected in manner acceptable to Vibration Isolator and Seismic Controls Manufacturer.
- 3.2.7 Spacing for restraints shall be as follows, except where lesser spacing is required to limit anchorage loads:
 - 3.2.7.1 Ductwork and electrical services (conduit, bus ducts, cable trays, and ladder trays) transverse restraints shall occur at 30' intervals (or at both ends of the duct run if less than specified interval) and longitudinal restraints shall occur at 60' intervals (with at least one restraint per duct run). Transverse restraints shall be installed at each duct/electrical services turn and at each end of a duct/electrical run.
 - 3.2.7.2 Walls including gypsum board non-bearing partitions, which have ducts running through them, may replace a typical transverse brace. Provide channel framing around ducts and solid blocking between the duct and frame.

END OF SECTION.

DIVISION 20 - MECHANICAL

SECTION 203100 - TESTING, BALANCING, LUBRICATION AND ADJUSTMENTS

PART 1 – GENERAL:

- 1.1 The Contractor's attention is directed to the General and Special Conditions, GENERAL PROVISIONS - MECHANICAL and to all other Contract Documents as they apply to this branch of the work. Attention is also directed to all other sections of the Contract Documents which affect the work of this section and which are hereby made a part of the work specified in this section.
- 1.2 The Engineer, or authorized representative, shall be notified by the Contractor twenty-four (24) hours in advance of any tests called for in these Specifications or required by others.
- 1.3 Only after written approval, signed by the Engineer, shall the Contractor apply insulation or paint or allow the work to be furred-in. This written approval, however, does not relieve the Contractor of the responsibilities for any failure during the guarantee period. The expense of all tests shall be borne by the Contractor, along with all temporary equipment, materials, gauges, etc. required for tests.

PART 2 - HEATING, VENTILATING AND AIR CONDITIONING TESTING:

- 2.1 The test and balance of this system shall be by a Contractor who employs only the services of a certified AABC or independent NEBB firm whose sole business is to perform test and balance services. The Test and Balance contractor shall report all deficiencies to the Engineer.
- 2.2 The test and balance contractor shall bid directly to the General Contractor.
- 2.3 Mechanical Contractor shall provide all start-up documents to Test and Balance Contractor prior to any test and balance services.
- 2.4 The Mechanical Contractor shall test all piping before being insulated or concealed in any manner. Where leaks or defects develop, required corrections shall be made and tests repeated until systems are proven satisfactory. Water piping systems shall be subjected to a hydrostatic test as specified and shall be proven tight after a twenty-four (24) hour test.
- 2.5 All motors, bearings, etc. shall be checked and lubricated as required during start-up procedures. All automatic, pressure regulating and control valves shall be adjusted. Excessive noise or vibration shall be eliminated.
- 2.6 System balancing, where required, shall be performed only by persons skilled in this work. The system shall be balanced as often as necessary to obtain desired system operation and results.
- 2.7 All fan belts shall be adjusted for proper operation of fans.
- 2.8 Testing shall occur after completion of the ceiling systems installation.
- 2.9 All deficiencies observed by the Test and Balance Contractor shall be reported immediately to the Engineer and Mechanical Contractor.
- 2.10 Refer to Specification Section – CONTROLS – DIRECT DIGITAL for additional requirements.
- 2.11 Refer to Specification Section – GENERAL PROVISIONS – MECHANICAL for startup requirements.

- 2.12 PRIOR TO DEMOLITION (REFER TO DRAWINGS): Provide pre-construction test services information for the following systems: existing AHU along with supply, return and exhaust airflows. Information required is for the existing AHU supply, return and outside air flow rates and AHU static pressure profiles. Provide airflow for each exhaust fan with static profile. Measure CFM of each grilles, register and diffuser in project renovation area. Provide 15 duct static pressure and airflow measurements at all branch mains connected at the AHU intake/return plenums. Provide main heating hot water supply water flow and main system heating hot water supply pressure.
- 2.13 Provide a preliminary test report to the Engineer immediately after the system is air balanced, or any initial phases are balanced. This report may be hand written. Any systems that are not found to operate within the design tolerances by the Test and Balance Contractor shall be immediately be reported to the Engineer via telephone call to attempt to determine a resolution while the Test and Balance Contractor is still on site. Additional compensation will not be accepted for additional trips.
- 2.14 Anticipate visiting the site again after the Engineer has reviewed the report. The Engineer may request up to two (2) additional site visits for onsite troubleshooting where additional measurements may be required.
- 2.15 For the purpose of placing the Heating, Ventilating and Air Conditioning systems in operation according to design conditions and certifying same, final testing and balancing shall be performed in complete accordance with AABC Standards for Total System Balance, Volume Six (2002), for air and hydronic systems as published by the Associated Air Balance Council.
- 2.16 The following systems shall be tested and balanced:
- The supply, return and outside air duct systems associated with the existing AHUs. Provide static pressure profiles thru each system. Static pressure profiles shall include all sections from the return duct inlet and supply duct outlet of the air handling unit. Show accurate representation of return, relief, outdoor and economizer damper locations. On units equipped with return air fans; show location and profile of the return fan.
 - Measure and verify the minimum outside air flow at the minimum OA damper. Measure the resulting differential pressure across the damper and record it on the placard located on the unit.
 - The renovated area shall have supply and return duct air leakage measurements provided testing per Specification Section SHEET METAL.
 - Each EF shall have exhaust duct air leakage measurements provided per Specification Section SHEET METAL.
 - Verify calibrations of the duct static pressure sensors for all VAV AHUs.
 - The terminal unit hot water coils.
 - Set the minimum and maximum air flow rates for each VAV and CAV box.
 - Balance all supply, return and exhaust air grille to within 10% of design air flow rate.
 - Balance all supply, return and exhaust air grilles to within 5% air change required spaces such as patient rooms, exam, etc.
 - Balance all exhaust air fans and record inlet static pressure.
- 2.17 Set the flow rate for each balancing valve in the recirculating domestic hot water system at 0.10 GPM/fixture total. If flow rates are not indicated, contact the engineer for each balance valve GPM.
- 2.18 Instruments used for testing and balancing of air and hydronic systems shall have been calibrated within a period of six months prior to balancing. All final test analysis reports shall include a letter of certification listing instrumentation used and last date of calibration.
- 2.19 Test and Balance agency shall provide sizing of fan or motor sheaves required for proper balance. The Mechanical Contractor shall purchase and install all sheaves and belts as required. This includes new and existing equipment.

- 2.20 Three (3) copies of the complete test reports shall be submitted to the Consulting Engineer prior to final acceptance of the project. Preliminary test reports shall be submitted when requested.
- 2.21 The Contractor shall provide and coordinate work to provide sufficient time before final completion date so that tests and balancing can be accomplished and provide immediate labor and tools to make corrections when required without undue delay.
- 2.22 The Contractor shall put all heating, ventilating and air conditioning systems and equipment and rangehood system into full operation and shall continue the operation of same during each working day of testing and balancing.
- 2.23 The Test and Balance Contractor shall be present during the Engineer’s final inspection of the building, or a separate project review date. The Engineer may request confirmation of the air balance report by asking for new measurements to be taken at that time. Any information in the test and balance report may be asked to be reconfirmed.

END OF SECTION.

DIVISION 21 – FIRE PROTECTION

SECTION 210100 - FIRE PROTECTION SYSTEM

PART 1 – GENERAL:

- 1.1 The Contractor's attention is directed to the General and Special Conditions, GENERAL PROVISIONS - MECHANICAL and to all other Contract Documents as they apply to this branch of the work. Attention is also directed to all other sections of the Contract Documents which affect the work of this section and which are hereby made a part of the work specified in this section.
- 1.2 No Contractor, other than those regularly engaged in the installation of approved and franchised automatic sprinkler systems will be considered or approved for the work under this Specification Section. The Contractor shall have not less than five (5) years experience in the fabrication and erection of fire protection systems as specified. The Contractor shall have completed five (5) installations similar and equivalent in scope to the systems specified.
- 1.3 Before submitting bid, examine the Contract Documents, visit the site (if necessary) and become acquainted with all conditions that may, in any way whatsoever, affect the execution of this work. The Contractor shall take their own measurements and be responsible for exact size and location of all openings required for installation of this work. Figured dimensions where indicated are reasonably accurate and should govern in setting out work. Detailed method of installation is not indicated. Where variations exist between described work and approved practice, the Engineer shall be consulted for directive.
- 1.4 It is the intent of the Plans and Specifications to provide a general layout only and locate major equipment, components, piping, etc. Variations in head locations, pipe routing, etc., shall be anticipated by the Contractor and shall be coordinated with all other trades and indicated on the drawings and descriptive literature called for hereinafter. It shall be the express responsibility of the Contractor to provide all required design, materials and equipment and perform all work required to install a complete and approved installation.
- 1.5 All materials and methods shall be in accordance with applicable codes, regulations and/or ordinances and meet approval of local inspection authority and the State Fire Marshal. Also, all work shall comply with the latest editions of the National Board of Fire Underwriters, National Fire Protection Association, OSHA Regulations, the International Building Code, the Life Safety Code, International Mechanical Code and governing building codes. All materials and equipment installed as a part of this work shall be listed by the Underwriters Laboratories, Inc. as approved for fire protection installations.
- 1.6 Where flow and pressure data are available, they are indicated on the project drawings. The Contractor shall independently verify all such information and notify the Engineer of any discrepancies discovered prior to beginning the work. Where no flow information is indicated on the project drawings, the Contractor shall obtain the data and indicate it on the shop drawing submittal. All flow information obtained shall be less than six (6) months old. Piping systems shall be hydraulically sized based on the most conservative flow information obtained. No adjustments in the contract amount will be allowed for failure of the Contractor to obtain adequate flow information.
- 1.7 The Owner's local insuring agency may review plans prepared and submitted by the Contractor but shall have no authority to make changes once work has begun. Coordinate with the Owner prior to construction.
- 1.8 All work performed under this section shall be accomplished in close harmony with all other trades. All work not so coordinated shall be removed and reinstalled at the expense of the Contractor.

- 1.9 The Contractor shall list the following cost breakdowns, material and labor, on the official project schedule of values:
- Fire Protection Shop Drawings and Approvals
 - Fire Protection Materials & Labor
 - Fire Protection Record Drawings & Acceptance

PART 2 – SCOPE OF WORK:

- 2.1 Furnish all material, labor, tools, equipment and supervision required for installation of a complete and new fire protection system as indicated on the project drawings and within these specifications. Include all necessary piping, sprinkler heads, test connections, valves, drains, etc. Include modifications to the existing fire protection system as indicated on the project drawings and within these specifications. Include all necessary piping, sprinkler heads, test connections, valves, drains, etc.
- 2.2 The Contractor shall provide flushing and sterilization of all water lines in accordance with current Codes, Rules and Regulations and shall make connection to domestic water mains in accord with current rules and regulations of the State Department of Sanitary Engineering and Division of Water.
- 2.3 The Contractor shall obtain and pay for all necessary state, municipal, county, city and other permits and fees and pay all State taxes which are applicable.
- 2.4 All workmanship, equipment and material shall be guaranteed in writing against defects from any cause, other than misuse, for a period of one year from substantial completion.
- 2.5 Upon completion, the Contractor shall submit to the Engineer, a properly completed "Sprinkler Contractor's Certificate Covering Materials and Tests" form.
- 2.6 Upon completion of this work all debris, material, and equipment shall be removed from the building and premises; all piping shall be cleaned ready for finish painting. Do not remove rust inhibitive primer specified hereinafter.

PART 3 – SHOP DRAWINGS:

- 3.1 The Contractor shall prepare and submit to the Engineer, shop drawings including design calculations, detailed catalog cutsheets and layout drawings indicating the proposed automatic sprinkler system. All layouts and drawings shall be closely coordinated by the Contractor with the work of ALL other trades. The shop drawings shall indicate the following items (including existing equipment):
- Name and address of Owner, Architect and Engineer.
 - Sprinkler heads including temperature rating.
 - Detector check valves (location).
 - Wet pipe alarm valves and wet system specialties (location).
 - Flanged gate and check valves.
 - Pipe hangers.
 - The pressure sensing switch (location).
 - The main gate valve supervisory switch (coordinated with the Fire Alarm Contractor).
 - The flow switch (coordinated with the Fire Alarm Contractor).
- 3.2 On a set of drawings to the same scale as the drawings accompanying these specifications, indicate:
- Each head location coordinated with lights, diffusers and other ceiling mounted device.
 - Location of all risers, mains, runout lines, etc.
 - Size of all risers, mains, runout lines, etc.
 - Location and type of pipe hangers.
 - Labels and riser tags.

- All other information required by the Authority Having Jurisdiction providing approval.

3.3 The Contractor shall submit these shop drawings to the Engineer through the General Contractor and Architect for their review and approval. The Contractor shall submit the reviewed drawings to the Authority Having Jurisdiction for their review and approval. The Contractor shall incorporate all review comments from the Engineer and the Authority Having Jurisdiction. No work shall be performed onsite until all review processes are complete and updated drawings are on the job site.

PART 4 – EQUIPMENT AND MATERIALS:

- 4.1 Flow Indicator Switches: Furnish and install flow indicator switches as required by NFPA 13. All flow indicator switches shall be UL approved. Coordinate with Fire Alarm System supplier/installer.
- 4.2 Gate Valves: 2½" and over; listed and approved by UL and FM; marked SV-FM; 175# working pressure; 1 BBM; OS&Y; flanged; cast iron discs; bronze seat rings; four point wedging mechanism; equivalent to Mueller, Scott or Lunkenheimer. 2" and under; 150# working pressure; bronze; rising stem; screwed; bronze discs; bronze seat rings; two point wedging mechanism; equivalent to Jenkins, Scott or Lunkenheimer.
- 4.3 Check Valves: 2½" and over; listed and approved by UL and FM; marked SV-FM; 175# working pressure; 1 BBM; flanged; equivalent to Mueller, Scott or Lunkenheimer. 2" and under; 150# working pressure; bronze; screwed; equivalent to Jenkins, Scott or Lunkenheimer.
- 4.4 Fire Protection piping shall be Schedule 10, rolled grooved standard steel for piping mains 2 1/2" and above and Schedule 40 rolled grooved or threaded standard steel for branches and laterals 2" and below Victaulic's "Press-fit" sprinkler piping or threadable thin wall shall not be used on HCA projects.
- 4.5 Do not route sprinkler piping (including drops) directly above any light fixtures. Do not route sprinkler piping near ceiling; hold tight to structure. The Sprinkler Contractor shall coordinate during design of sprinkler systems to insure these requirements are met.
- 4.6 Sprinkler Heads: Gem, Grinnell, Star, Viking, Reliable: All sprinkler heads shall be fed in a reverse bend arrangement. Sprinkler head degree ratings shall be determined by the area serviced in accord with current Codes and Standard Practices. Types of sprinkler heads shall be as follows:
- Semi-Recessed, Quick Response – Reliable (or equal) Model F1FR-300 semi-recessed automatic sprinkler head. Escutcheon and head shall be white.
 - Upright, Quick Response – Reliable (or equal) Model F1FR Vertical Upright automatic sprinkler head.
 - Sidewall, Quick Response – Reliable (or equal) Model GFR, horizontal sidewall automatic sprinkler head.
 - Concealed, Quick Response – Reliable (or equal) Model G4A Concealed automatic sprinkler head. Cover shall be white.
 - Caged, Pendent, Quick Response – Reliable (or equal) Model F1FR Vertical Upright automatic sprinkler head with D1 cage.
 - Institutional, Quick Response – Tyco "Raven" TFP-PH2 institutional type sprinkler heads.
- 4.7 Except for institutional heads, when working in existing facilities, sprinkler heads style and color shall match existing.
- 4.8 Where sprinkler heads are installed in a tile ceiling, they shall be installed in the middle of the tiles, at half or quarter points along the length of the tiles.
- 4.9 Clamps and Anchors: Furnish and install approved clamps, as required, at all (45 degree) 1/8 bends, (90 degree) ¼ bends and flange and spigot pieces to the straight pipe to insure permanent

anchorage of all fire lines. Fittings, clamps, clamp rods, nuts, washers, and glands shall be factory zinc-coated.

- 4.10 Hangers: All piping shall be adequately and permanently supported in an approved manner on approved hangers. Minimally support piping on 8 foot intervals for pipe 3" and smaller; 10 foot intervals for larger piping. Also support within 24" of changes in direction and end of runs.
- 4.11 Sleeves and Escutcheon Plates: Furnish and install sleeves for pipes where piping penetrates masonry walls; exterior wall sleeves to be watertight. Fire and smoke stop all penetrations through fire and smoke walls and coordinate with General Contractor for locations. Furnish and install cast brass chrome plated split ring type escutcheons where piping penetrates walls, ceilings and floors, whether in finished areas or not.
- 4.12 Inspection Test Connections & Pressure Gauges: A 1" inspection test connection as required by the Building Code. Discharge shall run to open air. Control valve for test connection shall be installed not over 7' above the floor. A pressure gauge at the inspection. Test connection at each location indicated on the Plans. Pressure gauges shall be 2½" diameter and readable from the floor.
- 4.13 Signs: Appropriate code approved and required signs shall be installed on all control valves, drains, inspector's test, etc., indicating the function, installation, etc. Signs shall be neatly affixed with rust inhibitive screws, rivets or where hung from piping; with stainless steel No. 14 AWG wire.
- 4.14 Sprinkler Head Cabinet: Furnish and install a cabinet, clearly labeled, with four (4) sprinklers of each type complete with required wrenches. Locate as directed by Engineer. Label "Sprinkler Heads".

PART 5 – SYSTEM DRAINAGE:

- 5.1 The entire System except that part which is below grade and will not freeze shall be installed so as to allow 100% drainage.
- 5.2 All sprinkler branch piping shall be installed so as to drain back to the main riser.
- 5.3 Approved 2" drawoff piping shall be provided on sprinkler risers with discharge piping running to nearest floor drain or open air.
- 5.4 Where sprinkler piping is trapped, an approved auxiliary draw-off shall be provided and neatly installed.
- 5.5 All draw-offs shall have a metal tag labeled "Sprinkler Drain".

PART 6 – INSPECTIONS AND TESTS:

- 6.1 Furnish all labor, equipment and conduct all required tests in the presence of the Owner and Engineer or designated representative if requested. Coordinate with Owner and Engineer prior to testing.
- 6.2 All interior and exterior piping and devices comprising the fire protection system shall be tested under hydrostatic pressure of not less than 200 PSI and maintained for not less than two (2) hours. Any leaks or cracks developing as a result of these tests shall be repaired to the satisfaction of the Owner.

- 6.3 Upon completion of their work, the Contractor shall submit a written and signed certificate to the Engineer indicating that they performed the above prescribed tests and rectified all malfunctions arising therefrom.

END OF SECTION.

DIVISION 23 – HVAC

SECTION 231100 - REGISTERS, GRILLES & DIFFUSERS

PART 1 – GENERAL:

- 1.1 The Contractor's attention is directed to the General and Special Conditions, GENERAL PROVISIONS - MECHANICAL and to all other Contract Documents as they apply to this branch of the work. Attention is also directed to all other sections of the Contract Documents which affect the work of this section and which are hereby made a part of the work specified in this section.

PART 2 – REGISTERS, GRILLES AND DIFFUSERS:

- 2.1 Acceptable R, G & D manufacturers are Price or Titus. Shop drawings shall identify and list all characteristics of each device exactly as scheduled herein. Finishes for specified devices shall be selected by the Architect. Factory color samples shall be submitted with shop drawings. Devices shall be white unless noted otherwise. Aluminized steel devices are not acceptable. Steel devices are not acceptable unless specifically noted otherwise.
- 2.2 Include with the shop drawings a room-by-room schedule indicating devices installed. Also note ceiling types and installations.
- 2.3 Refer to drawings for schedule.

END OF SECTION.

DIVISION 23 – HVAC

SECTION 231200 - SHEET METAL

PART 1 – GENERAL:

- 1.1 The Contractor's attention is directed to the General and Special Conditions, GENERAL PROVISIONS - MECHANICAL and to all other Contract Documents as they apply to this branch of the work. Attention is also directed to all other sections of the Contract Documents which affect the work of this section and which are hereby made a part of the work specified in this section.
- 1.2 This branch of the work includes all materials, labor and accessories for the fabrication and installation of all sheet metal work as shown on the drawings and/or as specified herein. Where construction methods for various items are not indicated on the drawings or specified herein, all such work shall be fabricated and installed in accordance with the recommended methods outlined in the latest edition of SMACNA's Duct Manual and Sheet Metal Construction for Low Velocity Ventilating and Air Conditioning Systems. All equipment furnished by manufacturers shall be installed in strict accord with their recommended methods.
- 1.3 Ductwork shall be kept clean at all times. Ductwork stored on the job site shall be placed a minimum of 4" above the floor and shall be completely covered in plastic. Installed ductwork shall be protected with plastic. Do not install the ductwork if the building is not "dried-in". If this is required, the entire lengths of duct shall be covered in plastic to protect. The Owner/Engineer shall periodically inspect that these procedures are followed. If deemed unacceptable, the Contractor shall be required to clean the duct system utilizing a NADCA certified Contractor.
- 1.4 Prior to purchase and fabrication of ductwork (shop fabricated or manufactured), the Contractor shall coordinate installations with new and existing conditions. Notify the Engineer if there are any discrepancies for resolution.
- 1.5 For healthcare projects, provide a SMACNA duct cleanliness level "C" per the latest SMACNA standards.

PART 2 – LOW VELOCITY DUCTWORK:

- 2.1 Ductwork, plenums and other appurtenances shall be constructed of one of the following: Steel sheets, zinc coated, Federal Specification 00-S-775, Type I, Class E & ASTM A93-59T with G-90 zinc coating.
- 2.2 Ductwork, plenums and other appurtenances shall be constructed of the materials of the minimum weights or gauges as required by the latest SMACNA 2" W.G. Standard or below table. When gauge thickness differs, the heavier gauge shall be selected. The below table shall serve as a minimum.

<u>Round Diameter</u>	<u>Duct Gauge</u>	<u>Rectangular Width</u>	<u>Duct Gauge</u>
3-12 Inches	24 Ga.	3-12 inches	24 Ga,
12-18 Inches	24 Ga.	13-30 inches	24 Ga.

- 2.3 All ductwork connections, fittings, joints, etc., shall be sealed. Seal with high velocity, smooth-textured, water based duct sealant. Sealant shall be UL 181B-M listed, UL 723 classified, NFPA 90A & 90B compliant, permanently flexible, non-flammable, and rated to 15"wg. Apply per manufacturer's recommendations. Contractors shall insure no exposed sharp edges or burrs on ductwork.
- 2.4 Duct dimensions indicated are required inside clear dimensions. Plan duct layouts for adequate insulation and fitting clearance.

- 2.5 All angular turns shall be made with the radius of the center line of the duct equivalent to 1.5 times the width of the duct.
- 2.6 Cross-break all ducts where either cross sectional dimension is 18" or larger.
- 2.7 Ducts shall be hung by angles, rods, 18 ga. minimum straps, trapezes, etc., in accordance with SMACNA's recommended practices. There shall be no less than one set of hangers for each section of ductwork. Where ductwork contains filter sections, coils, fans or other equipment or items, such equipment or items shall be hung independently of ductwork with rods or angles. Do not suspend ducts from purlins or other weak structural members where no additional weight may be applied. If in doubt, consult the Structural Engineer.
- 2.8 Double turning vanes shall be installed in square turns and/or where indicated.
- 2.9 Provide a "high efficiency" type take-off with round damper (Flexmaster STOD-B03) or approved equal) for all round duct branches from a rectangular main to a GRD. Refer to the detail on the drawings for all installation requirements.
- 2.10 Air volume dampers shall be installed in each duct branch takeoffs and/or where indicated, whichever is more stringent. All such dampers shall be accessible without damage to finishes or insulation and shall be provided where required for proper system balance.
- 2.11 Unless otherwise dimensioned on the drawings, all diffusers, registers and grilles shall be located aesthetically and symmetrically with respect to lighting, ceiling patterns, doors, masonry bond, etc. Locate all supply, return and exhaust diffusers and grilles in the locations shown on the architectural reflected ceiling plan.
- 2.12 The interior surface of the ductwork connecting to return/exhaust air grilles shall be painted flat black. The ductwork shall be painted a minimum of 24" starting from the grille.
- 2.13 Provide approved flexible connectors at inlet and outlet of each item of heating and cooling equipment whether indicated or not. Install so as to facilitate removal of equipment as well as for vibration and noise control.
- 2.14 All fans and other vibrating equipment shall be suspended by independent vibration isolators.
- 2.15 Miscellaneous accessories such as test openings with covers, latches, hardware, locking devices, etc., shall be installed as recommended by SMACNA and/or as indicated. Test openings shall be placed at the inlet and discharge of all centrifugal fans, VAV boxes, fan sections of air handling units, at the end and middle of all main trunk ducts and where indicated. All such openings shall be readily accessible without damage to finishes.
- 2.16 Whether indicated or not, provide code approved, full sized fire dampers at all locations where ductwork penetrates fire rated walls. Fire stop rating shall meet or exceed the rating of the wall. Provide an approved access panel at each fire damper located and sized so as to allow hand reset of each fire dampers. All such fire dampers and access panels shall be readily accessible without damage to finishes. Refer to Architectural Plans for locations of fire rated walls. All access doors shall be 16"x16" or as high as ductwork permits and 16" in length.
- 2.17 The Contractor who installs the sheet metal shall furnish to the Air Balancing Contractor, a qualified person to assist in testing and balancing the system.
- 2.18 Insulated Flexible Air Duct: Thermaflex MKE or equal. Flexible air duct shall be one (1) inch thick fiberglass insulation with CPE liner permanently bonded to a coated spring steel wire helix supporting

- a fiberglass insulating blanket. Flexible air duct shall be listed under UL Standard 181, conforming to UL Class 1 Air Duct, Standard 181 with minimum rated air velocity of 4,000 feet per minute, and is pressure rated for a minimum of 4-inches water gage positive pressure and 1-inch water gage negative pressure. Flexible ductwork shall meet Florida building code, **419.3.6.4.4**, which has passed an impact test equal to the UL 181 standard, conducted by a nationally recognized testing laboratory (NRTL) except it shall use a 25-pound weight dropped from a height of 10 feet. Flexible air duct shall also comply with NFPA 90A and 90B, with maximum flame spread = 25 and maximum smoke developed = 50, including a fire-retardant metalized vapor barrier that is reinforced with crosshatched fiberglass scrim having a permanence of not greater than 0.05 perms when tested in accordance with ASTM E 96 Procedure A. Minimum insulating value is R-6.0. Flexible duct shall be used only for GRD runouts and no section shall be more than five feet in length.
- 2.19 Flexible Connectors: Duro-Dyne, Ventfabrics, Inc., U.S. Rubber or equivalent; conforming to NFPA No. 90A; neoprene coated glass fabric; 20 oz. for low velocity ducts secured with snap lock.
- 2.20 Turning Vanes: Fabricated as recommended by SMACNA: noiseless when in place without mounting projections in ducts. All turning vanes shall be double blade type.
- 2.21 Access Doors in Ductwork: Flexmaster TBSM, Air Balance, Vent Products or equal. Access doors for rectangular ducts shall be 16"x16" where possible. Otherwise install as large an access door as height permits by 16" in length. Door shall be 2" thick double-wall insulated with continuous hinge and cam lock. Provide in ducts where indicated or where required for servicing equipment whether indicated or not. Provide a hinged access door in duct adjacent to all fire, smoke and control dampers for the purpose of determining position. Access doors shall also be provided on each side of duct coils and downstream side of VAV boxes and CAV boxes.
- 2.22 Architectural Access Doors in Ceilings or Walls: Provide Kees D Panel, Cesco, Milcor or equal. Panels shall be 24"x24" in size and constructed with 16 gauge galvanized steel for door and frame. Provide with primer finish to accept specified finish. Door shall include three (3) screwdriver operated cam latches and concealed continuous pivoting rod hinge. Door shall open 175 degrees. For masonry construction, furnish frames with adjustable metal masonry anchors. For fire rated units, provide manufacturer's standard insulated flush panel/doors with continuous piano hinge and self-closing mechanism. The Contractor shall include all required access doors in the bid and shall coordinate with the General Contractor prior to the bid to insure a complete project.
- 2.23 Security Architectural Access Doors in Ceilings or Walls: Provide Kees SSAP Panel, Cesco, Milcor or equal. Panels shall be 24"x24" in size and constructed with 12 gauge steel for door and frame. Provide with primer finish to accept specified finish. Door shall include key-operated cylinder dead bolt lock (coordinate cylinders and keys with Owner to match facility standards) and concealed continuous pivoting rod hinge. Door shall open 175 degrees. For masonry construction, furnish frames with adjustable metal masonry anchors and straps. For fire rated units, provide manufacturer's standard insulated flush panel/doors with continuous piano hinge and self-closing mechanism. The Contractor shall include all required access doors in the bid and shall coordinate with the General Contractor prior to the bid to insure a complete project.
- 2.24 Volume Dampers (Rectangular): Ruskin MD35 or Air Balance, Pottorff, rectangular volume dampers. Frames shall be 18 gauge galvanized steel. Blades shall be opposed blade 18 gauge galvanized steel with triple crimped blades on 6" centers. Linkage shall be concealed in jamb. Bearings shall be 1/2" nylon. Maximum single section size shall be 48" wide and 72" high. Provide with Ventfabrics 1" high elevated dial regulator to avoid damper handle from conflicting with duct insulation. Provide permanent mark on dial regulator to mark air balance point.
- 2.25 Volume Dampers (Round): Ruskin MDR525 or Air Balance, Pottorff round volume dampers. Dampers shall be butterfly type consisting of circular blade mounted to axle. Frames shall be 22

gauge steel and 5" long. Damper blades shall be 20 gauge crimped galvanized steel. Axle shall be 3/8"x5" square plated steel. Bearing shall be 3/8" nylon. Provide with Ventfabrics 1" high elevated dial regulator to avoid damper handle from conflicting with duct insulation. Provide permanent mark on dial regulator to mark air balance point.

- 2.26 Fire Dampers: Fire dampers shall be Ruskin D1BD2 1½ hour rating. Other acceptable manufacturers are Air Balance or Pottorff. Fire dampers shall be constructed and tested in accordance with UL Safety Standard 555. Each fire damper shall have a 1½ or 3 hour fire protection rating as required by fire wall. Damper shall have a 165 degrees F fusible link, and shall include a UL label in accordance with established UL labeling procedures. Fire damper shall be equipped for vertical or horizontal installation as required by the location shown. Fire dampers shall be installed in wall and floor openings utilizing minimum 20 gauge steel sleeves, angles, other materials, practices required to provide an installation equipment to that utilized by the manufacturer when dampers were tested at UL. Blade and frame thickness shall be a minimum of 24 gauge. Installation shall be in accordance with the damper manufacturer's instructions. The blades shall be out of the air stream. Provide an access door for fire damper reset at all fire damper locations. Provide factory supplied caulked sleeve, gauge as required to meet manufacturer UL installation requirements.

PART 3 – MEDIUM VELOCITY DUCTWORK:

- 3.1 Medium velocity ductwork shall be utilized for all supply ductwork between air handling units and VAV/CAV boxes. Provide Eastern Sheet Metal Model "CB" or equal takeoff fitting for each VAV/CAV off main. Shop or field fabricated takeoffs are not acceptable. Straight tees are not allowed.
- 3.2 Prior to purchase/shipment of the ductwork, manufacturer shall provide as part of the submittal process scaled, field coordinated Autocad drawings of the complete system to be furnished. Drawings will indicate all system components including fittings, ductwork and manifolds. Drawings shall be available in an electronic format.
- 3.3 All round ductwork for systems above 1.5" W.G. shall be Eastern Sheet Metal, United McGill or Semco or equal as required by the latest SMACNA 10" W.G. Standard.
- 3.4 Ductwork shall be spiral, lock-seam construction fabricated from galvanized steel meeting ASTM-527 standard. Any ductwork exposed to view shall be constructed of galvanized steel. Galvanized metal shall be prepped and clean prior to painting. Coordinate with General Contractor. Ductwork shall be constructed of the following minimum gauges:

<u>Round Diameter</u>	<u>Duct Gauge</u>	<u>Rectangular Major Axis</u>	<u>Duct Gauge</u>
3-14 Inches	26 Ga.	10-24 inches	24 Ga,
15-26 Inches	24 Ga.	25-48 inches	22 Ga.
27-36 Inches	22 Ga.	49-71 inches	20 Ga.

- 3.5 All medium velocity duct fittings shall be fabricated by the same manufacturer as the spiral pipe. Contractor or field fabricated fittings shall not be accepted. Duct fittings shall be constructed per the latest SMACNA 10" WG standard with continuous welds. Take-off fittings shall be combination type tees (Eastern Sheet Metal Model "CB" or equal). Straight or angle tees are not acceptable. Fittings shall be constructed of the following minimum gauges.

<u>Round Diameter</u>	<u>Duct Gauge</u>	<u>Rectangular Major Axis</u>	<u>Duct Gauge</u>
3-50 Inches	20 Ga.	10-36 inches	20 Ga.
52-60 Inches	18 Ga.	37-60 inches	18 Ga.

- 3.6 All single wall ductwork will be furnished with factory installed flanges equal to Eastern Sheet Metal Flange on all ductwork greater than 24 inches in size.
- 3.7 Duct dimensions indicated are required inside clear dimensions.
- 3.8 All ductwork connections, fittings, joints, etc., shall be sealed. Seal with high velocity, smooth-textured, water based duct sealant. Sealant shall be UL 181B-M listed, UL 723 classified, NFPA 90A & 90B compliant, permanently flexible, non-flammable, and rated to 15"wg. Apply per manufacturer's recommendations.
- 3.9 Ductwork shall be installed per the latest SMACNA Medium or High Pressure Manual, whichever is applicable.
- 3.10 All hanger straps shall be 18 ga. minimum with reinforcement angles installed in strict accordance with SMACNA. Flat oval ducts shall be installed with 2"x2"x¼" angles on top and bottom ducts 18" wide and larger. Use 1"x1"x3/16" angles on ducts under 18" wide.
- 3.11 Miscellaneous accessories such as test openings with covers, latches, hardware, locking devices, etc., shall be installed as recommended by SMACNA or the duct manufacturer, and/or as indicated. Test openings shall be placed at the discharge of all air handling units and at the end and middle of all main trunk ducts and where indicated. All such openings shall be readily accessible without damage to finishes.
- 3.12 Whether indicated or not, provide code approved, full sized fire dampers at all locations where ductwork penetrates fire rated walls. Fire stop rating shall meet or exceed the rating of the wall. Provide an approved access panels at each fire damper located and sized so as to allow hand reset of each fire damper. All such fire dampers and access panels shall be readily accessible without damage to finishes. Refer to Architectural Plans for locations of fire rated walls. Where access doors are installed in insulated ductwork, the access door shall be the insulated type.
- 3.13 Flexible Connectors: Duro-Dyne, Ventfabrics, Inc., U.S. Rubber or equivalent; conforming to NFPA No. 90A; neoprene coated glass fabric. Provide flexible connectors at inlet and outlet of air handling equipment to accommodate a minimum of three times the operating pressure of the system.
- 3.14 Architectural Access Doors in Ceilings or Walls: Provide Kees D Panel, Cescio, Milcor or equal. Panels shall be 24"x24" in size and constructed with 16 gauge galvanized steel for door and frame. Provide with primer finish to accept specified finish. Door shall include three (3) screwdriver operated cam latches and concealed continuous pivoting rod hinge. Door shall open 175 degrees. For masonry construction, furnish frames with adjustable metal masonry anchors. For fire rated units, provide manufacturer's standard insulated flush panel/doors with continuous piano hinge and self-closing mechanism. The Contractor shall include all required access doors in the bid and shall coordinate with the General Contractor prior to the bid to insure a complete project.
- 3.15 Security Architectural Access Doors in Ceilings or Walls: Provide Kees SSAP Panel, Cescio, Milcor or equal. Panels shall be 24"x24" in size and constructed with 12 gauge steel for door and frame. Provide with primer finish to accept specified finish. Door shall include key-operated cylinder dead bolt lock (coordinate cylinders and keys with Owner to match facility standards) and concealed continuous pivoting rod hinge. Door shall open 175 degrees. For masonry construction, furnish frames with adjustable metal masonry anchors and straps. For fire rated units, provide manufacturer's standard insulated flush panel/doors with continuous piano hinge and self-closing mechanism. The Contractor shall include all required access doors in the bid and shall coordinate with the General Contractor prior to the bid to insure a complete project. Access door sizes shall be as follows:

- 3.16 Access Doors; In Ductwork: All access doors in round or oval high velocity ductwork shall be screw and gasketed type. Screws shall be maximum 4 inches on centers.

<u>DUCT DIAMETER</u>	<u>OPENING SIZE</u>
3-4 inches	4"x10"
5-6 inches	6"x10"
7-24 inches	10"x16"
26-36 inches	16"x16"
Over 36 inches	16"x22"

- 3.17 Fire Dampers: Fire dampers shall be Ruskin D1BD2 1½ hour rating. Other acceptable manufacturers are Air Balance or Pottorff. Fire dampers shall be constructed and tested in accordance with UL Safety Standard 555. Each fire damper shall have a 1½ or 3 hour fire protection rating as required by fire wall. Damper shall have a 165 degrees F fusible link, and shall include a UL label in accordance with established UL labeling procedures. Fire damper shall be equipped for vertical or horizontal installation as required by the location shown. Fire dampers shall be installed in wall and floor openings utilizing minimum 20 gauge steel sleeves, angles, other materials, practices required to provide an installation equipment to that utilized by the manufacturer when dampers were tested at UL. Blade and frame thickness shall be a minimum of 24 gauge. Installation shall be in accordance with the damper manufacturer's instructions. The blades shall be out of the air stream. Provide an access door for fire damper reset at all fire damper locations. Provide factory supplied caulked sleeve, gauge as required to meet manufacturer UL installation requirements.

PART 4 – AIR LEAKAGE TESTING OF THE DUCTWORK SYSTEMS:

- 4.1 It is the intent of this section to determine if existing ductwork has air leakage. Air leakage testing shall be accomplished by an AABC certified company. Refer to the Test & Balance specifications. Whenever the systems are being leak tested by the Test & Balance Contractor, a representative from the Mechanical Contractor shall be present to assist.
- 4.2 Carefully select the ductwork construction requirements and the type of duct sealant to be used as required to meet the leakage allowances. The sheet metal duct pressure classification is a minimum only. The Contractor shall select the appropriate sheet metal pressure classification, duct sealant class and duct sealant materials to meet the project air leakage allowances.
- 4.3 The entire HVAC air ductwork system shall be tested with some exceptions. On VAV systems, the ductwork upstream of the VAV boxes shall only be tested. Cap the duct at the inlet to the VAV box.
- 4.4 A duct pre-installation conference shall be held prior to the installation of the ductwork. Present should be the Owner, Engineer, Test & Balance Contractor, General Contractor, Mechanical Contractor, Sheet Metal Contractor and Insulation Contractor. At this meeting, the Contractor shall advise all of the duct materials and sealant materials to be used to meet the air leakage allowances.
- 4.5 The duct systems which will require testing are as follows:
- All supply air duct systems.
 - All return air duct systems.
 - All exhaust air duct systems.
- 4.6 Do not insulate the supply air systems prior to testing.
- 4.7 Report the existing leakage rate as percent of the total diffusers compared to the central main airflows.

PART 5 – DRYER VENT DUCTWORK

- 5.1 Provide dryer vents for all dryers (Refer to Architectural and equipment plans). All dryer ducting shall be a minimum of 4" in diameter. Refer to the equipment submittals for exact duct sizing.
- 5.2 Dryer vent ductwork shall be rigid metal 20-gauge aluminum duct. Duct joints shall be installed so that the male end of the duct points in the direction of the airflow. Joints shall be secured with metal tape (not duct tape). Do not use rivets or screws in the joints or anywhere else in the duct as these will incur lint collection.
- 5.3 Length of concealed rigid metal ducting shall not exceed the allowable length of 25 feet. Deduct 5 feet from the allowable length for every 90 degree elbow and 2.5 feet for every 45 degree fitting. These lengths may vary per local codes and dryer manufacturer's recommendations. Provide a complete, working in-line booster fan system, including power, if the maximum allowable duct length is exceeded.
- 5.4 Flexible transition hose connection at the dryer shall be the aluminum flexible duct type. Do not use the plastic or vinyl.
- 5.5 Termination of dryer venting shall be to the exterior with a proper hood or roof jack equipped with a backdraft damper. Hood/jack shall be painted with suitable exterior grade paint and color per the Owner's direction. Small orifice metal screening shall not be part of the hood or roof jack as this will trap lint and block the opening. The hood opening shall point down and maintain a minimum of 12 inches of clearance between the bottom of the hood and the ground or other obstruction.

END OF SECTION.

DIVISION 23 - HVAC

SECTION 231210 – HVAC SYSTEM CLEANING

PART 1 – GENERAL:

- 1.1 The Contractor's attention is directed to the General and Special Conditions, GENERAL PROVISIONS - MECHANICAL and to all other Contract Documents as they apply to this branch of the work. Attention is also directed to all other sections of the Contract Documents which affect the work of this section and which are hereby made a part of the work specified in this section.

PART 2 – QUALIFICATIONS:

- 2.1 The HVAC system cleaning Contractor shall be certified member of the National Air Duct Cleaners Association (NADCA), or shall maintain membership in a nationally recognized non-profit industry organization dedicated to the cleaning of HVAC systems.
- 2.2 The HVAC system cleaning Contractor shall have a minimum of one (1) Air System Cleaning Specialist (ASCS) certified by NADCA on a full time basis, or shall have staff certified by a nationally recognized certification program and organization dedicated to the cleaning of HVAC systems. A person certified as an ASCS by NADCA, or maintaining an equivalent certification by a nationally recognized program and organization, shall be responsible for the total work herein specified.
- 2.3 The HVAC system cleaning Contractor shall possess and furnish all necessary equipment, materials and labor to adequately perform the specified services. The Contractor shall assure that its employees have received safety equipment training, medical surveillance programs, individual health protection measures, and manufacturer's product and material safety data sheets (MSDS) as required for the work by the U.S. Occupational Safety and Health Administration, and as described by this specification. For work performed in countries outside of the U.S.A., contractors should comply with applicable national safety codes and standards. The Contractor shall maintain a copy of all current MSDS documentation and safety certifications at the site at all times, as well as comply with all other site documentation requirements of applicable OSHA programs and this specification. Contractor shall submit to the Owner all Material Safety Data Sheets (MSDS) for all chemical products proposed to be used in the cleaning process.
- 2.4 The HVAC system cleaning Contractor shall provide proof of maintaining the proper license(s), if any, as required to do work in this state. Contractor shall comply with all Federal, state and local rules, regulations, and licensing requirements.
- 2.5 The HVAC system cleaning Contractor shall perform the services specified here in accordance with the current published standards of the National Air Duct Cleaners Association (NADCA). NADCA Standards must be followed with no modifications or deviations being allowed.

PART 3 – SCOPE OF WORK:

- 3.1 This section defines the minimum requirements necessary to render HVAC components clean, and to verify the cleanliness through inspection and/or testing in accordance with items specified herein and applicable NADCA Standards.
- 3.2 The Contractor shall be responsible for the removal of visible surface contaminants and deposits from within the HVAC system in strict accordance with these specifications.
- 3.3 The following systems shall be cleaned:
- The entire heating, air-conditioning and ventilation system serving the renovation area from the main

- shaft branch ducts to the removed ductwork.
 - The return air ducts to the air handling unit (AHU) main return plenums.
 - The entire exhaust system(s) serving the renovation area.
- 3.4 The HVAC system includes any interior surface of the facility's air distribution system for conditioned spaces. The HVAC system also includes other components such as dedicated exhaust and ventilation components and air systems including supply, return and exhaust ducts.
- 3.5 The scope of cleaning shall be as necessary for clean ductwork as required to achieve original design airflows.

PART 4 – HVAC SYSTEM INSPECTIONS AND SITE PREPARATIONS:

- 4.1 Prior to the commencement of any cleaning work, the HVAC system cleaning Contractor shall perform a visual inspection of the HVAC system to determine appropriate methods, tools, and equipment required to satisfactorily complete this project. Contractor shall conduct a site evaluation, and establish a specific, coordinated plan which details how each area of the building will be protected during the various phases of the project.
- 4.2 Damaged system components found during the inspection shall be documented and brought to the attention of the Owner.

PART 5 – GENERAL HVAC SYSTEM CLEANING REQUIREMENTS:

- 5.1 Debris removed during cleaning shall be collected and precautions must be taken to ensure that Debris is not otherwise dispersed outside the HVAC system during the cleaning process.
- 5.2 Where the Particulate Collection Equipment is exhausting inside the building, HEPA filtration with 99.97% collection efficiency for 0.3-micron size (or greater) particles shall be used. When the Particulate Collection Equipment is exhausting outside the building, Mechanical Cleaning operations shall be undertaken only with Particulate Collection Equipment in place, including adequate filtration to contain Debris removed from the HVAC system. When the Particulate Collection Equipment is exhausting outside the building, precautions shall be taken to locate the equipment down wind and away from all air intakes and other points of entry into the building.
- 5.3 All reasonable measures shall be taken to control offensive odors and/or mist vapors during the cleaning process.
- 5.4 Cleaning methods shall be employed such that all HVAC system components must be Visibly Clean as defined in applicable standards. Upon completion, all components must be returned to those settings recorded just prior to cleaning operations.
- 5.5 Dampers and any air-directional mechanical devices inside the HVAC system must have their position marked prior to cleaning and, upon completion, must be restored to their marked position.
- 5.6 The Contractor shall utilize service openings, as required for proper cleaning, at various points of the HVAC system for physical and mechanical entry, and inspection.
- 5.7 The Contractor shall utilize the existing service openings already installed in the HVAC system where possible and add additional openings where needed to properly clean the HVAC system.
- 5.8 Additional openings shall be created so they can be sealed in accordance with industry codes and standards.

- 5.9 Closures must not significantly hinder, restrict, or alter the air-flow within the system. Closures must be properly insulated to prevent heat loss/gain or condensation on surfaces within the system. Openings must not compromise the structural integrity of the system.
- 5.10 Construction techniques used in the creation of openings should conform to requirements of applicable building and fire codes, and applicable NFPA, SMACNA and NADCA Standards.
- 5.11 Cutting service openings into flexible duct is not permitted. Flexible duct shall be disconnected at the ends as needed for proper cleaning and inspection.
- 5.12 All service openings capable of being re-opened for future inspection or remediation shall be clearly marked and shall have their location reported to the Owner in project report documents.
- 5.13 Mechanically clean all duct systems to remove all visible contaminants, such that the systems are capable of passing Cleaning Verification Testings (see NADCA Standards).

PART 6 – SAFETY:

- 6.1 Cleaning Contractors shall comply with all applicable federal, state, and local requirements for protecting the safety of the Contractors' employees, building occupants, and the environment. In particular, all applicable standards of the Occupational Safety and Health Administration (OSHA) shall be followed when working in accordance with this specification.
- 6.2 No processes or materials shall be employed in such a manner that they will introduce additional hazards into occupied spaces.
- 6.3 All Debris removed from the HVAC System shall be disposed of in accordance with applicable federal, state and local requirements.

PART 7 – CLEANING METHODOLOGY:

- 7.1 The HVAC system shall be cleaned using Source Removal mechanical cleaning methods designed to extract contaminants from within the HVAC system and safely remove contaminants from the facility. It is the Contractor's responsibility to select Source Removal methods which will render the HVAC system Visibly Clean and capable of passing cleaning verification methods (See applicable Standards) and other specified tests, in accordance with all general requirements. No cleaning method, or combination of methods, shall be used which could potentially damage components of the HVAC system or negatively alter the integrity of the system.
- 7.2 All methods used shall incorporate the use of vacuum collection devices that are operated continuously during cleaning. A vacuum device shall be connected to the downstream end of the section being cleaned through a predetermined opening. The vacuum collection device must be of sufficient power to render all areas being cleaned under negative pressure, such that containment of debris and the protection of the indoor environment are assured.
- 7.3 All vacuum devices exhausting air inside the building shall be equipped with HEPA filters (minimum efficiency), including hand-held vacuums and wet-vacuums. All vacuum devices exhausting air outside the facility shall be equipped with Particulate Collection including adequate filtration to contain Debris removed from the HVAC system. Such devices shall exhaust in a manner that will not allow contaminants to re-enter the facility. Release of debris outdoors must not violate any outdoor environmental standards, codes or regulations.
- 7.4 All methods require mechanical agitation devices to dislodge debris adhered to interior HVAC system surfaces, such that debris may be safely conveyed to vacuum collection devices. Acceptable methods will

include those which will not potentially damage the integrity of the ductwork, nor damage porous surface materials such as liners inside the ductwork or system components.

- 7.5 If there is any evidence of damage, deterioration, delamination, friable material, mold or fungus growth, or moisture such that fibrous glass materials cannot be restored by cleaning or resurfacing with an acceptable insulation repair coating, they shall be identified for replacement.

PART 8 – CLEANLINESS VERIFICATION:

- 8.1 Verification of HVAC System cleanliness will be determined after mechanical cleaning. The HVAC system shall be inspected visually to ensure that no visible contaminants are present.
- 8.2 If no contaminants are evident through visual inspection, the HVAC system shall be considered clean; however, the Owner reserves the right to further verify system cleanliness.
- 8.3 If visible contaminants are evident through visual inspection, those portions of the system where contaminants are visible shall be re-cleaned and subjected to re-inspection for cleanliness.
- 8.4 Cleanliness verification shall be performed immediately after mechanical cleaning and before the HVAC system is restored to normal operation.

PART 9 – POST-PROJECT REPORT:

- 9.1 At the conclusion of the project, the Contractor shall provide a report to the Owner indicating the following:
- Success of the cleaning project, as verified through visual inspection and/or gravimetric analysis. Provide video before and after.
 - Areas of the system found to be damaged and/or in need of repair.

END OF SECTION.

DIVISION 25 – BUILDING AUTOMATION SYSTEM

SECTION 250100 - ELECTRIC MOTORS AND OTHER ELECTRICAL REQUIREMENTS FOR MECHANICAL EQUIPMENT

PART 1 – GENERAL:

- 1.1 The Contractor's attention is directed to the General and Special Conditions, GENERAL PROVISIONS - MECHANICAL and to all other Contract Documents as they apply to this branch of the work. Attention is also directed to all other sections of the Contract Documents which affect the work of this section and which are hereby made a part of the work specified in this section.
- 1.2 Through coordination with other Contractors, Vendors and Suppliers associated with this Project, this Contractor shall insure a complete, 100% functional, tested, inspected and approved systems. Claims for additional cost or change orders will immediately be rejected. Refer to Specification Section – HVAC EQUIPMENT for additional requirements. All equipment shall be furnished for a single point electrical connection unless specifically excluded as a requirement.
- 1.3 Review the Specification Section - CONTROLS to determine controls, including variable frequency drives, to be furnished.
- 1.4 Prior to ordering any materials or rough-in of any kind, the Mechanical Contractor shall be responsible for final coordination of all electrical requirements (i.e. voltage, phase, circuit breaker, wire sizing, etc.) with the Electrical Contractor. There will be no change in the Contract Amount for any discrepancies. A final coordination meeting shall be held with the Architect, Owner, Engineer, General Contractor, Mechanical Contractor, Electrical Contractor and their sub-contractors.

PART 2 – ELECTRICAL REQUIREMENTS FOR MECHANICAL EQUIPMENT:

- 2.1 All mechanical equipment shall be provided for single point electrical connection unless noted otherwise.
- 2.2 The equipment manufacturer shall provide internally mounted fuses with the equipment, as required, to comply with the U.L. listing on the equipment name plate. (i.e., hermetically sealed compressors or equipment with name plate data that recommends or requires fuse protection.) See also, National Electrical Code, Article 440, Part C, and other applicable sections of the N.E.C.
- 2.3 It shall be the Contractor's responsibility to assure that all mechanical equipment requiring electrical connections be provided with all required proper wiring, electrical protective devices, disconnecting means and electro-mechanical starting units to properly match the mechanical equipment requirement.
- 2.4 Each separate contractor engaged for the project shall coordinate with all other trades to ensure all necessary equipment and labor is included for fully functioning mechanical systems, installed per Code and Project requirements.
- 2.5 Refrigeration condensing units with internal compressors shall be furnished with integral starter.
- 2.6 All interlock or other control wiring, unless specifically noted otherwise, is the responsibility of this Contractor.
- 2.7 All equipment shall be suitably enclosed. All enclosures for equipment shall be rated and approved for the environment in which it operates. (i.e., NEMA 1, NEMA 3R, NEMA 7, NEMA 12, etc.) Verify the requirement with the installation condition if not indicated on the plans.

- 2.8 Observe the following standards for manufacture of equipment and in selection of components: (1) Starters, control devices and assemblies - NEMA (I.E.C. style not acceptable), (2) Enclosures for electrical equipment – NEMA, (3) Enclosed switches – NEMA, (4) All electrical work, generally NFPA 70, (5) All electrical work in industrial occupancies - J.I.C. standards, (6) All electrical components and materials - U.L. listing required.
- 2.9 Where scheduled on the drawings, provide disconnect switches and contactors. Disconnect switches shall be fusible type or circuit breaker type.

PART 3 – REQUIREMENTS FOR MECHANICAL EQUIPMENT 3/4 H.P. OR LESS:

- 3.1 This section describes requirements for small mechanical equipment such as (but not limited to) VAV terminal units, exhaust fans, DDC temperature control panels, etc.
- 3.2 Small equipment with motor(s) of 3/4 H.P., single phase or less are generally not required to be furnished with starter(s), unless otherwise noted. For such equipment, provide integral contactor or horsepower-rated relay where controlled by thermostat or other type of switch. Contactors or relays shall be as recommended by the manufacturer of the equipment.
- 3.3 Coordinate transformer power requirements for terminal unit and thermostat control.
- 3.4 Provide internal fusing for unit motor and other loads in fuse block or in-line fuseholder.
- 3.5 Where externally-mounted disconnecting means is required and would be impractical, unsightly or inappropriate in the judgment of the Engineer, disconnects shall be located within the unit. These disconnects may be fusible H.P.-rated snap switches or manual starters with overload elements, as required. Locate this and other electrical equipment within enclosure where easily accessible behind access panel or door on unit, and as acceptable to the electrical inspector or local authority having jurisdiction.

END OF SECTION.

DIVISION 25 – BUILDING AUTOMATION SYSTEM

SECTION 250400 - CONTROL - DIRECT DIGITAL

PART 1 – GENERAL:

- 1.1 The controls system for this project shall be a web-based digital controls system. All controllers, control interface hardware, services, installation, warranty, training, etc., shall be included as hereinafter specified. The system shall utilize a network controller and unitary" type controllers. Including such minor details not specifically mentioned or shown, as may be necessary for the complete operation of the system.
- 1.2 The Temperature Control Contractor (TCC) shall furnish all labor, materials, equipment, and service necessary for a complete and operating Building Automation System (BAS), utilizing Web Based Direct Digital Controls. All labor, materials, tools, equipment, software, software licenses, software configurations and database entries, interfaces, wiring, tubing, installation, labeling, engineering, calibration, documentation, samples, submittals, testing, commissioning, training services, permits and licenses, transportation, shipping, handling, administration, supervision, management, insurance, temporary protection, cleaning, cutting and patching, warranties, services, and items, even though these may not be specifically mentioned shall be included for the complete, fully functional and commissioned temperature controls system.
- 1.3 The TCC shall provide all items, articles, materials, devices, operations or methods listed, mentioned or scheduled on the drawings including all labor, materials, equipment and incidentals necessary and required for their completion to provide a complete and operating temperature control system. This will include connecting to any mechanical equipment furnished with a control interface device and contacting the equipment suppliers and/or manufacturers for information for the proper interface to the equipment being furnished.
- 1.4 These apparatus' shall consist of, but not limited to, all necessary thermostats, sensing devices, valves, automatic dampers, damper motors, actuators, (except automatic dampers, valves, and damper motors furnished with HVAC equipment), and with the necessary accessories for the complete control of all equipment hereinafter specified.
- 1.5 Control sequences are specified on the drawings. Provide all control equipment required to perform sequences described.
- 1.6 Include all power wiring and cabling for the operation of the controls system. Refer to Electrical Division Specifications for additional requirements.
- 1.7 Manufacturer's, Existing Hospital System: Andover. This TCC/manufacturer has prior approval with the Owner and are the only allowed suppliers and/or installing TCCs.
- 1.8 The TCC shall have an established working relationship with the control manufacturer of not less than five years and shall have prior approval from the Owner and Engineer and are the only allowed suppliers and/or installing contractors. The TCC shall have a local office within 100 miles of the project site and provide service and/or replacement parts within a 24 hour notification of a control failure.
- 1.9 The installation shall comply with the Local Authorities and State Fire Marshal code requirements, including normal operating and smoke mode functions (where applicable). The installation shall comply with the requirements of the NEC, NFPA, UL and the Building Codes, including referenced mechanical, electrical, energy codes, etc.
- 1.10 Abbreviations
 - TCC – Temperature Control Contractor

- 1.11 The TCC shall list the following cost breakdowns, material and labor, on the official project schedule of values:
- Controls shop drawings
 - Controls graphics
 - Controls materials and labor
 - Controls startup, commissioning, testing, documentation (2.5% of controls contract value)
 - Controls training and Owner acceptance (2.5% of controls contract value)

PART 2 – GENERAL SYSTEM REQUIREMENTS:

- 2.1 All labeling for this system shall utilize actual final room names and numbers. The room names and numbers on the Contract Documents may not be the Owner's exact requirements. Coordinate with the Owner to insure compliance.
- 2.2 Include in the bid for the Controls Contractor to perform additional 8 on-site hours of on-site programming, adjustments, modifications, etc. as requested by the Engineer during the warranty period after the date of substantial completion for the project.
- 2.3 All points of user interface shall be on Owner's PCs that do not require the purchase of any special software from the control's manufacturer for use as a building operations terminal. The primary point of interface on these PCs will be a standard Web Browser.
- 2.4 The intent of this specification is to provide a peer-to-peer networked, stand-alone, distributed control system integrated utilizing ANSI/ASHRAE Standard 135-2001 BACNet, LONWorks technology, OBIX TCP/IP, MODBUS, OPC, and other open and proprietary communication protocols in one open, interoperable system
- 2.5 The operating system shall be based on a distributed control system in accordance with specifications. All building controllers, application controllers and all input/output devices shall communicate via BACnet MS/TP or LonMark/LonTalk communication protocol. Network controller shall communicate via BACnet over Ethernet (IP).
- 2.6 The TCC shall all have access to various types of WEB browsers (i.e. Netscape, IE, etc.), which shall be included for access to the Direct Digital Control (DDC) system via the Owner's Wide Area Network (WAN) and/or Local Area Network (LAN).
- 2.7 The TCC shall be responsible for coordination with the Owner's IT staff to ensure that their system will perform in the Owner's environment without disruption to any of the other activities taking place on that WAN/LAN.

PART 3 – SPECIAL PROJECT REQUIREMENTS

- 3.1 Control system to comply with the Hospital's requirements, Building Automatic System Guidelines. Graphics and sequence shall be as required per HCA standards.
- 3.2 It will be the responsibility of the TCC to implement this project onto the Master WEB Supervisor at the maintenance services office with no damage to the existing projects. Any computer connected to the WAN, utilizing a web browser and having the proper password shall be able to communicate with the Owner's DDC system.
- 3.3 Utilize owner's central system and existing computer for control system.

- 3.4 If the existing central system head end software needs to be updated or revised to communicate with TCC's software it is to be completed by the TCC as a part of the bid.
- 3.5 All new software, graphics, terminology, operation, trending, scheduling etc. is match any existing systems and any changes needed to accomplish this will be the responsibility of the TCC.
- 3.6 Base Bid: VAV, stand alone control.
- 3.7 Alternate Bid: VAV unit controls to interface and be controlled at existing Andover front-end.

PART 4 – SUBMITTALS:

- 4.1 The TCC shall not start the project installation until the shop drawing submittals have been reviewed by the Engineer.
- 4.2 Submittals shall include hardware, end devices, ancillary control components, a written operating sequence, unitary control wiring, building floor plans showing communication cabling and labels as well as logic flow diagrams. All submittals shall be provided on paper and electronically in PDF format.
- 4.3 Submittals shall contain one control drawing per specified system and equipment. Drawing shall include point descriptors (DI, DO, AI, AO), addressing, and point names. Each point names shall be unique (within a system and between systems). For example, the point named for the mixed air temperature for AHU #1, AHU #2, and AHU #3 shall not be MAT but should be named AHU#1MAT, AHU#2MAT, and AHU#3MAT. The point names should be logical and consistent between systems and AHU's. The abbreviation or short hand notation (e.g., MAT) shall be clearly defined in writing by the TCC.
- 4.4 Control diagrams shall identify: System being controlled (attach abbreviated control logic text, all digital points, analog points, virtual points, all functions (logic, math, and control) within control loop, legend for graphical icons or symbols, definition of variables or point names and detailed electric connections to all control devices and sensors.
- 4.5 Points list shall include all physical input/output. Points list shall be provided in both hard copy and in electronic format and shall include: Name, address, engineering units, high and low alarm values and alarm differentials for return to normal condition, default value to be used when the normal controlling value is not reporting, message and alarm reporting as specified, identification of all adjustable points and description of all points.
- 4.6 Submittals shall contain floor plans depicting DDC control devices (control units, network devices, LAN interface devices, and power transformers as well as static pressure sensor in duct and temperature sensors in rooms) in relation to mechanical rooms, HVAC equipment, and building footprint.
- 4.7 Submittals shall contain DDC system architecture diagram indicating schematic location of all control units, workstations, LAN Interface devices, gateways, etc. Indicate address and type for each control unit, Indicate protocol, baud rate, and type of LAN per control unit.
- 4.8 Electrical wiring diagrams shall include motor start, control, and safety circuits and detailed digital interface panel control point termination diagrams with all wire numbers and terminal block numbers identified. Indicate all required electrical wiring. Provide panel termination drawings on separate drawings. Clearly differentiate between portions of wiring that are existing, factory-installed and portions to be field-installed.
- 4.9 Show all electric connections of the controls system to equipment furnished by others complete to terminal points identified with manufacturer's terminal recommendations.

- 4.10 TCC shall provide one complete drawing that shows the control-wiring interface with equipment provided by others.
- 4.11 Submittals shall include project specific graphic screens for each system including a picture of the screen with a list of the variables to be placed on the screen.
- 4.12 Submittals shall include TCC's hardware checkout sheets and test reports.
- 4.13 Submittals shall include the agenda for approval by the engineer and owner of the specified training periods. See training section for requirements.
- 4.14 Provide complete panel drawings that are:
- Clearly labeled and schematic or drawn to scale.
 - Show the internal and external component arrangement so that the operators can identify the components by their position if the labels come off.
 - Wiring access routes shall also be identified so that Class 1 wiring is separated from Class 2 and 3 and so high voltage wiring is segregated from low voltage wiring.
 - Complete identification of all control devices (manufacturer's type, number, and function).
 - Provide details for labeling all wiring, control devices, and controllers.
 - Material and equipment descriptive material such as catalog cuts, diagrams, performance curves, and other data to demonstrate conformance with specifications shall be provided.
- 4.15 Include room schedule including a separate line for each thermostat, etc. indicating location and address.
- 4.16 Include control valve schedules including a separate line for each valve provided under this section and a column for each of the valve attributes: code number, configuration, fail position, pipe size, valve size, body configuration, close-off pressure, capacity, valve Cv, design pressure, and actuator type.

PART 5 – O&M MANUALS AND CLOSEOUT DOCUMENTS:

- 5.1 Refer to Mechanical Specification Section – REQUIRED SHOP DRAWINGS, ETC. for additional requirements.
- 5.2 Operating instructions, maintenance procedures, parts and repair manuals shall be supplied. Repair manuals shall include detailed instructions in the setup, calibration, repair and maintenance of all equipment furnished. Also supplied with these manuals will be a complete parts listing of all devices supplied which is to include part numbers and model numbers of all parts and component parts along with exploded views of devices.
- 5.3 All as built drawings (wiring diagrams, flowcharts, floor plans, etc.) shall also be supplied to the owner electronically in PDF format.
- 5.4 System specific wiring, control diagrams, sequence of operation and points lists shall be as installed in each control panel. This means as-built drawings, not design (submittal) drawings.
- 5.5 Supply all software necessary for configuration of, modification, editing or communicating to any of the unitary devices. Software shall be capable of uploading and down-loading the entire unitary data base or any part of the automated system for backup or archiving.
- 5.6 Supply one copy of the software programming manual (hard copy and PDF format). The manual shall describe all furnished software. The manual shall be oriented to programmers and shall describe calling requirements, data exchange requirements, data file requirements, and other information necessary to enable proper integration, loading, testing, and program execution.

- 5.7 Provide a Bill of Materials with each schematic drawing. List all devices/equipment and match to schematic and actual field labeling. Provide quantity, manufacturer, actual product ordering number, description, size, accuracy, operating ranges (voltage, temperature, pressure, etc.), input/output parameters, etc.
- 5.8 Maintenance manual shall include copies of signed-off acceptance test forms, commissioning reports, start-up reports, etc.

PART 6 – WARRANTY & SOFTWARE LICENSES:

- 6.1 Labor and materials for the control system specified shall be warranted free from defects for a period of 12 months after substantial completion and acceptance. Control system failures during the warranty period shall be adjusted, repaired, or replaced at no additional cost or reduction in service to the Owner.
- 6.2 The TCC shall respond to the Owner's request for warranty service within 24 hours during normal business hours. The TCC shall respond to the Owner's request for Emergency service (defined as life-threatening or creating the potential to cause property damage) during the warranty period within 4 hours.
- 6.3 The TCC shall provide technical phone support to the owner during the warranty period for warranty related issues and for two years after the warranty period. If the technical support location of the TCC is outside of the toll free calling area for the customer, the TCC shall have a toll free number or accept collect calls for the purpose of providing technical support.
- 6.4 During the warranty period, standard parts for the DDC system shall arrive at the facility within 48 hours of placing an order. Non-standard parts (requiring re-manufacturing or ordering from another supplier) shall be shipped within 96 hours.
- 6.5 Operator workstation software, project-specific software, graphic software, database software, and firmware updates which resolve known software deficiencies as identified by the TCC shall be provided and correctly installed at no charge during the warranty period.

PART 7 – TRAINING:

- 7.1 A formal on-site "Hands On" training session shall be conducted for the owner's maintenance personnel. This session shall be a minimum of one (1) eight (4) hour days to train the staff on setup, operation, and maintenance of all system(s) and/or devices. This will be at a time and location selected by the owner. All expenses are to be provided by the TCC. All training sessions shall be scheduled at owner's request.
- 7.2 TCC shall conduct training courses for designated personnel in operation and maintenance of system. Training shall be oriented to specific system being installed under his contract and shall be digitally recorded and submitted on DVD by the TCC.
- 7.3 Training shall be a mix of, test exercises, and actual keyboard entry and screen viewing at the operator's terminal. A curriculum shall be discussed and implemented based on the level of expertise of the employees. Hands-on experience and problem solving shall be emphasized.
- 7.4 If during any training session, the trainer/owner finds more than three (3) items that need repair, the training session will be immediately terminated. The session will be rescheduled for another date. The rescheduled training session will be carried out at no additional cost to the Owner.
- 7.5 The training shall be oriented to making the owner self sufficient in the day-to-day use and operation of the DDC system.

PART 8 – COMMISSIONING & VERIFICATION, FUNCTIONAL PERFORMANCE TESTING & CHECKLISTS:

- 8.1 100% compliance with the requirements of this section is a condition of the Owner's acceptance and start of the warranty period.
- 8.2 The TCC shall be responsible for completion of (1) their hardware checkout sheets and test reports, (2) Point-by-point confirmations of ALL points – this includes visual inspection of installed components, and (3) sequence of operation confirmation.
- 8.3 This documentation and process shall be complete, approved and accepted by Engineer and Owner prior to acceptance. This information shall be documented as completed. A copy shall be delivered to the Engineer and Owner and included in the O&M manuals. Each subcontractor shall be responsible for completion of their own System Verification Checklists/Manufacturer's Checklists. Sample checklists shall be submitted to the Engineer and Testing Agent for approval.
- 8.4 Air and water balancing shall be completed (and discrepancies resolved) before the TCC's final system check and before the acceptance test to be conducted in the presence of the Engineer.
- 8.5 Refer to Mechanical Specification Section – GENERAL PROVISIONS for additional information and requirements. Refer to commissioning requirements in the project specifications.

PART 9 – WIRE MANAGEMENT, ELECTRICAL POWER, ETC:

- 9.1 Refer to CABLING section of this specification for additional requirements.
- 9.2 Electrical work required for system interlock and installation of the temperature control system shall be included in the bid and installed per all applicable codes. Coordinate with other trades as required for installation of a complete system.
- 9.3 All wiring and cabling in mechanical and electrical rooms shall be in conduit. No wiring or conduit can be exposed to view in any other area. Conceal all wiring and cabling in conduit in wall from thermostats or other controls devices to above ceiling. Install conduit in wall from wall thermostats to above ceiling for cabling. Route wiring directly to cable tray from control points above the ceiling. Rough-in for control devices shall be in compliance with the requirements of the ELECTRICAL SPECIFICATIONS.
- 9.4 Any power for controls shall be fed from dedicated circuits in emergency electrical panels, when provided for a project, and shall not be obtained from receptacles, lighting, or equipment circuits. Unitary control power may be obtained from the equipment served. If power is obtained from the equipment served, the power may not be interrupted to the electronics if the equipment is off for any reason.
- 9.5 The TCC shall be responsible for the power source to any VAV terminal units (controllers), control panels, unitary controllers, etc. on any controlled equipment and all other control power requirements. This includes circuit breakers, wiring, conduit, etc. installed in strict accordance with NEC. The TCC may contract with the electrical contractor for the power wiring installation.
- 9.6 Prior to installation, insure through coordination with all trades, that appropriate clearances (36" minimum) as required by the N.E.C. are maintained at all control panels, including unitary controllers for VAV terminals, heat pumps, etc.
- 9.7 The TCC shall provide all CAT5 or CAT6 cabling network cabling for a complete system. This shall include cabling to the Owner's data drop. The main system data drop will be provided by others.

- 9.8 All control circuits within the electrical panels shall be marked to indicate equipment served.
- 9.9 The TCC shall perform all temperature control interlock wiring. This shall include control valves, dampers, thermostats, indoor/outdoor HVAC systems, etc. Electrical work required for system interlock and installation of the temperature control system shall be included in the bid and installed per all applicable codes. Coordinate with other trades as required for installation of a complete system.
- 9.10 The TCC shall be responsible for any power required for the unitary controls or control panels. This includes circuit breakers, wiring, conduit, etc. installed in strict accordance with NEC. The TCC may contract with the electrical contractor for the power wiring installation.
- 9.11 Provide one duplex outlet mounted inside the control panel and separately fused with a non-time delay fuse at 15 A at any panel location containing electronic control components. This receptacle may be served from the control panel 120 VAC power source.
- 9.12 All wiring shall be continuous runs. Any junctions must be made in metal enclosure.
- 9.13 Grounding terminals shall be color coded green and yellow and shall be compatible with the other specialty terminals specified above and shall mount on the same DIN rail system. Units shall be arranged so that the wiring connected to them is grounded to the enclosure via the mounting rail. These terminals shall be provided for grounding cable shields at the points where the cables enter a control panel and terminate on the control panel terminal strip. Terminals shall be Entrelec M 4/5.3A.PI or equivalent by Weidmuller, Phoenix, or Allen Bradley.

PART 10 – CABLING:

- 10.1 Refer to WIRE MANAGEMENT section of this specification for additional requirements.
- 10.2 ALL CONTROL WIRING SHALL BE INSTALLED IN A WIRE MANAGEMENT SYSTEM TO INCLUDE CABLE TRAYS, BRIDLE RINGS, & CONDUITS. NO EXCEPTIONS! COORDINATE WITH ELECTRICAL CONTRACTOR TO INSURE A COMPLETE WIRE MANGEMENT SYSTEM.
- 10.3 Acceptable cable manufacturers shall be per HCA requirements, refer to Division 16 specifications.
- 10.4 A complete cabling system shall be furnished and installed, which shall adhere to the highest workmanlike standard of quality and appearance. Cabling shall be installed square with building lines and contained within a wire management system.
- 10.5 All sizing of cabling shall be according to manufacturer's recommendations, but shall be a minimum of 18 AWG.
- 10.6 Furnish a floor plan of the building indicating communication cable labeling and routing as well as addresses and branch wiring from the unitary devices. All cabling shall be labeled on both ends. The type, size and label of all cabling shall be indicated on submittal floor plan drawings.
- 10.7 Wall space temperature sensor cabling (from the sensor to the unitary controller) shall have a minimum of four (4) conductors.
- 10.8 All cabling shall be stranded. "NO" solid conductors will be accepted. All cabling shall be 100% shielded with appropriate drain wire and insulation.
- 10.9 All cable connections shall be continuous run (including shield). Any junctions must be made in a metal enclosure, connections must be soldered, taped and the metal enclosure must be mechanically attached

to the nearest ground. No wire nuts or crimped connections will be accepted. Note location of junction boxes on the as built floor plans. All cabling networking unitary controllers, and other networked equipment, shall be in soldered.

- 10.10 All shields must be terminated as per manufacturer's recommendation. Shield termination requirements by the manufacturer must be provided with submittals.
- 10.11 Wireless controllers are not approved unless specifically mentioned in the sequence of operations or noted on plans.

PART 11 – NETWORK CONTROLLER

- 11.1 Install the Network Controller in a surface mounted panel, NEMA type 1 enclosures, with a removable hinged door. Provide a flush mounted key lock. All control panels must be painted the same color and identified. The boxes are to be made from 16 gauge material. Panels should not be provided with knockouts.
- 11.2 Control panels shall be constructed by a UL approved panel manufacturer. The standard used shall be UL508A. All proper labels are to be attached. Panel shall meet arc flash requirements.
- 11.3 The Network Controller shall be web-based and communicate BACnet IP. It shall issue all time schedules, summer/winter commands, customized trending, holiday scheduling, alarm handling, clock or other shared commands to all unitary controllers within the building network. If for any reason communications between the unitary(s) and the Network Controller is lost, the unitary(s) shall operate in a stand-alone manner (in day operation) until communications is restored. It shall also operate in the "summer" or "winter" mode as last commanded.
- 11.4 The Network Controller shall be integrated and interoperable with the facility infrastructure and include user access to all system data locally over the Local Area Network (LAN) / Wide Area Network (WAN) within the building and remotely by a standard Web Browser over the Internet. Any computer connected to the network, utilizing a web browser and having the proper password.
- 11.5 The Network Controller shall be a fully user-programmable, supervisory controller. It shall monitor the network of distributed unitary controllers, provide global strategy and direction, and communicate on a peer-to-peer basis with other Network Controllers.
- 11.6 The Network Controller shall have battery back-up to allow a minimum of seven days of operation. The Network Controller shall be composed of one or more independent, stand-alone, microprocessor to manage the network strategies described in Application software section. The network controller shall have ample memory to support its operating system, database and programming requirements. The operating system of the Network Controller shall manage the input and output communications signals to allow distributed unitary controllers to share real and virtual point information and allow central monitoring and alarms. The database and custom programming routines of the Network Controller shall be editable from a single operator station.
- 11.7 The Network Controller shall be remotely monitored via the internet. Additionally, it shall include automatic emailing and texting out alarms, gathering alarms, reports and logs, programming and downloading database.
- 11.8 The Network Controller shall continually check the status of all processor and memory circuits. If a failure is detected, the controller shall:
- Assume a predetermined failure mode.
 - Emit an alarm.
 - Display card failure identification.

- 11.9 Under no circumstance shall more than 75% of the total number of sensor and control points be connected through a single Network Controller. Each DDC system component shall provide for the future addition of at least 20% of each type of the number of sensor and control points connected to that component including a minimum of one universal input and one universal output.

PART 12 – UNITARY CONTROLLER

- 12.1 Unless otherwise specified, each piece of equipment shall have its own Unitary Controller (i.e., AHU, terminal unit, etc.). The Unitary Controller for each piece of equipment shall be mounted on the side of the unit. The Unitary Controller for all other equipment shall be mounted in a panel and properly labeled.
- 12.2 Each Central Station Air Handler and/or Outside Air Unit shall have its own Unitary Controller mounted at the air handling unit or mechanical/electrical room near the AHU. If an installation location is not clear, the Contractor shall notify the Engineer for clarification prior to installation.
- 12.3 Unitary Controllers used in conditioned ambient shall be mounted in dust-proof enclosures, and shall be rated for operation at 32 degrees F to 120 degrees F. All Unitary Controllers shall have an RJ-11 or similar type connection for monitoring or programming access by room or local equipment level with access to any unitary within the network without modification.
- 12.4 Control panels shall be constructed by a UL approved panel manufacturer. The standard used shall be UL508A. All proper labels are to be attached. Panel shall meet arc flash requirements.
- 12.5 Unitary Controllers utilized in the network shall have full stand alone capability including time of day and holiday scheduling as well as all energy management functions such as optimal start/stop, duty cycling, etc. The terminal unit Unitary Controllers may be pre-programmed with the project specific sequence of operation as specified for the application. Any re-programming of the electronics shall be performed on location using a portable personal computer with appropriate software or through the Network Controller. The entire unitary data base shall have the capability of being backed up and or downloaded locally.
- 12.6 All points to have a unique digital input to the BAS system. The use of digital point count expanders is not an acceptable replacement to digital inputs to the unitary controller. The conversion of a single universal input channel to accept up to multiple voltage free contacts such as relay contacts, auxiliary starter contacts, differential pressure switches, etc. IS NOT ACCEPTABLE.
- 12.7 Unitary Controllers shall communicate via BACnet MSTP or LonMark/LonTalk communication protocol. A BACnet Protocol Implementation Conformance Statement (PICS) shall be provided for each Unitary Controller that will communicate on the BACnet MS/TP Bus.
- 12.8 All Unitary Controllers shall be fully application programmable. All control sequences within or programmed into the unitary controller shall be stored in non-volatile memory, which is not dependent upon the presence of a battery shall be retained.
- 12.9 Unitary Controllers shall have a 10% spare point capacity to be provided for all applications.
- 12.10 The Unitary Controller for each VAV box shall be mounted on the side of the unit. The unitary controller for all other equipment shall be mounted in a panel and properly labeled. Prior to installation, insure through coordination with all trades, that appropriate clearances (36" minimum) as required by the N.E.C. are maintained at all control panels, including unitary controllers for VAV terminals, etc.

- 12.11 After a power failure, the Unitary Controller shall operate the control application using the current setpoints and configuration. Reverting to default or factory setpoints are not acceptable.

PART 13 – SENSORS AND MISCELLANEOUS DEVICES:

- 13.1 SENSOR RESOLUTION: All temperature sensors shall have a minimum resolution of 1/10th of 1 degree F. (0.1 degree F.) Sensor stability shall be 0.24 degrees over a year period. Space sensors shall be tested and accurate to within 0.75 degrees F. Outside air, water and duct sensors shall be tested and accurate to within 2.0 degrees F.
- 13.2 SPACE SENSORS AND THERMOSTATS:
- Refer to the drawings for proper type and location.
 - All thermostat and sensors shall be provided with temperature indication, unless otherwise noted.
 - Programmed set-point shall be locally adjustable limited to 2 degrees above set-point and 2 degrees below set-point for supervised areas.
 - Unsupervised areas shall have non-adjustable set-point.
 - Generally, thermostats/sensors shall be installed 5'-0" above the finished floor.
 - Where thermostats/sensors are to be mounted next to a light switch, install at the same height as the light switch.
 - Sensors in hallways, vestibules, stairways, restrooms and locker rooms shall utilize a stainless steel surface mount temperature sensor installed on an interior wall or partition (2"x4" blank plate). Care must be taken in the installation of these sensors to ensure proper insulation from the wall temperatures in order to properly sense space temperature.
 - If there is a question consult engineer prior to rough-in.
- 13.3 DISCHARGE AIR AND DUCT ROOM RETURN AIR SENSORS: Shall be rigid insertion type. In all applications, care shall be taken to insure that the sensors are securely mounted as not to allow any vibration and installed in such a manner as to indicate the truest possible temperature.
- 13.4 CURRENT SENSING DEVICES: Veris Industries model Hx08 Series and H701 or equal. All current sensors shall be capable of alarming to the BAS for belt losses, pump coupling shear or other mechanical failure on loads.
- 13.5 DIFFERENTIAL PRESSURE TRANSMITTERS: Provide Rosemount (ITT Bell & Gossett ST-102R) or Johnson Controls Setra DPT 2302-050-V field mounted differential pressure sensor transmitters as indicated on the plans. Range shall be 0-25 psig. Accuracy shall be .025% full span.

PART 14 - VALVES, DAMPERS AND ACTUATORS:

- 14.1 Unless otherwise specified, valves shall be furnished and sized by the TCC. The valves are to provide the required capacity and the close off rating shall be in excess of the system pressures encountered (minimum 40 psi differential). Proportioning-type valve bodies shall be packed type with throttling type inner valve (quick close plug shall not be acceptable). Proportional type valves to be rated at 125 psi static pressure. Modulating control valves shall be selected within a 3-5 psig pressure drop range. Two position control valves (open/close) shall be line size.
- 14.2 All valve actuators shall be fail safe spring return type with sufficient force to operate the dampers or valves under all normal operating conditions. They shall return to the normally open position upon a loss of power. Actuators for fan coil units, terminal units, etc. shall fail in the last position.
- 14.3 "ALL" Actuators shall be of the same manufacturer and have internal feedback circuitry to provide a positive action to insure proper positioning of the damper or valve through the entire sequence. Actuators shall have an adjustable starting point to accurately set the range of travel to the output of the controller. All actuators shall also utilize the same input signal (6-9 VDC, 0-010V, 2-10 VDC, 4-20 MA) in

order to maintain some consistency in the control application. Analog actuation is 6-9 VDC, 0-010V, 2-10 VDC or 4-20 MA, floating point control with 2 digital outputs is NOT approved as analog actuation.

- 14.4 Actuators may be factory installed. If not factory installed they shall be installed as per instructions by the terminal equipment manufacturer.
- 14.5 Locations mounted above ceiling shall be marked on ceiling grid.
- 14.6 Install damper motors on the outside of the duct in warm areas where possible, not in air stream or locations exposed to outdoor conditions.

PART 15 – OPERATOR INTERFACE AND SERVER:

- 15.1 The TCC shall utilize a desktop PC provided by Owner in a location as directed.

PART 16 – GRAPHICS SCREENS AND TRENDS:

- 16.1 All graphics screens shall be submitted for review by Engineer. The graphics shall be as required in the HCA Building Automation system Guidelines. Provide the following animated, color graphics screens minimally:
- 16.2 Entire floor plan home screen with OAT, Time and Date displays.
- Floor plan showing major zones,
 - Click major zone displays enlarged floor plan of the zone showing individual zones & numbers. Include link to respective mechanical room.
 - Click individual zone shows terminal unit graphic. Display all data points from points list, occ/unocc schedule and setpoints, VAV cfm and setpoint, OAT, Time and Date.
- 16.3 Graphics to include floor plans with room numbers (as-built room numbers) and thermostat locations, links to flow diagrams for terminal units, hydronic loop systems, and the air handling system.

PART 17 - VARIABLE AIR VOLUME (VAV) BOX:

- 17.1 A wall mounted thermostat/sensor with cover shall control the VAV box. Refer to drawings for additional information.
- 17.2 When cooling is required, the variable air inlet damper shall modulate between the minimum and maximum air flow rates to maintain room air temperature setpoint. The 2-way hot water control valve shall be closed.
- 17.3 When heating is required, the variable air inlet damper shall be in the minimum air flow rate position and the 2-way hot water control valve modulated to maintain room setpoint.
- 17.4 Primary air CFM and leaving air temperature shall be monitored by the DDC control system.

PART 18 - BUILDING EXHAUST FANS (EXISTING):

- 18.1 Existing building exhaust fans shall operate continuously. A current switch shall monitor fan status.

PART 19 - POINT LIST

- 19.1 Points list shall be provided as part of controls submittal.
- 19.2 Points list shall be as required per Hospital/HCA standards.

- 19.3 Provide complete points list for all HVAC systems, including but not limited to terminal units and exhaust fans.
- 19.4 Provide hot water supply and return temperatures (Heating and Domestic).
- 19.5 Provide terminal unit discharge air temperature, damper position, airflow (CFM), reheat valve position, and room space temperature.

END OF SECTION.

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DIVISION 26 - ELECTRICAL

SECTION 260500 - GENERAL PROVISIONS - ELECTRICAL

PART 1 - GENERAL:

- 1.1 The Instructions to Bidders, General and Special Conditions, and all other contract documents shall apply to the Contractor's work as well as to each of his Sub-Contractor's work. Each Contractor is directed to familiarize himself in detail with all documents pertinent to this Contract. In case of conflict between these General Provisions and the General and/or Special Conditions, the affected Contractor shall contact the Engineer for clarification and final determination.
- 1.2 Each Contractor shall be governed by any alternates, unit prices and Addenda or other contract documents insofar as they may affect his part of the work.
- 1.3 The work included in this division consists of the furnishing of all labor, equipment, transportation, supplies, material and appurtenances and performing all operations necessary for the satisfactory installation of complete and operating Electrical Systems indicated on the drawings and/or specified herein.
- 1.4 Any materials, labor, equipment or services not mentioned specifically herein which may be necessary to complete or perfect any part of the Electrical Systems in a substantial manner, in compliance with the requirements stated, implied, or intended in the drawings and specifications, shall be included as part of this Contract. The Contractor shall give written notice of any materials or apparatus believed inadequate or unsuitable; in violation of laws, ordinances, rules or regulations of authorities having jurisdiction; and any necessary items of work omitted a minimum of ten days prior to bid. In the absence of such written notice and by the act of submitting his bid, it shall be understood that the Contractor has included the cost of all required items in his bid, and that he will be responsible for the approved satisfactory functioning of the entire system without extra compensations.
- 1.5 It is not the intent of this section of the specifications (or the remainder of the contract documents) to make any specific Contractor, other than the Contractor holding the prime contract, responsible to the Owner, Architect and Engineer. All transactions such as submittal of shop drawings, claims for extra costs, requests for equipment or materials substitution, shall be done through the Contractor to the Architect (if applicable), then to the Engineer.
- 1.6 This section of the Specifications or the arrangement of the contract documents shall not be construed as an attempt to arbitrarily assign responsibility for work, material, equipment or services to a particular trade Contractor or Sub-Contractor. Unless stated otherwise, the subdivision and assignment of work under the various sections shall be the responsibility of the Contractor holding the prime contract.
- 1.7 It is the intent of this Contract to deliver to the Owners a "like new" project once work is complete. Although plans and specifications are complete to the extent possible, it shall be responsibility of the Contractors involved to remove and/or relocate or re-attach any existing or new systems which interfere with new equipment or materials to be installed by other trades without additional cost to the Owner.
- 1.8 In general, and to the extent possible, all work shall be accomplished without interruption of the existing facilities' operations. Each Contractor shall advise the Architect, Owner and Engineer in writing at least one week prior to the deliberate interruption of any services. The Owners shall be advised of the exact time that interruption will occur and the length of time the interruption will

occur. Failure to comply with this requirement may result in complete work stoppage by the Contractors involved until a complete schedule of interruptions can be developed.

1.9 Whenever utilities are interrupted, either deliberately or accidentally, the Contractor shall work continuously to restore said service. The Contractor shall provide tools, materials, skilled journeymen of his own and other trades as necessary, premium time as needed and coordination with all applicable utilities, including payment of utility company charges (if any), all without requests for extra compensation to the Owner, except where otherwise provided for in the contract for the work.

1.10 Definitions:

1.10.1 Prime Contractor - The Contractor who has been engaged by the Owner in a contractual relationship to accomplish the work.

1.10.2 Electrical Contractor - Any Contractor whether bidding or working independently or under the supervision of a General Contractor, that is: the one holding the Prime Contract and who installs any type of Electrical work, such as: power, lighting, television, telecommunications, data, fiber optic, intercom, fire detection and alarm, security, video, underground or overhead electrical, etc.

1.10.3 Electrical Sub-Contractor - Each or any Contractor contracted to, or employed by, the Electrical Contractor for any work required by the Electrical Contractor.

1.10.4 Engineer - The Consulting Mechanical-Electrical Engineers either consulting to the Owner, Architect, other Engineers, etc.

1.10.5 Architect - The Architect of Record for the project, if any.

1.10.6 Furnish - Deliver to the site in good condition.

1.10.7 Provide - Furnish and install in complete working order.

1.10.8 Install - Install equipment furnished by others in complete working order.

1.10.9 Contract Documents - All documents pertinent to the quality and quantity of all work to be performed on the project. Includes, but not limited to: Plans, Specifications, Addenda, Instructions to Bidders, (both General and Sub-Contractors), Unit Prices, Shop Drawings, Field Orders, Change Orders, Cost Breakdowns, Construction Manager's Assignments, Architect's Supplemental Instructions, Periodical Payment Requests, etc.

1.10.10 Note: Any reference within these specifications to a specific entity, i.e., "Electrical Contractor" is not to be construed as an attempt to limit or define the scope of work for that entity or assign work to a specific trade or contracting entity. Such assignments of responsibility are the responsibility of the Contractor or Construction Manager holding the prime contract, unless otherwise provided herein.

1.11 Abbreviations:

1.11.1 UON – Unless otherwise noted.

1.11.2 AHJ – Authority having jurisdiction.

1.11.3 NEC – National Electric Code; adopted version within the jurisdiction.

PART 2 – INTENT:

- 2.1 It is the intent of these specifications and all associated drawings that the Contractor provide finished work, tested, and ready for operation. Wherever the word "provide" is used, it shall mean "furnish and install complete and ready for use.
- 2.2 Minor details not usually shown or specified, but necessary for the proper installation and operation, shall be included in the work, the same as if herein specified or shown.

PART 3 - ELECTRICAL DRAWINGS AND SPECIFICATIONS:

- 3.1 The drawings are diagrammatic only and indicate the general arrangement of the systems and are to be followed insofar as possible. If deviations from the layouts are necessitated by field conditions, detailed layouts of the proposed departures shall be submitted in writing to the Engineer for review before proceeding with the work. The Contract Drawings are not intended to show every vertical or horizontal offset which may be necessary to complete the systems. Contractors shall, however, anticipate that additional offsets may be required and submit their bid accordingly.
- 3.2 The drawings and specifications are intended to supplement each other. No Contractor or supplier shall take advantage of conflict between them, or between parts of either, but should this condition exist, the Contractor or supplier shall request a clarification of the condition at least ten days prior to the submission of bids so that the condition may be clarified by Addendum. In the event that such a condition arises after work is started, the interpretation of the Engineer shall be the determining factor. In all instances, unless modified in writing and agreed upon by all parties thereto, the Contract to accomplish the work shall be binding on the affected Contractor.
- 3.3 The drawings and specifications shall be considered to be cooperative and complimentary and anything appearing in the specifications which may not be indicated on the drawings or conversely, shall be considered as part of the Contract and must be executed the same as though indicated by both.
- 3.4 This Contractor shall make all his own measurements in the field and shall be responsible for correct fitting. He shall coordinate this work with all other branches of work in such a manner as to cause a minimum of conflict or delay.
- 3.5 The Engineer shall reserve the right to make minor adjustments in location of conduit, fixtures, outlets, switches, etc., where he considers such adjustments desirable in the interest of concealing work or presenting a better appearance.
- 3.6 Each Contractor shall evaluate ceiling heights called for on Architectural Plans. Where the location of Electrical equipment may interfere with ceiling heights, the Contractor shall call this to the attention of the Engineer in writing prior to making the installation. Any such changes shall be anticipated and requested sufficiently in advance so as to not cause extra work on the part of the Contractor or unduly delay the work.
- 3.7 Should overlap of work between the various trades become evident, this shall be called to the attention of the Engineer. In such event neither trade shall assume that he is to be relieved of the work which is specified under his branch until instructions in writing are received from the Engineer.
- 3.8 The Electrical drawings are intended to show the approximate location of equipment, materials, etc. Dimensions given in figures on the drawings shall take precedence over scaled dimensions and all dimensions whether given in figures or scaled shall be verified in the field. In case of conflict between small and large scale drawings, the larger scale drawings shall take precedence.
- 3.9 The Electrical Contractor and his Sub-Contractors shall review all drawings in detail as they may relate to his work (structural, architectural, site survey, mechanical, etc.). Review all drawings for general

coordination of work, responsibilities, ceiling clearances, wall penetration points, chase access, fixture elevations, etc. Make any pertinent coordination or apparent conflict comments to the Engineers at least ten days prior to bids, for issuance of clarification by written addendum.

- 3.10 Where on any of the drawings a portion of the work is drawn out and the remainder is indicated in outline, or not indicated at all, the parts drawn out shall apply to all other like portions of the work. Where ornament or other detail is indicated by starting only, such detail shall be continued throughout the courses or parts in which it occurs and shall also apply to all other similar parts of the work, unless otherwise indicated.
- 3.11 Special Note: Always check ceiling heights indicated on Drawings and Schedules and ensure that these heights may be maintained after all mechanical and electrical equipment is installed. If a conflict is apparent, notify the Engineer in writing for instructions.

PART 4 - EXAMINATION OF SITE AND CONDITIONS:

- 4.1 Each Contractor shall inform himself of all of the conditions under which the work is to be performed, the site of the work, the structure of the ground, the obstacles that may be encountered, the availability and location of necessary facilities and all relevant matters concerning the work. All Contractors shall carefully examine all Drawings and Specifications and inform themselves of the kind and type of materials to be used throughout the project and which may, in any way, affect the execution of his work.
- 4.2 Each Contractor shall fully acquaint himself with all existing conditions as to ingress and egress, distance of haul from supply points, routes for transportation of materials, facilities and services, availability of temporary or permanent utilities, etc. The Contractor shall include in his work all expenses or disbursements in connection with such matters and conditions. Each Contractor shall verify all work shown on the drawings and conditions at the site, and shall report in writing to the Engineer ten days prior to bid, any apparent omissions or discrepancies in order that clarifications may be issued by written addendum. No allowance is to be made for lack of knowledge concerning such conditions after bids are accepted.

PART 5 - EQUIPMENT AND MATERIALS SUBSTITUTIONS OR DEVIATIONS:

- 5.1 When any Contractor requests review of substitute materials and/or equipment, and when under an approved formal alternate proposal, it shall be understood and agreed that such substitution, if approved, will be made without additional cost regardless of changes in connections, spacing, service, mounting, etc. In all cases where substitutions affect other trades, the Contractor offering such substitutions shall advise all such Contractors of the change and shall reimburse them for all necessary changes in their work. Any drawings, Specifications, Diagrams, etc., required to describe and coordinate such substitutions or deviations shall be professionally prepared at the responsible Contractor's expense. Special Note: Review of Shop Drawings by the Engineer does not absolve the Contractor of this responsibility.
- 5.2 References in the specifications to any article, device, product, material, fixture, form, or type of construction by name, make, or catalog number shall be interpreted as establishing a standard of quality and shall not be construed as limiting competition. Each Contractor, in such cases, may, at his option, use any article, device, product, material, fixture, form, or type of construction which in the judgement of the Engineer is equivalent to that specified, provided the provisions of paragraph (5.1) immediately preceding are met. Substitutions shall be submitted to the Engineer a minimum of ten days prior to bid date for approval to bid in written form thru addenda or other method selected by the Engineer. If prevailing laws of cities, towns, states or countries are more stringent than these specifications regarding such substitutions, then those laws shall prevail over these requirements.

- 5.3 Wherever any equipment and material is specified exclusively only such items shall be used unless substitution is accepted in writing by the engineers.
- 5.4 Each Contractor shall furnish along with his proposal a list of specified equipment and materials which he proposes to provide. Where several makes are mentioned in the Specifications and the Contractor fails to state which he proposes to furnish, the Engineer shall have the right to choose any of the makes mentioned without change in price.

PART 6 - SUPERVISION OF WORK:

- 6.1 Each Contractor and Sub-Contractors shall personally supervise the work or have a competent superintendent on the project site at all times during progress of the work, with full authority to act for him in matters related to the project.

PART 7 - CODES, RULES, PERMITS, FEES, REGULATIONS, ETC.:

- 7.1 The Contractor shall give all necessary notices, obtain and pay for all permits, government sales taxes, fees, and other costs including utility connections or extensions, in connection with his work. As necessary, he shall file all required plans, utility easement requests and drawings, survey information on line locations, load calculations, etc., prepare all documents and obtain all necessary approvals of all utility and governmental departments having jurisdiction; obtain all required certificates of inspection for his work and deliver same to the Engineer before request for acceptance and final payment for the work..
- 7.2 Ignorance of Codes, Rules, regulations, utility company requirements, laws, etc., shall not diminish or absolve Contractor's responsibilities to provide and complete all work in compliance with such.
- 7.3 The Contractor shall include in the work, without extra cost, any labor, materials, services, apparatus or drawings required in order to comply with all applicable laws, ordinances rules and regulations, whether or not shown on drawings and/or specified.
- 7.4 All materials furnished and all work installed shall comply with the current edition of the National Electrical Codes, National Fire Codes of the National Fire Protection Association, the requirements of local utility companies, and with the requirements of all governmental agencies or departments having jurisdiction.
- 7.5 All material and equipment for the electrical systems shall bear the approval label, or shall be listed by the Underwriters' Laboratories, Incorporated. Listings by other testing agencies may be acceptable with written approval by the Engineer.
- 7.6 All electrical work is to be constructed and installed in accordance with plans and specifications which have been approved in their entirety and/or reflect any changes requested by the State Fire Marshal, as applicable or required. Electrical work shall not commence until such plans are in the hands of the Electrical Contractor.
- 7.7 The Contractor shall ensure that his work is accomplished in accordance with OSHA Standards and any other applicable government requirements.
- 7.8 Where conflict arises between any code and the plans and/or specifications, the code shall apply except in the instance where the plans and specifications exceed the requirements of the code. Any changes required as a result of these conflicts shall be brought to the attention of the Engineer at least ten working days prior to bid date, otherwise the Contractor shall make the required changes at his own expense. The provisions of the codes constitute minimum standards for wiring methods, materials, equipment and construction and compliance therewith will be required for all electrical

work, except where the drawings and specifications require better materials, equipment, and construction than these minimum standards, in which case the drawings and specifications shall be the minimum standards.

PART 8 - COST BREAKDOWNS:

- 8.1 Within thirty days after acceptance of the Contract, each Contractor is required to furnish to the Engineer one copy of a detailed cost breakdown on each respective area of work. These cost breakdowns shall be made on forms provided or approved by the Engineer or Architect. Payments will not be made until satisfactory cost breakdowns are submitted.
- 8.2 In addition to cost breakdowns by specification section, the following shall also be provided: Material and labor shall be listed separately. These items are in addition to items listed in front-end specifications. Pay special attention to required withholding percentages for startup, testing, documentation, acceptance, owner training, etc.:
- Electrical Shop Drawings
 - Electrical Record Drawings & Acceptance
 - Electrical O&M Manuals & Acceptance
 - Electrical Owner Training & Acceptance
 - Electrical Identification Materials & Labor
 - Coordination Drawings (Electrical)
 - Fire Alarm System Startup, Testing, & Verification (shall equal 5% of Equipment Value)
 - Electrical Distribution Equipment Startup, Testing, & Verification (shall equal 2.5% of Equipment Value)
 - Lighting and Lighting Controls Startup, Testing, & Verification (shall equal 2.5% of Equipment Value)
 - Low Voltage Systems Startup, Testing, & Verification (shall equal 5% of Equipment Value)
 - Emergency Standby Systems Startup, Testing, & Verification (shall equal 2.5% of Equipment Value)
- 8.3 Refer also to Division 0 and 1 specifications.

PART 9 - GUARANTEES AND WARRANTIES:

- 9.1 The Contractor shall guarantee all equipment, apparatus, materials, and workmanship entering into this Contract to the best of its respective kind and shall replace all parts at his own expense, which are proven defective within one year from final acceptance of the work by the Engineer. The effective date of completion of the work shall be the date of the Engineer's Statement of Substantial Completion. Items of equipment which have longer guarantees, as called for in these specifications or as otherwise offered by the manufacturer, such as generators, engines, batteries, transformers, etc., shall have warranties and guarantees completed in order, and shall be in effect at the time of final acceptance of the work by the Engineer. The Contractor shall present the Engineer with such warranties and guarantees at the time of final acceptance of the work. The Owner reserves the right to use equipment installed by the Contractor prior to date of final acceptance. Such use of equipment shall in no way invalidate the guarantee except that Owner shall be liable for any damage to equipment during this period due to negligence of his operator or other employee.

PART 10 - INSPECTION, APPROVALS AND TESTS:

- 10.1 Before requesting a final review of the installation from the Architect and/or Engineer, the Contractor shall thoroughly inspect his installation to assure that the work is complete in every detail and that all requirements of the Contract Documents have been fulfilled. Failure to accomplish this may result in charges from the Architect and/or Engineers for unnecessary and undue work on their part.

- 10.2 The Contractor shall provide as a part of this contract electrical inspection by a competent Electrical Inspection Agency, licensed to provide such services in the jurisdiction where work is performed. The name of this agency shall be included in the list of materials of the Form of Proposal by the Contractor. All costs incidental to the provision of electrical inspections shall be borne by the Electrical Contractor.
- 10.3 The Contractor shall advise each Inspection Agency in writing (with an information copy of the correspondence to the Architect and/or Engineer) when he anticipates commencing work. Failure of the Inspection Agency to inspect the work in the stage following and submit the related reports may result in the Contractor's having to expose concealed work not so inspected. Such exposure will be at the expense of the responsible Contractor.
- 10.4 Inspections shall be scheduled for rough as well as finished work. The rough inspections shall be divided into as many inspections as may be necessary to cover all roughing-in without fail. Report of each such inspection visit shall be submitted to the Architect, Engineer and the Contractor within three days of the inspection.
- 10.5 Approval by an Inspector does not relieve the Contractor from the responsibilities of furnishing equipment having a quality of performance equivalent to the requirements set forth in these plans and specifications. All work under this contract is subject to the review of the Architect and/or Engineer, whose decision is binding.
- 10.6 Before final acceptance, the Contractor shall furnish three copies of the certificates of final approval by the Electrical Inspector (as well as all other inspection certificates) to the Engineer with one copy of each to the appropriate government agencies, as applicable. Final payment for the work shall be contingent upon completion of this requirement.

PART 11 - CHANGES IN ELECTRICAL WORK:

- 11.1 REFER TO GENERAL AND SPECIAL CONDITIONS.

PART 12 - CLAIMS FOR EXTRA COST:

- 12.1 REFER TO GENERAL AND SPECIAL CONDITIONS.

PART 13 - SURVEYS, MEASUREMENTS AND GRADES:

- 13.1 The Contractor shall lay out his work and be responsible for all necessary lines, levels, elevations and measurements. He must verify the figures shown on the drawings before laying out the work and will be held responsible for any error resulting from his failure to do so.
- 13.2 The Contractor shall base all measurements, both horizontal and vertical from established bench marks. All work shall agree with these established lines and levels. Verify all measurements at site and check the correctness of same as related to the work.
- 13.3 Should the Contractor discover any discrepancy between actual measurements and those indicated, which prevents following good practice or the intent of the drawings and specifications, he shall notify the Engineer thru normal channels of job communication and shall not proceed with his work until he has received instructions from the Engineer.

PART 14 - TEMPORARY USE OF EQUIPMENT:

- 14.1 The permanent electrical equipment, when installed, may be used for temporary services, subject to an agreement among the Contractors involved, the Owner, and with the consent of the Engineer. Should the permanent systems be used for this purpose, each Contractor shall pay for all temporary connections required and any replacements required due to damage without cost, leaving the equipment and installation in "as new" condition. The Contractor may be required to bear utility costs, user fees, etc.
- 14.2 Permission to use the permanent equipment does not relieve the Contractors who utilize this equipment from the responsibility for any damages to the building construction and/or equipment which might result because of its use.

PART 15 - TEMPORARY SERVICES:

- 15.1 The Contractor shall arrange for temporary electrical and other services which he may require to accomplish his work. In the absence of other provisions in the contract, the Contractor shall provide for his own temporary services of all types, including the cost of connections, utility company fees, construction, removal, etc., in his bid.

PART 16 - CLOSE-OUT DOCUMENTATION:

- 16.1 All items listed in this section shall be provided to the engineer upon substantial completion. Provide three bound copies with complete index and tabs to locate each item.
- 16.2 As-Built Record Drawings: The Contractor shall ensure that any deviations from the design are being recorded daily or as necessary on record drawings being maintained by the Contractor. Dimensions from fixed, visible permanent lines or landmarks shown in vertical and horizontal ways shall be utilized. Compliance shall be a requirement for final payment. Pay particular attention to the location of underfloor or underground exterior in-contract or utility-owned or leased service lines, main switches and other appurtenances important to the maintenance and safety of the Electrical System. Deliver these record drawings to the Engineer at the completion of the work.
- 16.3 Start-up and System Testing Certifications and Reports: Provide reports from all required testing to indicate procedures followed and complete results of all tests. Provide reports on manufacturer's standard forms for all equipment and system tests. Testing shall be per applicable NEC, NFPA, UL, NETA, and/or ANSI standards.
- 16.4 Operation and Maintenance Manuals:
- 16.4.1 For all equipment, provide detailed operating instructions.
- 16.4.2 Each Contractor shall furnish three complete bound sets for approval to the Engineer of typewritten and/or blueprinted instructions for operating and maintaining all systems and equipment included in this contract. All instructions shall be submitted in draft, for approval, prior to final issue. Manufacturer's advertising literature or catalogs will not be acceptable for operating and maintenance instructions.
- 16.4.3 Each Contractor, in the above mentioned instructions, shall include the maintenance schedule for the principal items of equipment furnished under this contract and a detailed, easy to read parts list and the name and address of the nearest source of supply.
- 16.4.4 Provide detailed maintenance instructions, including recommended preventative maintenance schedules for all equipment requiring maintenance. For lighting and lighting controls, provide recommended relamping program, provide a schedule for inspecting and recalibrating lighting controls, and provide a recommended settings list for all components with adjustable settings.

- 16.4.5 Provide contacts (company name, address, phone number, email) where parts may be purchased for all equipment.
- 16.4.6 Shop drawings WILL NOT be accepted as satisfying the requirement for Operation and Maintenance Manuals.
- 16.5 Shop Drawings: Provide complete copies of all approved shop drawings. Where shop drawings were returned “Furnish as Corrected”, the contractor shall make the corrections noted by the engineer and submit final corrected shop drawings with close-out documentation.
- 16.6 Parts Lists: Provide an inventory of all spare parts, special tools, attic stock, etc. that have been provided to the owner.
- 16.7 Warranties: Contractor’s one year warranty and all other specific warranties indicated in the construction documents.
- 16.8 Training Verification: Provide certification that all specified training has been completed. List training session dates, times, and types.
- 16.9 Inspection Certificates: Provide certificates of inspection from electrical inspector, fire marshal, and any other required special inspections.
- 16.10 Panel Schedules: Provide hard copies and digital copies of Excel files for all panel-board schedules.
- 16.11 Final Power System Study Reports.
- 16.12 Fire Alarm System Certification.
- Designer Note: Delete for projects that do not have lightning protection.**
- 16.13 Lightning Protection System Certification.
- Designer Note: Delete for projects that do not have CFCI nurse call systems.**
- 16.14 Nurse Call System Certification
- Designer Note: Delete for small projects that do not add/remove panels.**
- 16.15 Power Riser Diagram: Provide a framed full-size copy of the overall power riser diagram (under glass) to the Owner. Also provide three vinyl-coated copies of same. Where an existing power riser diagram is present, the Contractor shall obtain the document from the Owner, and update in digital format with the scope of this project. Edits shall be in digital format and this work shall be closely coordinated with the Owner.
- Designer Note: Delete for small projects that do not add/remove major system components.**
- 16.16 Fire Alarm Riser Diagram: Provide vinyl coated fire alarm system diagrams including floor plans and device addresses at fire alarm equipment. Provide a full system diagram at the main fire alarm control panel and provide the respective level’s system diagram at the NAC panels located on other levels of the structure. Where an existing power riser diagram is present, the Contractor shall obtain the document from the Owner, and update in digital format with the scope of this project. Edits shall be in digital format and this work shall be closely coordinated with the Owner.

PART 17 - MATERIALS AND WORKMANSHIP:

- 17.1 All electrical equipment, materials and articles incorporated in the work shall be new and of comparable quality to that specified. All workmanship shall be first-class and shall be performed by electricians skilled and regularly employed in their respective trades. The Contractor shall determine that the equipment he proposes to furnish can be brought into the building(s) and installed within the space available. All equipment shall be installed so that all parts are readily accessible for inspection, maintenance, replacement, etc. Extra compensation will not be allowed for relocation of equipment for accessibility or for dismantling equipment to obtain entrance into the building(s).
- 17.2 All conduit and/or conductors shall be concealed in or below walls, floors or above ceilings unless otherwise noted. All fixtures, devices and wiring required shall be installed to make up complete systems as indicated on the drawings and specified herein.
- 17.3 All materials, where applicable, shall bear Underwriters' Laboratories label or that of another Engineer-approved testing agency, where such a standard has been established.
- 17.4 Each length of conduit, wireway, duct, conductor, cable, fitting, fixture and device used in the electrical systems shall be stamped or indelibly marked with the makers mark or name.
- 17.5 All electrical equipment shall bear the manufacturer's name and address and shall indicate its electrical capacity and characteristics.
- 17.6 All electrical materials, equipment and appliances shall conform to the latest standards of the National Electric Manufacturers Association (NEMA) and the National Board of Fire Underwriters (NBFU) and shall be approved by the Owner's insuring agency if so required.

PART 18 - QUALIFICATIONS OF WORKMEN:

- 18.1 All Electrical Contractors bidding this project must have been a licensed company for a minimum of three years to qualify to bid this project. Individual employee experience does not supercede this requirement.
- 18.2 All Sub-Contractors bidding the electrical work must have completed one project of 70% this subcontract cost size and two projects of 50% this subcontract cost size.
- 18.3 All electrical work shall be accomplished by qualified workmen competent in the area of work for which they are responsible. Untrained and incompetent workmen as evidenced by their workmanship shall be relieved of their responsibilities in those areas. The Engineer shall reserve the right to determine the quality of workmanship of any workman and unqualified or incompetent workmen shall refrain from work in areas not satisfactory to him. Requests for relief of a workman shall be made through the normal channels of responsibility established by the Architect or the contract document provisions.
- 18.4 All electrical work shall be accomplished by Journeymen electricians under the direct supervision of a licensed Electrician. All applicable codes, utility company regulations, laws and permitting authority of the locality shall be fully complied with by the Contractor.
- 18.5 Special electrical systems, such as Fire Detection and Alarm Systems, Intercom or Sound Reinforcement Systems, Telecommunications or Data Systems, Lightning Protection Systems, Video Systems, Special Electronic Systems, Control Systems, etc., shall be installed by workmen normally engaged or employed in these respective trades. As an exception to this, where small amounts of such work are required and are, in the opinion of the Engineer, within the competency of workmen directly employed by the Contractor involved, they may be provided by this Contractor.

PART 19 - CONDUCT OF WORKMEN:

- 19.1 The Contractor shall be responsible for the conduct of all workmen under his supervision. Misconduct on the part of any workmen to the extent of creating a safety hazard, or endangering the lives and property of others, shall result in the prompt relief of that workman. The consumption or influence of alcoholic beverages, narcotics or illegally used controlled substances on the jobsite is strictly forbidden.

PART 20 - COOPERATION AND COORDINATION BETWEEN TRADES:

- 20.1 The Contractor is expressly directed to read the General Conditions and all detailed sections of these specifications for all other trades and to study all drawings applicable to his work, including Architectural, Mechanical, Structural and other pertinent Drawings, to the end that complete coordination between trades will be effected.
- 20.2 Refer to Coordination Among Trades, Systems Interfacing and Connection of Equipment Furnished by Others section of these Specifications for further coordination requirements.

PART 21 - PROTECTION OF EQUIPMENT:

- 21.1 The Contractor shall be entirely responsible for all material and equipment furnished by him in connection with his work and special care shall be taken to properly protect all parts thereof from damage during the construction period. Such protection shall be by a means acceptable to the Engineer. All rough-in conduit shall be properly plugged or capped during construction in a manner approved by the Engineer. Equipment damaged while stored on site either before or after installation shall be repaired or replaced (as determined by the Engineer) by the responsible Contractor.

PART 22 - CONCRETE WORK:

- 22.1 The Contractor shall be responsible for the provision of all concrete work required for the installation of any of his systems or equipment. If this work is provided by another trade, it will not relieve the Electrical Contractor of his responsibilities relative to dimensions, quality of workmanship, locations, etc. In the absence of other concrete specifications, all concrete related to Electrical work shall be 3000 PSI minimum compression strength at 28 days curing and shall conform to the standards of the American Concrete Institute Publication ACI-318. Heavy equipment shall not be set on pads for at least seven days after pour.
- 22.2 All concrete pads shall be complete with all pipe sleeves, embeds, anchor bolts, reinforcing steel, concrete, etc., as required. Pads larger than 18" in width shall be reinforced with minimum #4 round bars on 6" centers both ways. All reinforcing steel shall be per ASTM requirements, tied properly, lapped 18 bar diameters and supported appropriately up off form, slab or underlayment. Bars shall be approximately 3" above the bottom of the pad with a minimum 2" cover. All parts of pads and foundations shall be properly rodded or vibrated. If exposed parts of the pads and foundations are rough or show honeycomb after removing forms properly adhered repairs shall be made. If structural integrity is violated, the concrete shall be replaced. All surfaces shall be rubbed to a smooth finish.
- 22.3 Special Note: All pads and concrete lighting standard bases shall be crowned slightly so as to avoid water ponding beneath equipment.
- 22.4 In general, concrete pads for small equipment shall extend 6" beyond the equipment's base dimensions. For large equipment with service access panels, extend pads 18" beyond base or overall dimensions to allow walking and servicing space at locations requiring service access.
- 22.5 Exterior concrete pads shall be 4" minimum above grade and 4" below grade on a tamped 4" dense grade rock base unless otherwise noted or required by utility company. Surfaces of all foundations

and bases shall have a smooth finish with three-quarter inch radius or chamfer on exposed edges, trowelled or rubbed smooth. All exterior pads shall be crowned approximately 1/8" per foot, sloping from center for drainage.

PART 23 - RESTORATION OF NEW OR EXISTING SHRUBS, PAVING, ETC.:

23.1 The Contractor shall restore to their original condition all paving, curbing surfaces, drainage ditches, structures, fences, shrubs, existing or new building surfaces and appurtenances, and any other items damaged or removed by his operations. Replacement and repairs shall be in accordance with good construction practice and shall match materials employed in the original construction of the item to be replaced. All repairs shall be to the satisfaction of the Engineer, and in accordance with the Architect's standards for such work, as applicable.

PART 24 - MAINTENANCE OF EXISTING UTILITIES AND LINES:

24.1 The locations of all piping, conduits, cables, utilities and manholes existing, or otherwise, that come within the contract construction site, shall be subject to continuous uninterrupted maintenance with no exception unless the Owner of the utilities grants permission to interrupt same temporarily, if need be. Provide one week's written notice to Engineer, Architect and Owner prior to interrupting any utility service or line. Also see Article 1. - General, this section.

24.2 Known utilities and lines as available to the Engineer are shown on the drawings. However, it is additionally required that, prior to any excavation being performed, each Contractor ascertain that no utilities or lines, known or unknown, are endangered by the excavation.

24.3 If the above mentioned utilities or lines occur in the earth within the construction site, the Contractor shall first probe and make every effort to locate the lines prior to excavating in the respective area.

24.4 Cutting into existing utilities and services shall be done in coordination with and as designated by the Owner of the utility. The Contractor shall work continuously to restore service(s) upon deliberate or accidental interruption, providing premium time and materials as needed without extra claim to the Owner.

24.5 The Contractor shall repair to the satisfaction of the Engineer any surface or subsurface improvements damaged during the course of the work, unless such improvement is shown to be abandoned or removed.

24.6 Machine excavation shall not be permitted within ten feet of existing gas or fuel lines. Hand excavate only in these areas, in accordance with utility company, agency or other applicable laws, standards or regulations.

24.7 Protect all new or existing lines from damage by traffic, etc. during construction.

24.8 Protect existing trees, indicated to remain with fencing or other approved method. Hold all new subsurface lines outside the drip line of trees, offsetting as necessary to protect root structures. Refer to planting or landscaping plans, or in their absence, consult with the Architect.

PART 25 - SMOKE AND FIRE PROOFING:

25.1 The Contractor shall not penetrate rated fire walls, ceilings, floors or other rated construction with any raceway, backbox, enclosure, or other electrical work unless all penetrations/openings are protected in a code compliant manner which maintains the rating of the assembly. Smoke and fire stop all openings made in walls, chases, ceiling and floors. Patch all openings around conduit, wireway, bus duct, etc., with appropriate type material to smoke stop walls and provide needed fire rating at fire

walls, ceilings and floors. Smoke and fire proofing materials and method of application shall be approved by the local authority having jurisdiction. Refer to architectural plans and specifications for further requirements.

- 25.2 Firestopping materials and installation shall be by a single source through-out the project, by all trades.
- 25.2.1 All fire-stopping assemblies must be UL listed. Provide shop drawings indicating penetration detail for each type of wall and floor construction. Shop drawings must be specific for each individual type (i.e., one hour fire rated gypsum wall board with insulated metal pipe penetration.) and must indicate a UL listing for the complete fire-stopping assembly.
- 25.2.2 3M fire protection products are listed below. Equivalent products may be submitted if they are UL listed.
- 25.2.3 All fire-stopping shall be applied by a Contractor who is certified by the manufacturer of the fire-stopping product for installation of the product.
- 25.2.4 Fire-stopping materials to include but not limited to the following:
- 3M fire barrier FS-195 wrap/strip.
 - 3M fire barrier CP 25 caulk.
 - 3M fire barrier MP moldable putty.
 - 3M fire barrier RC-1 restricting collar with steel hose clamp.
 - 3M fire barrier damming materials.
 - 3M fire barrier CS-195 composite sheet.
 - 3M fire barrier fire dam 150 caulk.
 - Steel sleeves.
 - Hilti Speed Sleeves.

PART 26 - QUIET OPERATION, SUPPORTS, VIBRATION AND OSCILLATION:

- 26.1 All work shall operate under all conditions of load without any objectionable sound or vibration, the performance of which shall be determined by the Engineer. Noise from moving machinery or vibration noticeable outside of room in which it is installed, or annoyingly noticeable noise or vibration inside such room, will be considered objectionable. Sound or vibration conditions considered objectionable by the Engineer shall be corrected in an approved manner by the Contractor (or Contractors responsible) at his expense.
- 26.2 All equipment subject to vibration and/or oscillation shall be mounted on vibration supports suitable for the purpose of minimizing noise and vibration transmission, and shall be isolated from external connections such as piping, ducts, etc., by means of flexible connectors, vibration absorbers or other approved means. Surface mounted equipment such as panels, switches, etc., shall be affixed tightly to their mounting surface.
- 26.3 The Contractor shall provide supports for all equipment furnished by him using an approved vibration isolating type as needed. Supports shall be liberally sized and adequate to carry the load of the equipment and the loads of attached equipment, piping, etc. All equipment shall be securely fastened to the structure either directly or indirectly through supporting members by means of bolts or equally effective means. No work shall depend on the supports or work of unrelated trades unless specifically authorized in writing by the Architect or Engineer.

PART 27 - FINAL CONNECTIONS TO EQUIPMENT:

- 27.1 The roughing-in and final connections to all electrically operated equipment furnished under this and all other sections of the contract documents or by others, shall be included in the Contract and shall consist of furnishing all labor and materials for connection. The Contractor shall carefully coordinate with equipment suppliers, manufacturer's representatives, the vendor or other trades to provide complete electrical and dimensional interface to all such equipment (kitchen, hoods, mechanical equipment, panels, refrigeration equipment, etc.).

PART 28 – WELDING:

- 28.1 The Contractor shall be responsible for quality of welding done by his organization and shall repair or replace any work not done in accordance with the Architect's or structural Engineer's specifications for such work. If required by the Engineer, the responsible Contractor shall cut at least three welds during the job for X-raying and testing. These welds are to be selected at random and shall be tested as a part of the responsible Contractor's work. Certification of these tests and X-rays shall be submitted, in triplicate, to the Engineer. In case a faulty weld is discovered, the Contractor shall be required to furnish additional tests and corrective measures until satisfactory results are obtained.

PART 29 – ACCESSIBILITY:

- 29.1 The Contractor shall be responsible for the sufficiency of the size of shafts and chases, the adequate clearance in partitions and above suspended ceilings for the proper installation of his work. He shall cooperate with the General Contractor (or Construction Manager) and all other Contractors whose work is in the same space, and shall advise each Contractor of his requirements. Such spaces and clearances shall be kept to the minimum size required to ensure adequate clearance and access.
- 29.2 The Contractor shall locate all equipment which must be serviced, operated, or maintained in fully accessible positions. Equipment shall include but not be limited to junction boxes, pull boxes, contactors, panels, disconnects, controllers, switchgear, etc. Minor deviations from drawings may be made to allow for better accessibility, and any change shall be approved where the equipment is concealed.
- 29.3 Each Contractor shall provide (or arrange for the provision by other trades) the access panels for each concealed junction box, pull box, fixtures or electrical device requiring access or service as shown on Engineer's plans or as required. Locations of these panels shall be identified in sufficient time to be installed in the normal course of work. All access panels shall be as specified by the architect. In the absence of such specifications, at a minimum such work shall comply with the specifications below. All locations for access panels which are not specifically indicated on the drawings shall be submitted to and approved by the architect prior to ordering.
- 29.4 Access Doors; in Ceilings or Walls:
- 29.4.1 In mechanical, electrical, or service spaces:
- 29.4.1.1 14 gauge aluminum, 16"x16" minimum, brushed satin finish, 1" border.
- 29.4.2 In finished areas:
- 29.4.2.1 14 gauge primed steel, 16"x16" minimum, with 1" border to accept the architectural finishes specified for the space. Confirm these provisions with the Architect prior to obtaining materials or installing any such work.
- 29.4.3 In fire or smoke rated partitions, access doors shall be provided that equal or exceed the required rating of the construction they are mounted in.

PART 30 - ELECTRICAL CONNECTIONS:

- 30.1 The Contractor shall furnish and install all power wiring complete from power source to motor or equipment junction box, including power wiring through starters. The Contractor shall install all starters not factory mounted on equipment. Unless otherwise noted, the supplier of equipment shall furnish starters with the equipment. Also refer to Mechanical Sections of Specifications, shop drawings and equipment schedules for additional information.
- 30.2 All control, interlock, sensor, thermocouple and other wiring required for equipment operation shall be provided by the Contractor. All such installations shall be fully compliant with all requirements of Electrical Specifications regardless of which trade actually installs such wiring. Motors and equipment shall be provided for current and voltage characteristics as indicated or required. All wiring shall be enclosed in raceways unless otherwise noted.
- 30.3 Each Contractor or Sub-Contractor, prior to bidding the work, shall coordinate power, control, sensor, interlock and all other wiring requirements for equipment or motors with all other Contractors or Sub-Contractors, to ensure all needed wiring is provided in the Contract. Failure to make such coordination shall not be justification for claims of extra cost or a time extension to the Contract.

PART 31 - MOTORS:

- 31.1 If not furnished by the equipment manufacturer, each motor shall be provided with conduit terminal box and N.E.C. required disconnecting means as indicated or required. Three-phase motors shall be provided with external thermal overload protection in their starter units. Single-phase motors shall be provided with thermal overload protection, integral to their windings or external, in control unit. All motors shall be installed with NEMA-rated starters and shall be connected per the National Electrical Code. The electrical contractor shall examine the mechanical plans and specifications to determine where these components are not provided by the equipment manufacturer and shall so provide.
- 31.2 The capacity of each motor shall be sufficient to operate associated driven devices under all conditions of operation and load and without overload, and at least of the horsepower indicated or specified. Each motor shall be selected for quiet operation, maximum efficiency and lowest starting KVA per horsepower as applicable. Motors producing excessive noise or vibration shall be replaced by the responsible Contractor. See Mechanical Sections of Specifications for further requirements and scheduled sizes.

PART 32 - CUTTING AND PATCHING:

- 32.1 Unless otherwise indicated or specified, the Contractor shall provide cutting and patching necessary to install the work specified in this Division. Patching shall match adjacent surfaces to the satisfaction of the Engineer and shall be in accordance with the Architect's standards for such work, as applicable.
- 32.2 No structural members shall be cut without the approval of the Structural Engineer and all such cutting shall be done in a manner directed by him.

PART 33 - SLEEVES AND PLATES:

- 33.1 Each Contractor shall provide and locate all sleeves and inserts required for his work before the floors and walls are built, or shall be responsible for the cost of cutting and patching required where sleeves and inserts were not installed, or where incorrectly located. Each Contractor shall do all drilling required for the installation of his hangers. Drilling of anchor holes may be prohibited in post-tensioned concrete construction, in which case the Contractor shall request approved methods from the Architect and shall carefully coordinate setting of inserts, etc., with the Structural Engineer and/or Architect.

- 33.2 Sleeves shall be provided for all electrical conduit passing thru concrete floor slabs and concrete, masonry, tile and gypsum wall construction. Sleeves shall not be provided for piping running embedded in concrete or insulating concrete slabs on grade, unless otherwise noted.
- 33.3 Where sleeves are placed in exterior walls below grade, the space between the pipe or conduit and the sleeves shall be made completely water tight. Provide Crouse-Hinds Link-Seal Environmental Conduit Seal with stainless steel hardware. Alternative methods must be approved by the Engineer and/or Architect.
- 33.4 Where conduit motion due to expansion and contraction will occur, make sleeves of sufficient diameter to permit free movement of pipe. Check floor and wall construction finishes to determine proper length of sleeves for various locations; make actual lengths to suit the following:
- 33.4.1 Terminate sleeves flush with walls, partitions and ceiling.
- 33.4.2 In areas where pipes are concealed, as in chases, terminate sleeves flush with floor.
- 33.4.3 In all areas where pipes are exposed, extend sleeves ¼ inch above finished floor, except in rooms having floor drains, where sleeves shall be extended ¾ inches above floor.
- 33.5 Sleeves shall be constructed of 24 gauge galvanized sheet steel with lock seam joints for all sleeves set in concrete floor slabs terminating flush with the floor. All other sleeves shall be constructed of galvanized steel pipe unless otherwise indicated on the drawings.
- 33.6 Fasten sleeves securely in floors, walls, so that they will not become displaced when concrete is poured or when other construction occurs around them. Take precautions to prevent concrete, plaster or other materials being forced into the space between pipe and sleeve during construction. Fire and smoke stop all sleeves in a manner approved by the local authority having jurisdiction or per prevailing codes.

PART 34 – WEATHERPROOFING:

- 34.1 Where any work pierces waterproofing, including waterproof concrete, the method of installation shall be as approved by the Architect and/or Engineer before work is done. The Contractor shall furnish all necessary sleeves, caulking and flashing required to make openings absolutely watertight.
- 34.2 Wherever work penetrates roofing, it shall be done in a manner that will not diminish or void the roofing guarantee or warranty in any way. Coordinate all such work with the roofing installer.

PART 35 – OWNER TRAINING:

- 35.1 Upon completion of all work and all tests, each Contractor shall furnish the necessary skilled labor and helpers for operating his systems and equipment for a period of three days of eight hours each, or as otherwise specified. During this period, instruct the Owner or his representative fully in the operations, adjustment, and maintenance of all equipment furnished. Give at least one week's written notice to the Owner, Architect and Engineer in advance of this period. The Engineer may attend any such training sessions or operational demonstrations. The Contractor shall certify in writing to the Engineer that such demonstrations have taken place, noting the date, time and names of the Owner's representative that were present.
- 35.2 All training shall be video taped by the owner and all systems requiring training shall have four hours of training included. The following systems shall include owner training at a minimum:

Designer Note: Edit for scope of your project.

- 35.2.1 Switchgear
- 35.2.2 Emergency Standby Systems
- 35.2.3 Lighting and Controls
- 35.2.4 Fire Alarm System
- 35.2.5 Each Low Voltage System (See System Responsibilities Matrix and SCOPE OF THE ELECTRICAL WORK)

PART 36 - SCAFFOLDING, RIGGING AND HOISTING:

- 36.1 The Contractor shall furnish all scaffolding, rigging, hoisting, and services necessary for erection and delivery into the premises of any equipment and apparatus furnished. Remove same from premises when no longer required.

PART 37 - CLEANING:

- 37.1 The Contractor shall, at all times, keep the area of his work presentable to the public and clean of rubbish caused by his operations; and at the completion of the work, shall remove all rubbish, all of his tools, equipment, temporary work and surplus materials, from and about the premises, and shall leave the work clean and ready for use. If the Contractor does not attend to such cleaning immediately upon request, the Engineer may cause cleaning to be done by others and charge the cost of same to the responsible Contractor. Each Contractor shall be responsible or all damage from fire which originates in, or is propagated by, accumulations of his rubbish or debris.
- 37.2 After completion of all work and before final acceptance of the work, each Contractor shall thoroughly clean all equipment and materials and shall remove all foreign matter such as grease, dirt, plaster, labels, stickers, etc., from the exterior of materials, equipment and all associated fabrication. Pay particular attention to finished area surfaces such as lighting fixture lenses, lamps, reflectors, panels, etc.

PART 38 - PAINTING:

- 38.1 Each fixture device, panel, junction box, etc., that is located in a finished area shall be provided with finish of color and type as selected or approved by the Architect or Engineer. If custom color is required, it shall be provided at no additional cost to the Owner. All other equipment, fixtures or devices located in finished or unfinished areas, that are not required to have or are provided with finish color or coating shall be provided in a prime painted condition, ready to receive finish paint or coating. All galvanized metal in finished areas shall be properly prepared with special processes to receive finish paint as directed and approved by the Architect.

PART 39 - INDEMNIFICATION:

- 39.1 The Contractor shall hold harmless and indemnify the Engineer, employees, officers, agents and consultants from all claims, loss, damage, actions, causes of actions, expense and/or liability resulting from, brought for, or on account of any personal injury or property damage received or sustained by any person, persons, (including third parties), or any property growing out of, occurring, or attributable to any work performed under or related to this contract, resulting in whole or in part from the negligence of the Contractor, any Sub-Contractor, any employee, agent or representative.

PART 40 - HAZARDOUS MATERIALS:

- 40.1 The Contractor is hereby advised that it is possible that asbestos and/or other hazardous materials are or were present in this building(s). Any worker, occupant, visitor, inspector, etc., who encounters any

material of whose content they are not certain shall promptly report the existence and location of that material to the Contractor and/or Owner. The Contractor shall, as a part of his work, ensure that his workers are aware of this potential and what they are to do in the event of suspicion. He shall also keep uninformed persons from the premises during construction. Furthermore, the Contractor shall ensure that no one comes near to or in contact with any such material or fumes therefrom until its content can be ascertained to be non-hazardous.

- 40.2 CMTA, Inc., Consulting Engineers, have no expertise in the determination of the presence of hazardous materials. Therefore, no attempt has been made by them to identify the existence or location of any such material. Furthermore, CMTA nor any affiliate thereof will neither offer nor make any recommendations relative to the removal, handling or disposal of such material.
- 40.3 If the work interfaces, connects or relates in any way with or to existing components which contain or bear any hazardous material, asbestos being one, then, it shall be the Contractor's sole responsibility to contact the Owner and so advise him immediately.
- 40.4 The Contractor by execution of the contract for any work and/or by the accomplishment of any work thereby agrees to bring no claim relative to hazardous materials for negligence, breach of contract, indemnity, or any other such item against CMTA, its principals, employees, agents or consultants. Also, the Contractor further agrees to defend, indemnify and hold CMTA, its principals, employees, agents and consultants, harmless from any such related claims which may be brought by any Sub-Contractors, suppliers or any other third parties.

PART 41 - ABOVE-CEILING AND FINAL PUNCH LISTS:

- 41.1 The Contractor and Sub-contractors shall review each area and prepare a punch list for each of the Sub-Contractors, as applicable, for at least three stages of the project:
- 41.1.1 For review of in-wall work that will be concealed by drywall or other materials well before substantial completion.
- 41.1.2 For review of above-ceiling work that will be concealed by tile or other materials well before substantial completion.
- 41.1.3 For review of all other finished work at substantial completion.
- 41.2 When all work from the Contractors' punch list is complete at each of these stages and prior to covering the work to be inspected with ceilings or walls (as applicable), the Contractor shall request that the Engineer develop a punch list. This request is to be made in writing two weeks prior to the proposed date.
- 41.3 After all corrections have been made from the Engineer's punch list, the Contractor shall review and initial off on each item. This signed-off punch list shall be submitted to the Engineer. The Engineer shall return to the site once to review each punch list and all work prior to the ceilings being installed and at the final punch list review.
- 41.4 At the engineer's option, the contractor shall supply digital photographs via email or file-share of any installed work.
- 41.5 If additional visits are required by the Engineer to review work not completed by this review, the Engineer shall be reimbursed directly by the Contractor by check or money order (due net 10 days from date of each additional visit) at a rate of \$125.00 per hour plus travel expenses for extra trips required to complete either of the above-ceiling or final punch lists.

- 41.6 All panelboard fronts shall be omitted until final punch list inspection is made. Directories for each panelboard shall be completed and available for review by the Engineer at that time.

PART 42 - COORDINATION DRAWINGS:

- 42.1 **Detailed electronic coordination drawings shall be required for this project.** A specific line-item shall be included on the schedule of values by each Trade for “preparation of coordination drawings”. This line-item value shall be approved by the Engineer. The Engineer and the Engineer’s Field Inspector shall closely monitor progress and quality of the preparation of the electronic coordination drawings and may withhold pay requests as deemed appropriate.
- 42.2 Coordination Drawings shall be provided on this project by each Trade (Mechanical, Fire Protection, Electrical). Drawings shall be 30x42 sheet size and shall be at ¼” scale and shall match the drawing setup as included in the Architectural Drawings. Drawings shall be prepared in electronic format utilizing AutoCad software. The Architect and Engineer will supply electronic drawings files of the Contract Documents upon the Contractor’s request and release.
- 42.3 The basis for the Coordination Drawings shall be the sheet metal ductwork fabrication shop drawings, all electrical feeder conduits and other conduits 2” and larger, and pneumatic tube system piping and components in ceiling spaces. The Coordination Drawings shall be prepared by the Mechanical Contractor. The Coordination Drawings shall indicate (1) systems above ceilings in finished areas, (2) systems supported from the structure in finished areas without ceilings, (3) systems in the mechanical rooms, and (4) all wall, roof, floor penetrations. These drawings shall indicate all ductwork as double lined with bottom elevations noted.
- 42.4 The sheet metal fabrication shop drawings shall be completed in a timely manner so as not to conflict with construction schedule and phasing plan. At the Construction Manager’s discretion, these drawings shall be completed in phases to correspond with the project construction work sequencing. The Mechanical Contractor shall furnish an electronic copy of these ductwork shop drawings to all other Trades, specifically the Fire Protection and Electrical and other Contractors as requested by the Construction Manager for the purpose of including other trades work on the Coordination Drawings.
- 42.5 Pre-Coordination Meetings with all necessary trades shall occur. During these meetings, the Contractors shall discuss locations/elevations where piping, conduits, cable path, etc will be installed with respect to the sheetmetal fabrication drawings and other trades. The sheetmetal ductwork and gravity piping systems shall be given the first priority. Within 30 days of the meeting, each Trade shall provide the Mechanical Contractor electronic drawings of all of their systems (with elevation noted), coordinated with the ductwork and other trades for them to incorporate into the Coordination Drawings. Coordination Meetings shall then occur so that all conflicts can be resolved between Trades. All conflicts shall be resolved between all Trades at these Coordination Meetings and the Mechanical Contractor shall then amend the Drawings to include the Final Coordinated Work.
- Designer Note: Delete for non-renovation projects.**
- 42.6 The contractor’s final coordination drawings shall be coordinated with actual field conditions, as examined and verified by the contractor following completion of demolition. The contractor shall complete coordination drawings in phases as required to accommodate sequencing of construction, shop drawing review and approval, etc. as required for the contractor to maintain the construction schedule.
- 42.7 It is realized that not all systems can be completely detailed. The coordination drawings shall include the following at a minimum:
- 42.7.1 All supply/return/exhaust ductwork.

- 42.7.2 All above slab sanitary and roof drainage piping.
- 42.7.3 HVAC, fire protection and domestic water piping which are 2" in size and greater, excluding insulation.
- 42.7.4 Medical gas mains.
- 42.7.5 Electrical conduits which are 1.5" in size and greater.
- 42.7.6 J-hook and cable tray cabling paths
- 42.7.7 Multiple smaller piping/conduits hung on a common hanger.
- 42.7.8 All wall, roof, floor penetrations.
- 42.7.9 Light fixtures.
- 42.8 After completion of the Final Coordination Drawings, a Final Review with the all Trades shall occur to provide any final comments and approval by all Trades. Other interim coordination meeting will be required to ensure successful coordination drawings. Any additional coordination items will be updated by the Mechanical Contractor. The Final Approved Coordination Drawings shall distributed electronically (on CD) to each Trade by the Mechanical Contractor. The Mechanical Contractor shall also furnish a complete 30x42 paper set of drawings to the jobsite main office and shall utilize them for updates of field conditions/deviations that occur during construction. Final Approved Coordination Drawings shall also be distributed to the Construction Manager, Owner, Architect and Engineer for their Records. This process shall be completed prior to starting any work.
- 42.9 Each Contractor shall ensure that any deviations from the Coordination Drawings are recorded as they occur, in red erasable pencil on record drawings kept at the jobsite. Upon completion of a particular phase, the Mechanical Contractor shall incorporate all field deviations into the Coordination Drawings to be utilized as Record Drawings. The Engineer shall review the Record Documents from time to time to ensure compliance with this specification. Compliance shall be a contingency of final payment. Pay particular attention to the location of under floor sanitary and water lines, shut-off valves, cleanouts and other appurtenances important to the maintenance and operation of Mechanical Systems. Also, pay particular attention to Deviations in the Control Systems and all exterior utilities. Keep information in a set of drawings set aside at the job site especially for this purpose. The Record Drawings shall be distributed electronically (on CD) to the Construction Manager, Owner, Architect and Engineer for their Records.
- 42.10 The Mechanical Contractor is responsible to the General Contractor for the shop drawing layout of the following rooms and details:
- Concrete pads and foundations
 - Equipment room layouts with actual equipment
 - Roof layouts
 - Trench locations and sizes
 - Dimensioned floor drain locations
 - Congested areas above ceilings adjacent to mechanical and electrical rooms
 - Dimensioned ductwork shop drawings
 - Refer to Part 41 for additional requirements.
- 42.11 The Electrical Contractor is responsible to the General Contractor for the shop drawing layout of the following rooms and details:
- Concrete pads and foundations

- Equipment room layouts with actual equipment
- Routes of feeder conduits and all other conduits 1.5” and larger, floors 2 through 5 and roof
- J-hook and cable tray cabling paths
- Trench locations and sizes
- Congested areas above ceilings adjacent to mechanical and electrical rooms
- Refer to Part 41 for additional requirements.
- Light fixture locations
- Exact layouts of all work in open ceiling areas

PART 43 – EQUIPMENT/SYSTEMS TESTING, VERIFICATION, & START-UP:

- 43.1 The Contractor (and Sub-Contractors) shall be responsible for commissioning, starting-up, testing, checking, examining, inspecting, etc. their own systems.
- 43.2 The Electrical Contractor shall designate an individual under his employment to lead the startup , testing and verification process. This person should not be the project manager or job site superintendent, but a person dedicated to making this critical task successful and completed in a timely manner.
- 43.2.1 This individual shall also be responsible for the following items:
- 43.2.2 All identification and labeling requirements per plans and specifications.
- 43.2.3 Submission of switchgear coordination study, fault current study, and arc flash hazard analysis.
- 43.3 A pre-start-up conference shall be held with the Architect, Owner, Construction Manager, Electrical Contractor, and the Manufacturers providing startup services. The purpose of this meeting will be discuss the goals, procedures, etc. for start-up.
- 43.4 A specific line-item shall be included on the schedule of values for testing and verification of all systems indicated in this section. This line-item value shall be approved by the Engineer. The Engineer, Owner and the Engineer’s Field Inspector(s) shall closely monitor progress and quality of the testing, verification, and startup and may withhold pay requests as deemed appropriate.
- 43.5 The Contractor shall test all wiring and connections for continuity and grounds before equipment and fixtures are connected, and when indicated or required, demonstrate by Megger Test the insulation resistance of any circuit or group of circuits. Where such tests indicate the possibility of faulty insulation, locate the point of such fault, pull out the defective conductor, replacing same with new and demonstrate by further test the elimination of such defect.
- 43.6 Systems Requiring Testing & Verification:
- 43.6.1 Fire Alarm System
- 43.6.2 Electrical Distribution Equipment
- 43.6.3 Lighting and Lighting Controls
- 43.6.4 Emergency Standby Systems
- 43.6.5 All Low Voltage Systems
- 43.6.6 Grounding Systems

43.6.7 Wiring and Terminations

- 43.7 The Contractor shall include in the bid to provide systems startup and verification for ALL electrical systems specified for this project. Specific startup, testing, and verification specifications are included throughout the Electrical specifications. In general, as part of the verification process, equipment suppliers shall perform start-up by their factory authorized technicians (not third party Contractors) and shall complete and submit start-up reports/checklists. Submit start-up reports to the Engineer. The Contractor shall have appropriate trades on site to correct all deficiencies noted by the factory representative. For each deficiency noted, documentation of corrective action (including date and time) shall be submitted to the Engineer and Owner. Where factory start-up is not specified for a particular piece of equipment or system, the Contractor shall be responsible to perform start-up.
- 43.8 The Contractor shall be responsible for completion of System Verification Checklist (SVC) / Manufacturer's Checklists. Furnish to the Testing Agent and Engineer. Sample checklists shall be submitted to the Engineer, Owner, and Testing Agent for approval.
- 43.9 The completed reports shall be organized and bound together in a tabbed binder and submitted for review and approval.

PART 44 - UTILITY COMPANY REQUIREMENTS:

- 44.1 The Contractor shall provide the local utility company with a drawing produced by a licensed Surveyor or a licensed Engineer and acceptable to the utility that locates the centerline of the primary duct. Coordinate further requirements with utility company.
- 44.2 Contact the utility company for specifics on construction of pads, conduit, etc., prior to bidding the work and determine all their requirements. All work shall be in accordance with their standards.
- Designer Note: Choose one (*) for either owner or contractor responsible for utility company fees.**
- 44.3 (*)The electrical contractor is responsible for all fees, permit costs, etc., from the electrical utility, data, telephone and cable T.V. companies. This includes any cost associated with the underground electrical service extension.
- 44.4 (*)The owner is responsible for all fees, permit costs, etc., from the electrical utility, data, telephone and cable T.V. companies. This includes any cost associated with the underground electrical service extension.
- 44.5 Each contractor, prior to bidding the work, is to contact the utility companies (electric, data, telephone and cable T.V.) and determine the exact points of extension of all underground services in the field with a representative of each utility company. Also, obtain construction details on manholes, transformer pads, pedestal stub-ups, etc., from each utility company as applicable. Extension points indicated on the plans are approximate, and are given for the bidder's information only.

PART 45 - SPECIAL WRENCHES, TOOLS AND KEYS:

- 45.1 Each Contractor shall provide, along with the equipment provided, any special wrenches or tools necessary to dismantle or service equipment or appliances installed by him. Wrenches shall include necessary keys, handles and operators for valves, switches, breakers, etc. and keys to electrical panels, emergency generators, alarm pull boxes and panels, etc. At least two of any such special wrench, keys, etc. shall be turned over to the Architect prior to completion of the project. Obtain a receipt that this has been accomplished and forward a copy to the Engineer.

HCA - JFK Medical Center North Campus
Behavioral Health Program Expansion
West Palm Beach, Florida

SHA HCA1609
07 November 2016
CMTA Project VWPC16

END OF SECTION.

DIVISION 26 - ELECTRICAL

SECTION 260501 - SCOPE OF THE ELECTRICAL WORK

PART 1 – GENERAL:

- 1.1 Each Electrical Contractor's attention is directed to Electrical Specification Section - GENERAL PROVISIONS, and all other Contract Documents as they apply to his work.

PART 2 - SCOPE OF THE ELECTRICAL WORK:

- 2.1 The Electrical work for this project includes all labor, materials, equipment, fixtures, excavation, backfill and related items required to completely install, test, place in service and deliver to the Owner complete electrical systems in accordance with the accompanying plans and all provisions of these specifications. This work shall primarily include, but is not limited to the following:

Designer Note: Edit for your project. Delete items which do not apply.

- 2.2 All conduits, conductors, outlet boxes, fittings, etc.
- 2.3 All switchgear, panels, disconnect switches, fuses, transformers, contactors, starters, etc.
- 2.4 High voltage switchgear, cabling, pad mounted transformers, switches, etc.
- 2.5 All wiring devices and device plates.
- 2.6 All light fixtures, lamps, ballasts and lighting controls.
- 2.7 Electrical connection to all electrically operated equipment furnished and/or installed by others, including kitchen equipment.
- 2.8 Emergency power system.
- 2.9 Inspection of electrical system by licensed Electrical Inspector.
- 2.10 Fire alarm system.
- 2.11 Grounding.
- 2.12 Lightning Protection Systems.
- 2.13 Equipment Labeling.
- 2.14 Medical gas alarm valve connections.
- 2.15 Cabling management systems.
- 2.16 All Low Voltage Systems as listed in System Responsibilities Matrix on Electrical Legend.
- 2.17 All necessary coordination with electric utility company, telephone company, etc., to ensure that work connections, etc. that they are to provide is accomplished.
- 2.18 Paying all necessary fees and cost for permits, inspections, work by utility companies, etc. The Contractor shall contact the responsible parties prior to submitting a bid to determine exactly what

these charges will be.

2.19 Prior to submitting a bid, the Contractor shall contact all serving utility companies to determine exactly what each utility company will provide and exactly what is required of the Contractor and shall include such requirements in his base bid.

2.20 All general and special conditions required to accomplish the work.

END OF SECTION.

DIVISION 26 - ELECTRICAL

SECTION 260502 - SHOP DRAWINGS

PART 1 - SHOP DRAWINGS:

- 1.1 Each Contractor shall submit to the Architect and/or Engineer, within thirty days after the date of the Contract, seven sets of shop drawings and/or manufacturer's descriptive literature on all equipment required for the fulfillment of his contract. Each shop drawing and/or manufacturer's descriptive literature shall have proper notation indicated on it and shall be clearly referenced so the specifications, schedules, light fixture numbers, panel names and numbers, etc., so that the Architect and/or Engineer may readily determine the particular item the Contractor proposes to furnish. All data and information scheduled, noted or specified by hand shall be noted in color red on the submittals. The Contractor shall make any corrections or changes required and shall resubmit for final review as requested. Review of such drawings, descriptive literature and/or schedules shall not relieve the Contractor from responsibility for deviation from drawings or specifications unless they have, in writing, directed the reviewer's attention to such deviations at the time of submission of drawings, literature and manuals; nor shall it relieve them from responsibility for errors or omissions of any nature in shop drawings, literature and manuals. The term "as specified" will not be accepted.
- 1.2 If the Contractor fails to comply with the requirements set forth above, the Architect and/or Engineer shall have the option of selecting any or all items listed in the specifications or on the drawings, and the Contractor will be required to provide all materials in accordance with this list.
- 1.3 Review of shop drawings by the Engineer applies only to conformance with the design concept of the project and general compliance with the information given in the contract documents. In all cases, the installing Contractor alone shall be responsible for furnishing the proper quantity of equipment and/or materials required, for seeing that all equipment fits the available space in a satisfactory manner and that piping, electrical and all other connections are suitably located.
- 1.4 The Engineer's review of shop drawings, schedules or other required submittal data shall not relieve the Contractor from responsibility for the adaptability of the equipment or materials to the project, compliance with applicable codes, rules, regulations, information that pertains to fabrication and installation, dimensions and quantities, electrical characteristics, and coordination of the work with all other trades involved in this project.
- 1.5 No cutting, fitting, rough-in, connections, etc., shall be accomplished until reviewed equipment shop drawings are in the hands of the Contractors concerned. It shall be each Contractor's responsibility to obtain reviewed shop drawings and to make all connections, etc. in the neatest and most workmanlike manner possible. Each Contractor shall coordinate with all the other Contractors having any connections, roughing-in, etc., to the equipment, to make certain proper fit, space coordination, voltage and phase relationships are accomplished.
- 1.6 In accordance with the provisions specified hereinbefore, shop drawings, descriptive literature and schedules shall be submitted on each of the following indicated items as well as any equipment or systems deemed necessary by the Engineer:

Designer Note: Edit for your project

- 1.7 Power Equipment:
 - 1.7.1 Switchgear and panelboards.
 - 1.7.2 Circuit breakers or fusible switches, per each type.

- 1.7.3 Dry type transformers.
- 1.7.4 Liquid-filled pad mount transformers and their accessories.
- 1.7.5 Power and lighting contactors.
- 1.7.6 Disconnect switches.
- 1.7.7 Fuses, per each type required.
- 1.7.8 Motor starters, if not submitted with unit equipment by supplier.
- 1.7.9 Control components (relays, timers, selector switches, pilots, etc.)
- 1.7.10 Metering devices.
- 1.7.11 Bus duct and each type of fitting for bus duct.
- 1.7.12 Emergency generator, enclosure, engine fuel system and transfer switches, with all required generator system accessories, such as battery charger, batteries, exhaust system and its insulation, fuel pumps, day tanks, etc.
- 1.7.13 Surge protection devices.
- 1.7.14 Power system studies.
- 1.8 Raceways:
 - 1.8.1 Cable tray and each type of cable tray fitting.
 - 1.8.2 Wireways and each type of wireway fitting.
 - 1.8.3 Surface-mounted metal or plastic raceways, with each type of fitting.
 - 1.8.4 Conduit and each type of conduit fitting.
- 1.9 Devices:
 - 1.9.1 Each type of wiring device and their coverplates.
 - 1.9.2 Floor boxes, each by type, with required accessories.
 - 1.9.3 Data/voice/video wallplates, each type.
 - 1.9.4 Any special items not listed above.
- 1.10 Lighting
 - 1.10.1 Light fixtures, each by type, marked to indicate all required accessories and lamp selection. Also provide original color selection chart to allow Architect and/or Engineer to indicate color selection.
 - 1.10.2 Lamps, each by type.

- 1.10.3 Ballasts, each by type.
- 1.10.4 Lighting standards or poles.
- 1.10.5 Flexible modular wiring system with cutsheets and layout drawings.
- 1.10.6 Photocells, time clocks or other lighting accessories.
- 1.10.7 Lighting controls and sensors, each by type.
- 1.11 Conductors
 - 1.11.1 Conductors, splicing devices, and connectors, each by type.
 - 1.11.2 Splice or tap blocks.
 - 1.11.3 Primary cable (over 600 volts) and each style of termination fitting for primary cable.
- 1.12 Systems
 - 1.12.1 Note: Each system submittal is to be complete with legible cutsheets for all devices, equipment, special wiring, etc. Also provide scale building layout drawings that indicate device placement, wiring, etc. Drawings shall be in digital format and shall include complete (not typical) riser diagrams of all systems. Refer to specific system's specification for additional submittal requirements where required.
 - 1.12.2 Fire alarm system
 - 1.12.3 Building paging/intercom audio system
 - 1.12.4 Clock/Program system
 - 1.12.5 Telephone system
 - 1.12.6 Television/video system
 - 1.12.7 Data network
 - 1.12.8 Sound reinforcement system(s)
 - 1.12.9 Wireless intercom system
 - 1.12.10 Nurse call system
 - 1.12.11 Security systems(s)
 - 1.12.12 All other systems as listed on Systems Responsibility Matrix - See Electrical Legend.
- 1.13 Miscellaneous
- 1.14 Control panel assemblies.
- 1.15 Non-standard junction/pullboxes.

1.16 Manholes, hand holes, and all outdoor electrical equipment and fittings.

1.17 Grounding

1.17.1 Electrodes, bonding devices, terminals, etc.

1.17.2 Building service grounding electrode components.

1.18 Electronic 3D Coordination Drawings per Electrical General Provisions

1.19 Dimensioned electrical room plans/equipment layouts

1.20 Fire-stopping

1.21 Lightning Protection

1.22 Seismic Restraints

PART 2 – FIRE ALARM SHOP DRAWINGS:

2.1 The contractor and equipment supplier shall submit to the Architect and/or Engineer, fire alarm system shop drawings complete with catalog cuts, descriptive literature and complete system drawings for their review prior to submittal to the governing authority for their review. The contractor is responsible for obtaining all required approvals from the authority having jurisdiction as required for construction.

2.2 Fire alarm drawings shall be created in digital format (CAD or equivalent). Drawings shall include all power supply, battery, and circuit load and voltage drop calculations as required by NFPA. Complete wiring diagrams and proposed device addresses shall be provided.

2.3 Shop drawings shall indicate all devices as required to satisfy all local and state mandates, whether indicated on construction drawings or not. Include all components as required for a complete and operational system.

END OF SECTION.

DIVISION 26 - ELECTRICAL

SECTION 260503 - CUTTING, PATCHING AND REPAIRING

PART 1 – GENERAL:

- 1.1 The Contractor shall be responsible for all openings, sleeves, trenches, etc. that he may require in floors, roofs, ceilings, walls, etc. and shall coordinate all such work with the General Contractor and all other trades. He shall determine and coordinate any openings which he is to provide before submitting a bid proposal in order to avoid conflict and disagreement during construction. Improperly located openings shall be reworked at the expense of the responsible Contractor.
- 1.2 The Contractor shall plan his work ahead and shall place sleeves, frames or forms through all walls, floors and ceilings during the initial construction, where it is necessary for conduit, buss duct, conductors, wireways, etc. to go through; however, when this is not done, this Contractor shall do all cutting and patching required for the installation of his work, or he shall pay other trades for doing this work when so directed by the Architect. Any damage caused to the buildings by the workmen of the responsible Contractor must be corrected or rectified by him at his own expense.
- 1.3 The Contractor shall cut holes in casework, equipment panels, etc. (if any), as required to pass pipes in and out.
- 1.4 The Contractor shall notify other trades in due time where he will require openings of chases in new concrete or masonry. He shall set all concrete inserts and sleeves for his work. Failing to do this, he shall cut openings for his work and patch same as required at his own expense.
- 1.5 Openings in slabs and walls shall be cut with core drill. Hammer devices will not be permitted. Edges of trenches and large openings shall be scribe cut with a masonry saw.
- 1.6 Where any cutting, coring, etc. of reinforced concrete is required, such structures shall be x-rayed to avoid damaging existing reinforcing steel.
- 1.7 Where sleeves are placed in exterior walls below grade, the space between the pipe or conduit and the sleeves shall be made completely water tight. Provide Crouse-Hinds Link-Seal Environmental Conduit Seal with stainless steel hardware. Alternative methods must be approved by the Engineer and/or Architect.
- 1.8 In all cases, sleeves shall be at least two pipe sizes larger than nominal pipe diameter.
- 1.9 Sleeves passing through roof or exterior wall or where there is a possibility of water leakage and damage shall be caulked water tight for horizontal sleeves and flashed and counter-flashed with lead (4 lb.) or copper and soldered to the piping, lapped over sleeve and properly weather sealed.
- 1.10 All rectangular or special shaped openings in plaster, stucco or similar materials including gypsum board shall be framed by means of plaster frames, casing beads, wood or metal angle members as required. The intent of this requirements is to provide smooth even termination of wall, floor and ceiling finishes as well as to provide a fastening means for lighting fixtures, panels, etc. Lintels shall be provided where indicated over all openings in bearing walls, etc.
- 1.11 No cutting is to be done at points or in a manner that will weaken the structure and unnecessary cutting must be avoided. If in doubt, contact the Architect.
- 1.12 The Contractor shall be responsible for properly shoring, bracing, supporting, etc. any existing and/or new construction to guard against cracking, settling, collapsing, displacing or weakening while

openings are being made. Any damage occurring to the existing and/or new structures, due to failure to exercise proper precautions or due to action of the elements, shall be promptly and properly made good to the satisfaction of the Architect.

- 1.13 All work improperly done or not done at all as required by the Electrical trades in this section will be performed by others. The cost of this work shall be paid for by the Contractor who is in non-compliance with the Contract.

END OF SECTION.

DIVISION 26 - ELECTRICAL

SECTION 260504 - DEMOLITION, RESTORATION AND SALVAGE

PART 1 – GENERAL:

- 1.1 Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division A Specification Sections to apply to work specified in this section.
- 1.2 Contractor is responsible for submitting photos and documenting existing conditions to Owner prior to commencing demolition. Systems and equipment found to be defective after demolition has commenced shall be repaired or replaced by Contractor at no additional cost to Owner.

PART 2 – DESCRIPTION OF WORK:

- 2.1 This section covers all demolition, restoration and salvage required to perform the electrical work indicated on the drawings, specified and/or as required to complete the project. It is the intent of this section of work to remove all existing electrical equipment, materials, etc. which are not required for the completed building and to restore any and all finished surfaces to their original type and conditions. To accomplish these requirements, the Contractor(s) shall, at his own expense, engage the services of others already performing finish work on this project. All work shall be completed to the satisfaction of the Architect/Engineers whose decisions shall be final. This requirement shall apply to all restoration work whether indicated or specified.
- 2.2 All adjacent areas need to remain in operation and services to other areas need to be maintained during demolition.
- 2.3 Schedule all demolition and any outages affecting other areas with owner.
- 2.4 Provide and maintain temporary partitions and/or dust barrier per owners dust control plan.

PART 3 – ELECTRICAL:

- 3.1 Where electrical fixtures, equipment or other materials are removed and/or relocated, all abandoned conduit and conductors shall be removed in exposed areas. In concealed areas, materials shall be abandoned in place or removed as indicated and patch all openings.
- 3.2 The Contractor shall be responsible for the removal and/or relocation of any electrical equipment, fixtures, devices, appurtenances, etc. which may, in the course of construction, interfere with the installation of any new and/or relocated Architectural, Mechanical, Electrical, Structural or Fire Protection Systems whether indicated or not.
- 3.3 Relocate junction boxes and provide low voltage raceways and supports for existing cabling in areas above new inaccessible ceilings.
- 3.4 Where components of any system in this contractor's scope of work are to be reused, the contractor shall test those components prior to removal and record the state of functionality and condition of the components as tested. These records shall be provided to the owner or engineer upon request. In the absence of these records, all components removed shall be assumed functional at the time of removal. Any device subsequently found to be non-functioning or in unsuitable condition for reuse shall be replaced at the expense of the contractor.

PART 4 – REPAIR:

- 4.1 Unless otherwise indicated, the Contractor shall be responsible for the patching and repairing of all holes, etc. in the ceiling, wall and floors where electrical equipment is removed.

PART 5 – SALVAGE:

- 5.1 It is the intent of this section to deliver to the Owner all components of any electrical system which may be economically reused by him. The Contractor shall make every effort to remove reusable components without damage.

PART 6 - DISPOSAL OF LAMPS:

- 6.1 Contractor shall be responsible for the careful removal of all lamps and fluorescent tubes without breakage from existing lighting fixtures.
- 6.2 Lamps removed from fluorescent, metal halide, mercury vapor, and sodium fixtures that do not have green end caps shall be placed by the Contractor in cardboard boxes. The Contractor shall label each box with type and quantity of lamps in each box and seal the box. Boxes shall be properly disposed of.
- 6.3 Broken, fluorescent, metal halide, mercury vapor, and sodium lamps without green end caps shall be immediately and carefully cleaned up by the Contractor and placed in a 55 gallon steel drum. The Contractor shall properly dispose of.
- 6.4 All lamps and tubes with green end caps as well as incandescent lamps shall be disposed of by the Contractor in his dumpster. Green end cap lamps and broken lamps shall not be placed in any box designated for recycling lamps.

END OF SECTION.

DIVISION 26 - ELECTRICAL

SECTION 260505 - COORDINATION AMONG TRADES, SYSTEMS INTERFACING
AND CONNECTION OF EQUIPMENT FURNISHED BY OTHERS

PART 1 – COORDINATION:

- 1.1 The Contractor is expressly directed to read the General Conditions and all sections of these specifications for all other trades and to study all drawings applicable to his work, including Architectural, Plumbing Fire Protection, Mechanical and Structural drawings, to the end that complete coordination between trades will be affected. Each Contractor shall make known to all other contractors the intended positioning of materials, raceways, supports, equipment and the intended order of his work. Coordinate all work with other trades and proceed with the installation in a manner that will not create delays for other trades or affect the Owner's operations.
- 1.2 Special attention to coordination shall be given to points where raceways, fixtures, etc., must cross other ducts or conduit, where lighting fixtures must be recessed in ceilings, and where fixtures, conduit and devices must recess into walls, soffits, columns, etc. It shall be the responsibility of each Contractor to leave the necessary room for other trades. No extra compensation or time will be allowed to cover the cost of removing fixtures, devices, conduit, ducts, etc. or equipment found encroaching on space required by others.
- 1.3 The Contractor shall be responsible for coordination with all trades to ensure that they have made provision for connections, operational switches, disconnect switches, fused disconnects, motor starters, etc., for electrically operated equipment provided under this or any other division of the specifications, or as called for on the drawings. Any connection, circuiting, disconnects, fuses, etc., that are required for equipment operation shall be provided as a part of this contract.
- 1.4 Review and coordinate connections to electrically operated equipment furnished by other trades with project contract documents, shop drawings, submittals, and installation instructions. Notify architect in writing of discrepancies prior to proceeding with work. No extra payment will be allowed for relocation of fixtures, devices, conduit, and equipment not installed or connected in accordance with the above instructions.
- 1.5 In all areas where air diffusers, devices, lighting fixtures and other ceiling-mounted devices are to be installed, the Mechanical Trade(s) and the Electrical Trade and the General Trades shall coordinate their respective construction and installations so as to provide a combined symmetrical arrangement that is acceptable to the Architect and Engineer. Where applicable, refer to reflected ceiling plans. Request layouts from the Architect or Engineer where in doubt about the potential acceptability of an installation.
- 1.6 Refer to equipment schedules and details on all contract documents for additional information for mechanical and plumbing connections. Provide labor and materials for a complete and operable system.
- 1.7 Provide equipment overcurrent protection and feeder sizes for equipment furnished by this or other trades or by Owner per actual equipment nameplates and installation instructions.
- 1.8 Provide maintenance receptacle within 25 ft of each mechanical unit as required by NEC. Coordinate installation locations with final equipment layout provided by mechanical contractor.

PART 2 – INTERFACING:

- 2.1 Each Electrical Trade, Specialty Controls Trade, Mechanical Trade and the General Trades, etc., shall ensure that coordination is effected relative to interfacing of all systems. Some typical interface points are (but not necessarily all):
 - 2.1.1 Connection of Telecommunications (voice, video, data) lines to Owner's existing or new services.
 - 2.1.2 Connection of Power lines to Owner's existing or new services.
 - 2.1.3 Connection of fuel oil and exhaust piping to emergency generator and furnishing of fuel for testing unit. Provide a full tank at final acceptance.
 - 2.1.4 Connection of all controls to equipment.
 - 2.1.5 Electrical power connections to electrically operated (or controlled) equipment.
 - 2.1.6 Electrical provisions for all equipment provided by other trades or suppliers within this contract.

PART 3 - CONNECTION OF EQUIPMENT FURNISHED BY OTHERS:

- 3.1 Each Contractor shall make all connections to equipment furnished by others, whenever such equipment is shown on any part of the drawings or mentioned in any part of the Specifications, unless otherwise specifically specified hereinafter.
- 3.2 All drawings are complementary, one trade of the other. It is the Contractor's responsibility to examine all drawings and specifications to determine the full scope of his work. The project Engineers have arranged the specifications and drawings in their given order solely as a convenience in organizing the project, and in no way shall they imply the assignment of work to specific trades, contractors, subcontractors or suppliers.
- 3.3 Supervision to assure proper installation, functioning and operation shall be provided by the Contractor furnishing the equipment or apparatus to be connected.
- 3.4 Items indicated on the drawings as rough-in only (RIO) will be connected by the equipment supplier or Owner, as indicated. The Contractor shall be responsible for rough-in provisions only as indicated. These rough-ins shall be in accordance with the manufacturer's or supplier's requirements.
- 3.5 For items furnished by others, relocated, or RIO, the Contractor shall obtain from the supplier or shall field determine as appropriate, the exact rough-in locations and connection sizes for the referenced equipment.
- 3.6 The Contractor shall be responsible for coordinating with the General and all other trades, as necessary, to determine any and all final connections that he is to make to equipment furnished by others.

END OF SECTION.

DIVISION 26 - ELECTRICAL

SECTION 260506 - DISPOSAL OF P.C.B. CONTAMINATED ITEMS

PART 1 – GENERAL:

- 1.1 This section of the specification covers the requirements for removal, service, disposal, and replacement of P.C.B. items, P.C.B. articles, P.C.B. transformers, and/or P.C.B. contaminated electrical equipment in accordance with this specification, subject to the terms and conditions of the Contract.
- 1.2 Should there be conflicts between this section of the specification and the Contract documents, this section of the specification shall take precedence.
- 1.3 The Contractor must meet the conditions of this section of the specification. The Contractor is responsible for removal of P.C.B. transformers, providing and installing replacement transformers, pumping of P.C.B. fluids from existing transformers (if necessary), clean up if spills occur, marking, labeling and manifesting of all P.C.B. items, articles and containers, and all items in this specification. In addition, the Contractor is responsible for existing conditions including any cleanup as required to the satisfaction of all authorities having jurisdiction. In addition to the contaminated transformers, all rags, tools, containers, etc., that may be contaminated in cleanup operations shall be removed and properly disposed of as a part of this contract.
- 1.4 Prior to making any disconnections or loosening bushings at the existing transformers, the Contractor shall wrap the units securely in plastic (multiple layers) in accordance with environmental regulations to prevent spillage if leaking occurs at the connections or otherwise. The transformers shall be rigged and handled onto the disposal Contractor's vehicle in a manner that is in compliance with all current rules and regulations for such work.

PART 2 - APPLICABLE REGULATIONS:

- 2.1 The applicable sections, latest editions and addenda of the following government regulations, codes, industry standards and recommended practices, form a part of this specification. Nothing in these specifications is to be construed as permitting work not conforming to these requirements.
 - 2.1.1 EPA - Environmental Protection Agency
 - 2.1.2 OSHA - Occupational Safety and Health Administration
 - 2.1.3 NEC - National Electric Code
 - 2.1.4 NESC - National Electric Safety Code
 - 2.1.5 NEMA - National Electrical Manufacturers Association
 - 2.1.6 RCRA - Resource Conservation and Recovery Act
 - 2.1.7 TSCA - Toxic Substances and Control Act
 - 2.1.8 DOT - Department of Transportation
 - 2.1.9 All other applicable Federal, State, County and City Codes, Standards and Regulations.
- 2.2 The Contractor is cautioned that he is responsible for ascertaining the extent to which these regulations affect the operations resulting from this solicitation and to comply therewith.

PART 3 - P.C.B. DISPOSAL - SCOPE OF THE WORK:

- 3.1 This work consists of removal, transporting, disposal of the P.C.B. fluids, P.C.B. contaminated transformer and P.C.B. contaminated items used as a result of this scope of work, including but not limited to all modifications, rigging required to remove existing P.C.B. transformers and all cables, conduit, modification of electrical equipment, masonry, concrete, metal work and incidentals necessary to complete the work.

PART 4 - QUALIFICATIONS:

4.1 Insurance

- 4.1.1 The Contractor shall possess the following minimum insurance and provide certificates from qualified insurers attesting the same.

- 4.1.2 Environmental Impairment Expense - \$1,000,000 per occurrence, \$2,000,000 aggregate and covering sudden and accidental spills of hazardous waste material.

- 4.1.3 Comprehensive General Liability - \$1,000,000 combined single limit per occurrence.

- 4.1.4 Comprehensive Automobile Liability - \$1,000,000 combined single limit per occurrence.

- 4.2 In addition to the above described insurance requirements, the total assets of the P.C.B. disposal Contractor shall be at least \$5,000,000 as evidenced by the most recent annual or stockholder's report.

- 4.3 Evidence of reliable insurance coverage and assets to fully indemnify against long-term liabilities and/or catastrophic occurrences shall be a part of the valuation criteria for award of the Contract.

- 4.4 Special Note: In addition to the special areas of risk defined in this statement, the Contractor shall either by an endorsement to the Public Liability Policy or by separate policy cover the special risk of P.C.B. Processing, Transportation and Disposal. The bidder is hereby made aware that the ensured project is a P.C.B. removal/disposal project and that coverage of such projects has not been excluded. Failure to comply with this provision of the bid will mean automatic rejection of the bid.

4.5 Final Payment

- 4.5.1 Final payment will be processed only after submission of certification that all materials handled under this Contract were transported, processed and disposed of in the manner specified herein, assuming satisfactory completion of the project.

- 4.5.2 Contractor shall provide written evidence that as a major part of their business, the Contractor is engaged in P.C.B. related work. A listing of previously completed P.C.B. work over the past five years is to be included in the bid. List at least five projects completed, with facility names, addresses, contact person and telephone/fax numbers.

- 4.5.3 Contractor must show that his employees have on-going formal training in P.C.B. activities. Certification of training is to be included in the bid.

- 4.5.4 Contractor must show compliance with all of the above qualification. Use of any subcontractor's qualifications to fulfill prime Contractor's qualifications is unacceptable.

- 4.5.5 Failure to provide proof of the above qualifications will render Contractor's bid non-responsive.

4.6 Contracts

- 4.6.1 This work shall be performed under one Prime Contractor.
- 4.6.2 All work subcontracted by the Prime Contractor shall be identified as to function and written approval submitted. All subcontractors are to be submitted with bid.
- 4.6.3 No work shall start before Owner's written notice to proceed.
- 4.6.4 Each subcontractor shall provide insurance acceptable to Owner or be named as additional insured on the Prime Contractor's insurance certificate.

PART 5 - REMOVAL OF P.C.B. TRANSFORMERS AND DISPOSAL:

5.1 Scope

- 5.1.1 The work required to remove, transport, and the disposal of the P.C.B. contaminated transformer liquid and items used in this work that become contaminated.
- 5.1.2 The tasks include, but are not limited to:
 - 5.1.2.1 Removal
 - 5.1.2.2 Marking
 - 5.1.2.3 Transportation
 - 5.1.2.4 Manifesting
 - 5.1.2.5 Incineration
 - 5.1.2.6 Delivery to chemical waste landfill, with final certificate(s) of disposal
 - 5.1.2.7 Decontamination of site
 - 5.1.2.8 Record keeping
 - 5.1.2.9 Spill prevention, containment and countermeasure plans
 - 5.1.2.10 Personnel hazard
 - 5.1.2.11 Pert chart of work schedule
 - 5.1.2.12 Location of unit to be removed: _____

5.2 Description of Work

- 5.2.1 The Contractor shall familiarize himself with transformer and the site conditions
- 5.2.2 Transformer specifications shall be obtained by the Contractor as needed to complete the work.
- 5.2.3 Space available in the area and egress route.

5.2.4 Building walls, elevations, substrate loading, etc.

5.2.5 Failure to familiarize with conditions that may affect the work scope shall not lessen the Contractor's responsibility or entitle him to additional compensation for any work not included in his bid.

5.3 Regulations

5.3.1 All work performed by the Contractor on this project shall comply with the pertinent sections of the latest editions and addenda of the following government regulations. The regulations are referred to by the basic designations only.

5.3.2 General

- 29CFR1910 - Occupational Safety and Health Standards
- NEC - National Electric Codes
- NESC - National Electric Safety Code
- NEMA - National Electric Manufacturer's Association
- All other applicable Federal, State, County and City Regulations, Codes, and Standards.

5.3.3 P.C.B.

5.3.3.1 U.S. Environmental Protection Agency (EPA):

- 40 CFR 261 - Identification and Listing of Hazardous Waste
- 40 CFR 761 - Polychlorinated Biphenyls (P.C.B.s) Manufacturing, Processing, Distribution in Commerce, and Use Prohibitions
- U.S. Department of Transportation (DOT):
 - 49 CFR 172 - Hazardous Materials Tables and Hazardous Materials Communications Regulations
 - 49 CFR 178 Shipping Container Specifications
- The disposal of all P.C.B. liquids, P.C.B. solids, P.C.B. containers and P.C.B. equipment shall be in accordance with the latest revisions and addenda of the following Federal regulations:
 - 40 CFR 761.40 - Marking Requirements
 - 40 CFR 761.60 - Disposal Requirements
 - 40 CFR 761.65 - Storage for Disposal
 - 40 CFR 761.70 - Incineration
 - 40 CFR 761.75 - Chemical Waste Landfills
 - 40 CFR 761.79 - Decontamination
 - 40 CFR 761.180 - Records and Reports
 - 52 FR 107015 - P.C.B. Spill Cleanup Policy
- All other Federal, State, County and City Regulations, Codes and Ordinances applicable at the time of commencement of the removal work.

5.4 Definitions

5.4.1 "Disposal" means to intentionally or accidentally discard, throw away or otherwise complete or terminate the useful life of P.C.B.s and P.C.B. items. Disposal includes spills, leaks, and other uncontrolled discharges of P.C.B.s as well as actions relating to containing, transporting, destroying, degrading, decontaminating, or confining P.C.B.s and P.C.B. items.

5.4.2 "P.C.B. and P.C.B.s" means any chemical substance that is limited to the biphenyl molecule that has been chlorinated to various degrees or any combination of substances which contain such substance.

5.4.3 "P.C.B. Article" means any manufactured article, other than a P.C.B. container, that contains P.C.B.s and whose surfaces have been in direct contact with P.C.B.s. P.C.B. article includes capacitors,

transformers, electric motors, pumps, pipes and any other manufactured items whose surfaces have been in direct contact with P.C.B.s.

- 5.4.4 PP.C.B. Equipment" means any manufactured item, other than a P.C.B. container, which contains a P.C.B. article or other equipment and includes electronic equipment and fluorescent light ballasts and fixtures.
- 5.4.5 "P.C.B. Item" means any P.C.B. article, P.C.B. article container, P.C.B. equipment that deliberately or unintentionally contains or has as any part of it any P.C.B. or P.C.B.s at a concentration of fifty parts per million or greater (or whatever the most current government standard is for PPM/PPB concentrations).
- 5.4.6 "Incinerator" means a permitted and engineered device using controlled flame combustion to thermally degrade P.C.B.s and P.C.B. items. Examples of devices used in incineration include rotary kilns, liquid injection incinerators, cement kilns, and high temperature boilers.
- 5.4.7 "Leak" or "Leaking" means any instance in which a P.C.B. article, P.C.B. container, or P.C.B. equipment has any P.C.B.s on any portion of its external surface.
- 5.4.8 "Marked" means the marking of P.C.B. items and P.C.B. storage areas and transport vehicles by means of apply a legible mark by paintings, fixation of an adhesive label, or by any other method that meets the requirements of 40 CFR 761, Subpart C.
- 5.4.9 "P.C.B. Container" means any package, can, bottle, bag, barrel, drum, tank, or other de ice that contains P.C.B.s or P.C.B. Articles, and whose surface(s) have/has been in direct contact with P.C.B.s.
- 5.4.10 "SPCC" - Spill Prevention Countermeasures and Control Plan.

5.5 Filings

5.6 Thirty days prior to the commencement of the removal work, the Contractor shall file with the Engineer four copies of each of the following items:

5.6.1 A detailed written procedure that the Contractor will follow for the performance of the work. The procedure shall include plans for all aspects of the work, including specific measures for worker safety and specific plans for the containment and cleanup of any P.C.B.s generated by a leak or spill during any portion of the work.

5.6.2 Certification from the Contractor that the Contractor has obtained all necessary licenses and permits for every phase of the work, including the necessary licenses and permits for each State through which P.C.B.s will be transported. The Contractor shall also provide copies of the licenses and permits.

5.6.3 Certification from the manufactures that all containers, materials and protective clothing conform with the applicable regulations.

5.6.4 Experience, education and training of all P.C.B. supervisors and SPCC team personnel.

5.7 Safety

5.7.1 The Contractor shall be responsible for the safety of his personnel during all phases of the work. The Contractor shall also maintain site control during removal and cleanup operations to minimize ignition and spill hazards during the handling of P.C.B. materials.

5.8 Supervision

5.8.1 All P.C.B. related removal work shall be performed under the direct supervision of a trained and experienced P.C.B. supervisor provided by the Contractor. No movement or handling of P.C.B. items, P.C.B. liquids or other P.C.B. material shall occur unless so directed by the P.C.B. supervisor.

5.9 Materials and Equipment

5.9.1 The Contractor shall provide all protective clothing, cleanup and decontamination materials, containers and other material and equipment necessary for the completion of the work.

5.9.2 The Contractor shall provide all materials necessary to maintain appropriate levels of protection from respiratory, skin and eye exposure to P.C.B.s as required by 29 CFR 1910.

5.9.3 All containers used for the storage and/or transportation of P.C.B. liquids, solids and electrical equipment shall be new and undamaged; shall be in accordance with 40 CFR 761.65 and 49 CFR 178, and shall meet the specific requirements of the disposal facility.

5.9.4 Solvents and cleaners used for cleanup and decontamination shall be in accordance with the requirements of 40 CFR 761.79.

5.9.5 Absorbent material shall include granular material, powdered clay, blankets and pillows of non-woven fiber, amorphous inorganic foam particle pillows, or any other absorbent material recommended by the EPA.

5.10 Execution

5.10.1 The Contractor shall prepare, for the Owner's signature, all paperwork, manifesting and product records required by Federal, State, County and City regulations and by the disposal facilities. Items which are required by the applicable laws and regulations to be signed by personnel of the Owner shall be submitted for signature when they are required.

5.10.2 The Contractor shall assume title to all P.C.B. electrical equipment upon commencement of removal.

5.11 Environmental Protection

5.11.1 Prior to the commencement of the removal work, the Contractor shall install a secondary containment system in the specific P.C.B. equipment locations. The Contractor shall also place a portable spill cleanup kit that can be quickly mobilized along all routes used for the movement of P.C.B. liquids and/or P.C.B. equipment to the transport vehicle. The spill cleanup kit shall contain sufficient containment, absorbent and decontamination materials to completely contain and cleanup a spill from the largest volume P.C.B. container or P.C.B. item being moved.

5.11.2 Prior to the commencement of the removal work, the Contractor shall completely seal all drains and other openings through which P.C.B. liquids could migrate away from the immediate work area.

5.11.3 Prior to the transportation of P.C.B. liquids and other P.C.B. items out of the facility, the Contractor shall completely seal all drains along the transportation route unless transport vehicle has secondary containment.

5.11.4 Remove all seals, dikes, barriers, etc., at the conclusion of each cycle of removal operations.

5.12 PBC Electrical Equipment Removal

- 5.12.1 Prior to the commencement of any removal work, the work area shall be barricaded and identified as a P.C.B. work area.
- 5.12.2 All personnel authorized for entry into the work area shall be instructed in the proper procedures for working around high-voltage equipment.
- 5.12.3 All personnel authorized for entry to the area during removal of P.C.B. fluids or handling of P.C.B. equipment shall be certified for this work. Submit a list of the names of these personnel and their work and training experience in P.C.B. disposal to the Engineer and Owner for review.
- 5.12.4 A qualified journeyman electrician shall be present during all work involving the removal of P.C.B. transformers to provide technical advice should problems arise.
- 5.12.5 Prior to removal of carcass, P.C.B. transformers shall be completely drained of all dielectric fluid prior to the removal of the transformers from their installation locations only if deemed necessary by the disposal Contractor. The draining and handling of the P.C.B. dielectric fluid shall be in accordance with this Specification and all applicable state and federal regulations.
- 5.12.6 The removal work shall be confined to the immediate vicinity of the P.C.B. electrical equipment and the routes used for the movement of P.C.B. containers and P.C.B. equipment to the transport vehicle. Should damage occur as a result of the work, the Contractor shall be responsible, at his expense for repairing or replacing the damage in kind, to the acceptability of the Owner.
- 5.13 P.C.B. Transformer Liquid Draining (If Necessary to Complete the Work)
 - 5.13.1 Prior to undertaking any removal operations associated with the P.C.B. transformers the Contractor shall drain the P.C.B. oil into a dedicated vacuum tanker vehicle specifically designed for the draining and containment of P.C.B. fluids.
 - 5.13.2 Prior to containing any fluid draining operation, the work area shall be properly barricaded and identified. The Contractor shall take all measures as necessary to prevent contamination of the flooring, equipment or other areas in the event of a P.C.B. fluid spill during the draining operation. This may include, but is not limited to, the use of sorbent blankets or rolls plastic sheeting, spill control pillows and sorbent booms. The Contractor shall provide the following:
 - 5.13.2.1 Secondary containment in the area of the vacuum tanker to be filled. This may include but is not limited to the use of spill control pillows or sorbent booms.
 - 5.13.2.2 During pumping operations, sorbent material will be spread throughout the work area in adequate amounts to absorb a multi-gallon spill.
 - 5.13.2.3 Trained personnel from the Contractor's spill prevention, control and countermeasure team shall be present during all fluid handling operations to direct all actions in the event of P.C.B. dielectric fluid spill or leak.
 - 5.13.2.4 Pumps shall be equipped with an automatic shutoff device that is activated by a fluid level sensing device, and a shutoff device controllable by the operator during the filling of the tank vehicle. In addition, quick shutoff valves shall be installed on the transformer tank valves prior to the draining of fluid.
 - 5.13.2.5 Hoses shall be pressure rated at a minimum of 20 psi, and shall be constructed of material compatible with the liquids to be pumped. Immediately prior to P.C.B. dielectric fluid pumping operations, the Contractor shall inspect and verify the integrity of all hoses, valves and connections.

- 5.13.2.6 The fluid removal equipment used shall be operated by properly trained personnel.
- 5.13.2.7 After the P.C.B. dielectric fluid removal operation has commenced, the work area shall not be left unattended until all P.C.B. fluids and any material used to clean up leaks or spills have been sealed in containers conforming to the requirements of 40 CFR 761.65, and all spilled P.C.B. liquid has been cleaned up.
- 5.14 Fluid Retention Curbs
 - 5.14.1 The Contractor shall restore any existing fluid curbs in the area if damaged during the removal operation.
- 5.15 Clean Up of Work Area
 - 5.15.1 After completion of P.C.B. transformer, draining and removal operations, all hoses, valves, drip pans, tools and equipment used shall be decontaminated in accordance with applicable EPA regulations and properly secured.
 - 5.15.2 All articles of protective clothing used during the work that have come in direct contact with P.C.B.s shall be sealed in containers conforming to the requirements of 40 CFR 761.65 and disposed of as P.C.B. wasters.
 - 5.15.3 All concrete (or other surfaces) which have come in contact with P.C.B.s or P.C.B. contaminated fluids in the course of the work shall be thoroughly decontaminated using a combination of sorbents, solvents, and cleansers such that P.C.B. concentrations are below levels of regulatory concern. Any sampling to verify the effectiveness of the clean up shall be the responsibility of the Contractor. Clean up operations will not be considered complete until P.C.B. concentrations are below levels established by State and Federal EPA.
- 5.16 Removal of P.C.B. Transformer Carcasses
 - 5.16.1 The Contractor shall be responsible for the removal of the P.C.B. transformer carcass. During removal operations, the Contractor shall be responsible for, but not limited to:
 - 5.16.1.1 All electrical, structural and mechanical disconnecting of the transformers.
 - 5.16.1.2 Evaluation of substrate and roadway loading strengths and similar critical features to assure they are adequate to sustain the loads that the Contractor will place upon them without damage.
 - 5.16.1.3 Evaluation of horizontal and vertical pathway dimensions to assure that movement can be accomplished successfully by the Contractor as planned.
 - 5.16.1.4 All rigging and crane operations as necessary to remove the transformers from the site.
 - 5.16.1.5 Modifying existing structures as required to remove the transformers.
 - 5.16.1.6 Restoring to its condition before construction of any ducts, piping or equipment and electrical raceways or equipment which must be disassembled, moved or altered in any way in order to remove the transformer. The Contractor shall assume responsibility for any resulting damages arising from such alterations.
 - 5.16.1.7 Undertaking measures as necessary to prevent contamination of the equipment or other areas during the removal operations.

5.17 Containerization and Marking

- 5.17.1 All liquids generated as a result of work activities and clean up operations associated with the P.C.B. transformers shall be placed in new EPA/DOT specified containers.
- 5.17.2 All solids such as sorbents, rags, disposable protective clothing, and other incidentals shall be placed in new EPA/DOT specified containers.
- 5.17.3 All drums and article containers, where used, shall be properly sealed, marked, labeled and dated as required by Federal EPA/DOT regulations. The "Caution-Contains P.C.B.s" labels shall be prominently positioned such that they are readily visible.

5.18 Transportation of P.C.B. Wastes/Carcasses to Disposal Facility

- 5.18.1 All drums, containers, and transformer carcasses shall be transported to an EPA approved and permitted disposal facility. No P.C.B. item, with the exception of properly decontaminated tools and equipment used in the course of work activities, shall be transported elsewhere.
- 5.18.2 The Contractor shall prepare a detailed manifest of each load to be transported. Information to be listed on the manifest shall include a precise description and quantities of P.C.B. items being transported, a description of the contents of any P.C.B. containers, the date loaded on the transport vehicle, the date transported and the precise destination of the load.
- 5.18.3 All transport vehicles, vacuum tankers (if used), and carcass transport vehicles shall arrive at the Owner's facility empty. No batching of P.C.B. liquids, P.C.B. containers and other P.C.B. items generated by the work with P.C.B.s from sources outside of the Owner's facility shall be allowed either before or after loading at the site. Vacuum tankers (if used) are to take P.C.B. fluid directly from the facility to an EPA licensed incinerator for disposal. Co-mingling of P.C.B. fluid at either a decommissioning site or any other P.C.B. source is forbidden.
- 5.18.4 Carcass disposal vehicle(s) are to take carcass and P.C.B. debris drums directly to an EPA approved decommissioning site for decommissioning. Co-Mingling of P.C.B. transformer carcasses with other P.C.B. sources is forbidden.
- 5.18.5 The Owner and/or its agents reserves the right to inspect all vacuum tankers and disposal vehicles at the moment they arrive on site to ensure that they are empty.
- 5.18.6 The Owner and/or its agents reserves the right to follow both vacuum tankers and disposal vehicles to incinerators and decommissioning locations to ensure compliance of contract.
- 5.18.7 The Owner and/or its agents reserves the right to witness fluid incineration and carcass decommissioning. Contractor is to provide fourteen (14) days notice as to date of:
 - 5.18.7.1 Fluid Incineration
 - 5.18.7.2 Carcass Decommissioning
 - 5.18.7.3 Contractor will be responsible for providing access into these facilities for the Owner, Engineer and/or its agents to witness these events. The Contractor is not responsible for any maintenance and conveyance for the Owner, Engineer and/or their agents.
 - 5.18.7.4 Vehicles used for transportation shall be marked in accordance with 40 CFR 761.20 and 49 CFR 172, and must be licensed for the transportation of hazardous wastes. The Contractor or

Subcontractor responsible for the transportation of P.C.B.s shall be licensed for the transportation of hazardous wastes, and the operator of the transportation vehicle shall be trained in all the laws, regulations and procedures governing P.C.B.s.

- 5.18.7.5 The carcass transport vehicle shall be provided with secondary containment of sufficient size to hold 1-1/4 times the volume of the largest P.C.B. container or P.C.B. item or 25% of the total residual fluid volume of all P.C.B. containers or P.C.B. items to be loaded on to the vehicle, whichever is greater. The containment system shall be of sufficient depth to prevent any spillover of P.C.B. fluids, and the Contractor shall inspect integrity of the system prior to loading.
- 5.18.7.6 All P.C.B. containers, P.C.B. items and P.C.B. transformer carcass shall be secured to the transport vehicle to prevent movement. In addition, P.C.B. transformer carcass, valves, bushings and fittings shall be diapered with an impervious absorbent material.
- 5.18.7.7 Transport vehicles containing secured P.C.B. transformer carcasses may not remain on site for longer than required to secure load.

5.19 Disposal

- 5.19.1 The Contractor shall provide labor, materials, equipment and services necessary for the disposal of all P.C.B. fluids, P.C.B. contaminated equipment and supplies, and transformer carcasses removed and generated as part of this specification.
- 5.19.2 All disposal operations shall be in compliance with all applicable Federal, State, and local regulations and conform to 40 CFR 761 Subpart D.
- 5.19.3 Contaminated electrical equipment shall be disposed of at an EPA permitted disposal facility which is licensed to incinerate P.C.B.s. Incinerator location is to be listed as an attachment to the bid form.
- 5.19.4 P.C.B.s and P.C.B. contaminated solids shall be incinerated in an EPA permitted incinerator. P.C.B. transformer carcass shall be destroyed by an EPA permitted alternate disposal method using wash/solvent technology to decontaminate disassembled P.C.B. Transformer parts for eventual disposal by smelting of metallic components and incineration of combustibles. P.C.B. contaminated flush liquids shall be incinerated in an EPA permitted incinerator or shall be processed by an EPA permitted alternate method of destroying P.C.B.s.
- 5.19.5 The Contractor shall certify that the facility to which waste will be delivered is licensed and permitted in accordance with all applicable Federal, State, and local laws, regulations and ordinances to receive such waste. The Contractor shall obtain the consent of the Owner or its agent prior to the use of any treatment, storage or disposal facility.
- 5.19.6 The approval requirements for operators of incinerators and decontamination processes are in 40 CFR 761.

5.20 Documentation of Disposal Operations

- 5.20.1 Upon completion of all P.C.B. work related activities, the Contractor shall provide a complete record of such activities. At a minimum, the following information must be included in the documentation provided:
 - 5.20.1.1 Name and location of the firm involved in the removal of P.C.B. fluid from the transformers.
 - 5.20.1.2 Name and location of the firm responsible for handling and/or rigging of the transformers.

- 5.20.1.3 Name and location of the firm responsible for the transportation of P.C.B. fluids and solids.
- 5.20.1.4 Name, telephone number and location of the firm responsible for servicing of transformers and/or other P.C.B. containers if applicable.
- 5.20.1.5 Name and location of the firm(s) responsible for ultimate final disposal of transformer carcass, drums of fluid and other materials.
- 5.20.1.6 Transformer data such as weight, manufacturer, serial number, date removed from service and date transported to disposal facility.
- 5.20.1.7 Drum size, type, weight, contents and date transported to servicing and/or disposal facility.
- 5.20.1.8 Written certification that the items being disposed of were delivered to and accepted by the disposal facility. The certificate shall be signed by the person authorized by the disposal facility to accept P.C.B. items for disposal.
- 5.20.1.9 Written certification by the Contractor that all disposal operations were done in full compliance with applicable Federal, State, County and Local regulations in existence at the time.
- 5.20.1.10 Copies of all documents, shipping papers and manifests associated with disposal operations shall be provided by the Contractor.
- 5.21 Completion
 - 5.21.1 All work at the facility(ies) covered under this Contract is to be completed within the specified time in calendar days.
 - 5.21.2 Contractor has six months from the time transformers are removed from site to provide the Owner and Engineer with Certificates of Destruction of P.C.B. items stated on manifest. Contractor is advised that final payment on project will not be made until Certificates of Destruction of P.C.B. items are provided.

END OF SECTION.

DIVISION 26 - ELECTRICAL

SECTION 260519 - CONDUCTORS, IDENTIFICATION, SPLICING DEVICES & CONNECTORS

PART 1 – GENERAL:

- 1.1 This section of the Specifications covers all of the electrical power, lighting, and control power (line voltage) conductors, but does not include communications, data or signal system conductors, which are specified separately in these specifications.
- 1.2 All conduits installed without conductors shall have a 200 lb. test nylon string installed for future use, tied off securely at each end.
- 1.3 **No more than 40% conduit fill is permitted for any conduit system, including video, intercom, data, power or other signal circuits unless specifically indicated otherwise on the plans.**
- 1.4 No more than seven conductors (six current-carrying and one ground) shall be installed in conduit except for switch legs and travelers in multi-point switching arrangements.
- 1.5 Multi-wire branch circuits, as in an Edison circuit, shall not be permitted. Pull separate neutrals for each phase. Conductors shall be derated per N.E.C.
- 1.6 If more than three phases are installed in a single raceway, an additional equipment grounding conductor shall be installed as indicated by the number of phase conductors.

PART 2 – MATERIALS:

2.1 CONDUCTORS

- 2.1.1 All conductors shall be 98% conductive annealed copper unless otherwise noted, UL listed and labeled.
- 2.1.2 Lighting and receptacle branch circuits shall be not less than No. 12 copper wire or of the sizes shown on the drawings with Type THW, THHN or THWN insulation. All feeder circuits shall be Type THW or THWN of the size as shown on the Contract Drawings. THHN wiring shall only be installed in overhead, dry or damp locations. THWN or THW wiring shall be used for all circuits pulled in underground or other wet locations.
- 2.1.3 Conductors No. 10 and smaller sizes of wire shall be solid. Conductors No. 8 and larger sizes shall be stranded.

Designer Note: Remove sentence requiring plenum fire alarm cable if installed in conduit.
- 2.1.4 Conductors for fire alarm wiring shall be stranded and in full compliance with N.E.C. 760. Exposed cabling in air plenums shall be rated for plenum installation.
- 2.1.5 All wire on the project shall be new, in good condition, and shall be delivered in standard coils or reels.
- 2.1.6 The color of the wire shall be selected to conform with Section 210-5 of the latest edition of the National Electrical Code. Refer also to Electrical Specification Section CONDUCTORS, IDENTIFICATIONS, SPLICING DEVICES & CONNECTORS PART 4, Color Coding.

- 2.1.7 All equipment grounding conductors shall have green color insulation or if larger than #8, shall be taped for two inches, green color at every termination and pullbox access point.
- 2.1.8 Conductors used for motor connections and connections to vibrating or oscillating equipment shall be extra flexible.
- 2.1.9 Conductors for main ground from neutral bus, equipment grounding bus, building steel, grounding grid and main cold water pipe connection shall be bare copper.
- 2.1.10 All conductors shall be identified by color code and by means of labels placed on conductors in all junction boxes and at each terminal point with Brady, Ideal, T & B or approved equivalent labels indicating source, circuit No. or terminal No.
- 2.1.11 Branch wiring and feeder conductors that are greater than 100' in length shall be increased at least one size to compensate for voltage drop. All circuits shall be installed and sized for a maximum 2% voltage drop.
- 2.1.12 No aluminum conductors shall be used. All new conductors shall be copper.

Designer Note: Choose one of the following three options (*) for MC cable:

Designer Note: Keep 2.1.13 for projects where MC cable is not desired.

- 2.1.13 (*)MC cable shall not be permitted.

Designer Note: Keep 2.1.14 for non-HCA projects where MC cable is desired.

- 2.1.14 (*)MC cable may be used for normal power branch circuits, #10 and smaller, where concealed in walls, above ceilings, etc. MC cable shall not be used for emergency power circuits, any feeders, any exposed locations, or any wiring larger than #10. Supports shall be per NEC and all runs shall be parallel or perpendicular to building lines with right angle turns. Cables shall be bundled where run in groups using listed supports. Do not route through structure or on work of other trades. Provide independent supports directly from structure. All MC cable which serves patient care areas shall be type HCF, rated for healthcare use and shall have insulated ground wire and grounded sheath. HCF cable shall be NEMA WC 70 compliant, UL 4 and 1479 listed, with green exterior sheath.

Designer Note: Keep 2.1.15 for all HCA projects ONLY.

- 2.1.15 (*)All MC cable shall be type HCF, rated for healthcare use and shall have insulated ground wire and grounded sheath. HCF cable shall be NEMA WC 70 compliant, UL 4 and 1479 listed, with green exterior sheath. Supports shall be per NEC and all runs shall be parallel or perpendicular to building lines with right angle turns. Cables shall be bundled where run in groups using listed supports. Do not route through structure or on work of other trades. Provide independent supports directly from structure.

- 2.1.15.1 MC cable is acceptable for the following applications:

- 2.1.15.1.1 Feeders for lighting fixture whips and for branch circuits concealed in walls and partitions only. Locate junction box and convert to single conductors in rigid raceway within the same room as where the cable enters/exits the wall.
- 2.1.15.1.2 Use only for single-circuit cable (i.e. two wire plus ground). For devices in the same wall connected to different circuits, install separate single circuit cable for each circuit.
- 2.1.15.1.3 The MC cable length for power circuits shall be limited to 30' from the junction box to the wiring device located in the wall. If the circuit continues outside the wall, the circuit must immediately transition to conduit.
- 2.1.15.1.4 The MC cable length for lighting circuits shall be limited to 30' from the junction box to the first fixture and from that point only those fixtures above the enclosed space/room shall be served by

this HCF circuit.

2.1.15.2 MC cable is not acceptable for the following applications:

- 2.1.15.2.1 Homeruns to Panelboards.
- 2.1.15.2.2 Branch circuits serving Essential Electrical System (Emergency & Standby) loads; including Life Safety branch, Critical branch and equipment emergency system.
- 2.1.15.2.3 Branch circuits serving HVAC, elevator/escalator, medical and kitchen equipment loads.
- 2.1.15.2.4 Within mechanical, electrical or telecommunication equipment rooms.
- 2.1.15.2.5 Exposed Branch Circuits within areas that do not have a ceiling (i.e. open to structure).
- 2.1.15.2.6 Wet locations.

2.2 SPLICING DEVICES & CONNECTORS

- 2.2.1 Splicing devices for use on No. 14 to No. 10 AWG conductors shall be pressure type such as T & B "STA-KON", Burndy, Reliable or approved equivalent.
- 2.2.2 Wire nuts shall be spring pressure type, insulation 600V, 105°C insulation, up to #8 size. Greater than #6 Cu shall be a compression type connection, 600V insulation, cold shrink tubing, taped to restore full insulation value of the wire being spliced.
- 2.2.3 Pressure crimp-applied ring type (or fork with upturned ends) terminations shall be employed on motor and equipment terminals where such terminals are provided on motor and equipment leads or on all stranded wire terminations using No. 10 AWG or smaller conductors.
- 2.2.4 Splices, where necessary, shall be made with hydraulically-set "Hy-press" or equivalent crimped connectors. All splices shall be insulated to the full value of the wiring insulation using a cold-shrink kit or the equivalent in built-up materials.
- 2.2.5 Large connectors (lugs) at terminals shall be mechanical type, hex-head socket or crimp-on style, installed per the manufacturer's recommendations.
- 2.2.6 Underground connections made between bare ground wires or to ground rods shall be exothermically welded, "Cadweld" or equivalent. Utilize electronic ignition for exothermic welding.
- 2.2.7 The use of split-bolt clamps will be permitted in wireways at service entrance only. Torque to 55 foot-pounds or as recommended by manufacturer.

PART 3 – INSTALLATION:

- 3.1 The pulling of all wires and cable on this project shall be performed in strict compliance with applicable sections of the National Electrical Code. No conductor entering or leaving a cabinet or box shall be deflected in such a manner as to cause excess pressure on the conductor insulation. Conductors shall only be installed after insulating bushings are in place.
- 3.2 The radius of bending of conductors shall be not less than eighteen times the outside diameter of the conductor insulation or more, if recommended by the manufacturer.
- 3.3 Conductors installed within environmental air plenums shall be per N.E.C. Article 800 and other applicable codes, with FEP-type insulation or an approved equivalent.
- 3.4 Systems and controls conductors that are installed exposed shall not be routed across ceilings or ductwork. They shall be held up against building structure or against permanent support members. They shall be installed in such a manner that they do not interfere with the access to or operation of

equipment or removal of ceiling tiles. Nylon tie-wraps shall be installed in such a manner so as to bundle conductors neatly, allowing runouts of single conductors or groups to drop down to equipment served. Install grommeting where dropping out of trays or into panels or service columns. Install sleeves with bushings where penetrating partitions. Firestop sleeves with approved material. Do not penetrate firewalls if so indicated on plans. Provide j-hooks, 2" minimum, on 5' centers for cable support. Refer to the drawings for support requirements and details on routing exposed systems and communications conductors.

- 3.5 Conductors for isolated power systems shall be installed in as short a run of conduit as practicable. No pulling soap shall be used on conductors in isolated power systems.
- 3.6 Where conductors are installed in industrial facilities, they shall be per J.I.C. standards.
- 3.7 Maximum permissible pulling tensions, as recommended by the manufacturer for any given type of cable or wire installed shall not be exceeded. Utilize special remote readout equipment as required to ensure compliance. Use particular caution when installing twisted pair data cable or fiber optic cables – forces permitted for pulling in are typically very low for these cable types.
- 3.8 All conductors of parallel runs for a single feeder shall be of the same total length for each phase, neutral, ground, and equipment grounding conductor.
- 3.9 The Contractor shall test all wiring and connections for continuity and grounds before equipment and fixtures are connected, and when indicated or required, demonstrate by Megger Test the insulation resistance of any circuit or group of circuits. Where such tests indicate the possibility of faulty insulation, locate the point of such fault, pull out the defective conductor, replacing same with new and demonstrate by further test the elimination of such defect.

PART 4 - COLOR CODING DISTRIBUTION VOLTAGE CONDUCTORS, 600 VOLT OR LESS:

- 4.1 Conductors to be color coded as follows:
 - 4.1.1 120/208 Volt Conductors
 - Phase A - Black
 - Phase B - Red
 - Phase C - Blue
 - Neutral – White
 - 4.1.2 277/480 Volt Conductors
 - Phase A - Brown
 - Phase B - Orange
 - Phase C - Yellow
 - Neutral - Gray, or white with brown tracer
 - 4.1.3 Isolated Power Conductors (Type XLP or XHHN)
 - Phase A - Brown
 - Phase B - Orange
 - Phase C - Yellow
 - Neutral - White with brown tracer stripe
 - Note: Provide each phase with tracer color other than white, green, or gray.
 - 4.1.4 Note: Further identify isolated power conductors with ½" wide purple tape at all terminations and junctions.

- 4.1.5 Signal voltage wiring color coding shall be consistent throughout the project and shall match existing equipment and standards where applicable. Color coding for each system shall be unique.
- 4.1.6 Conductors within enclosures that may be energized when enclosure disconnect is off - yellow, or taped with ½" yellow tape every 6" of length, inside enclosure. Provide lamacoid plate warning sign on front of enclosure where this condition occurs.
- 4.1.7 D.C. Wiring - Positive - Light Blue
Negative - Dark Blue
- 4.1.8 Fire alarm wiring shall be red.

PART 5 - HIGH VOLTAGE PRIMARY CABLE:

- 5.1 High voltage primary cable shall be rated for use in aerial, direct burial, cable trays, conduit, and underground duct installations.
- 5.2 The conductor shall be annealed, compressed copper with class B stranding.
- 5.3 The conductor shield shall be compatible with and firmly bonded to the insulation and shall strip freely from the conductor.
- 5.4 The insulation shall be a homogeneous wall of No Lead natural color ethylene propylene rubber. The nominal thickness shall be 220 mils for 15kv cable 133% insulation level.
- 5.5 The insulation shield shall be extruded over the insulation and shall be clean stripping and removable from the insulation with an applied tension not less than 3 pounds and not greater than 24 pounds.
- 5.6 The extruded shield shall be covered with a 5 mil bare copper tape. It shall be helically applied with a 25% nominal overlap.
- 5.7 The overall jacket shall be PVC, flame retardant, sunlight resistant, low COF of .20 that can be installed without lubrication.
- 5.8 Cable shall have a 40 year warranty upon acceptance of pull calculations and field testing.
- 5.9 The manufacturer shall perform cable pull calculations including values for: max SWP side wall pressure, pull tension, COF 0.2 with lubrication, jam probability, location of pull box if requested, and location of splice if needed. Field Engineer must be on site for a minimum of one working day.
- 5.10 A very Low Frequency Test shall be performed per IEEE 400.2 at a sinusoidal withstand test voltage of 21kv rms for 60 minutes and pass. The Tan Delta values shall be recorded every minute and must be below 9.0×10^{-3} . A field engineer must be on site for a minimum of one working day.
- 5.11 **Industry Standards and references**
ICEA SS-93-639/NEMA WC 74 for 5-46KV Shielded Cables
UL1072 for Type MV 105
IEEE 1202- Flame test (70,000) BTU/ hr Vertical Tray Test
UL1685 (1/0 and larger)-UL Flame Exposure Test.
- 5.12 Approved manufacturers are Southwire, Okonite, Kerite or approved equal.
- 5.13 Cable shall be terminated at pad-mount transformer or as indicated with pre-manufactured load-break, dead-front elbows and fittings compatible with cable and rated for the purpose. Pre-

manufactured elbows and other types of fittings indicated shall be as manufactured by Elastimold Co., Blackburn-ITT, R.T.E. Corporation, S & C Company or other approved equivalent.

- 5.14 Cable terminators for 15 K.V., 200 ampere connection shall be ANSI Standard 386-1877 200 amp hot-stick operable load break elbow with voltage test point. The elbow shall be furnished with the necessary cable adapter for terminating the copper cable used.
- 5.15 Electrical ratings shall be as follows:
 - 5.15.1 Voltage: 15 KV class
 - 5.15.2 Continuous and Load Break Current: 200 amps, rms
 - 5.15.3 BIL: 95 KV
 - 5.15.4 Withstand Voltage (AC): 34 KV, 60 HZ, 1 minute
 - 5.15.5 Short-Time Current: 10,000 amps, rms, sym., .17 seconds.
- 5.16 Cable terminators for 15 K.V., 600 ampere connection shall be ANSI Standard 368-1977 premolded dead break unit for terminating 15 KV shielded cable. The connector shall be fully shielded, of dead front operation and shall be fully submersible. The connector shall be furnished with proper adapters for terminating the copper cable used.
- 5.17 The connectors shall have the following ratings:
 - 5.17.1 Voltage: 15 KV Class
 - 5.17.2 Continuous Current: 600 amps, rms
 - 5.17.3 BIL: 95 KV
 - 5.17.4 8 Hour Overload: 900 amps, rms
 - 5.17.5 Withstand Voltage (AC): 35 KV, 60 Hz, 1 minute
 - 5.17.6 Momentary: 25,000 amps, rms, sym, .17 seconds.
- 5.18 Cable shall be color coded at all terminations and junctions as follows:
 - 5.18.1 Phase A - Black
 - Phase B - Red
 - Phase C – Blue
- 5.19 Follow the above color coding unless otherwise indicated or required by system user.
- 5.20 Cable grounding at all terminations shall be in accordance with the manufacturer's recommendations and applicable codes.
- 5.21 A full size (matching phase conductors) copper 600 volt insulated ground is to be provided with each primary circuit.
- 5.22 Installation, termination and testing of primary power cables shall be accomplished by Journeymen Electricians with at least three years experience with such work.

- 5.23 In lieu of using pre-manufactured elbows and other fittings, installer may substitute field-build and taped stress cones or other type of termination, subject to written prior approval of the engineer. In requesting such approval, submit complete data on materials proposed to be used and tools to be used in cutting and stripping cable.
- 5.24 All new primary cable shall be high-potential tested in accordance with criteria outlined herein. Where taps, splices or terminations to existing primary cables are indicated on the plans, the Engineer reserves the right to request high-potential testing of the existing cable or systems to determine their suitability and safety, if not so indicated on the plans.
- 5.25 Always field verify exact primary power voltage potentials with the supplying utility and report any discrepancy from that indicated on the plans to the Engineer prior to placing any primary cable in service.

PART 6 - TESTING OF PRIMARY CABLE:

- 6.1 All new primary cable shall be tested prior to energization in accordance with the following criteria, or other approved method.
 - 6.1.1 Use equipment made by one of the following (or approved equivalent) and abide by their operation rules for their respective equipment:
 - 6.1.1.1 Associated Research, Inc
 - 6.1.1.2 J.G. Biddle Company
 - 6.1.1.3 Hipotronics, Inc.
 - 6.1.1.4 Von Corporation
 - 6.1.2 Clear cable of all equipment, switchgear, etc. for elbows, install insulation plugs. On cable end, insulate by high voltage taping, insulating jar or plastic. All terminations and splices shall be completely and properly grounded. All adjacent equipment shall be grounded, where danger of flashover exists.
 - 6.1.3 A sphere gap in parallel with the 100,000 volt D.C. "Hipot" tester shall be calibrated for sparkover at 70 KV D.C.
 - 6.1.4 The direct current test voltage shall be applied in increments of 5 KV and shall be left at the step for 1 minute. Saturate cable for 15 minutes at test voltage as in (5) below.
 - 6.1.5 Test: (as appropriate)
 - 6.1.5.1 15 KV cables with open terminations at 55 KV D.C.
 - 6.1.5.2 15 KV cables with elbow termination at 45 KV D.C., or to the limit of the elbow or splice. Verify with manufacturer.
 - 6.1.5.3 SPECIAL NOTE: It is suggested that tests be performed when relative humidity is 50 to 60% or less in clear, dry weather for greater safety.
 - 6.1.6 Record the leakage current at each step and at end of saturation time.

- 6.1.7 Acceptance: The above procedure with less than 100 microamperes of current registered.
- 6.1.8 Proof test on existing cable at 35 KV for 5a and 35 KV for 5.2 above.
- 6.1.9 After test (in order listed):
 - 6.1.9.1 Turn tester power off.
 - 6.1.9.2 Discharge tester and cable thru a resistive discharge device (8 MEGOHM discharge stick).
 - 6.1.9.3 Ground cable thru a grounding means (#12 AWG THW wire to ground).
 - 6.1.9.4 Disconnect tester.
- 6.1.10 For Safety:
 - 6.1.10.1 Wear high voltage gloves at all times.
 - 6.1.10.2 Treat cable and tester as high voltage at all times.
 - 6.1.10.3 Remember, D.C. static charges can be very harmful.
- 6.1.11 All tests must be made in the presence of the Engineer and shall be recorded on a form sheet signed by the person performing the test and dated. Three (3) copies shall be submitted to the Engineer. Provide 48 hour advance written notice to Engineer.

END OF SECTION.

DIVISION 26 - ELECTRICAL

SECTION 260526 - GROUNDING

PART 1 – GENERAL:

- 1.1 All metallic conduit, raceways, cable trays, wireways, supports, cabinets and equipment shall be grounded in accordance with the latest issue of the National Electrical Code, as shown on the Contract Drawings and in accordance with the requirements of the local authority having jurisdiction, as applicable.
- 1.2 The size of the equipment grounding conductors, grounding electrode conductors and service grounding conductors shall be not less than that given in Article No. 250 of the National Electrical Code, and/or as shown on the Contract Drawings. Where ungrounded conductor sizes are increased to minimize voltage drop, grounded conductor sizes shall be increased in the proper proportion.
- 1.3 Grounding bus and non-current carrying metallic parts of all equipment and raceway systems shall be securely grounded by connection to common ground.
- 1.4 The service entrance main ground bus shall also be connected to the main cold metallic water pipe within three feet of where it enters the building, on both the house and street sides of the main shut-off valve with a properly sized bonding jumper. A properly sized bonding jumper shall also be provided to the frame of any steel structure and steel reinforcing bars in structural concrete systems utilized in the construction. Where steel reinforcing bars are not present in concrete systems, provide minimum 20 feet of #4 bare copper conductor bonded to service ground. The steel frame of the building (if any) shall be made electrically continuous.

PART 2 – MATERIALS:

- 2.1 Ground wires and cables shall be of the AWG sizes shown on the Contract Drawings or shall be sized in accordance with the prevailing codes. All ground wires and cables shall be copper.
- 2.2 All grounding fittings shall be heavy cast bronze or copper of the mechanical type except for underground installations or interconnection of grounding grid to cable, columns and ground electrodes, which shall be thermally welded type as manufactured by Cadweld, Burndy Co., Therm-O-Weld, or approved equivalent.
- 2.3 Other bonding clamps or fittings in above ground locations shall be as manufactured by O.A. Co., T & B, Burndy, or approved equivalent.
- 2.4 Ground rod electrodes shall be 5/8" minimum diameter, ten feet long, molecularly bonded copper to high-strength steel core, copper thickness per UL/ANSI – Erico or equal. All ground electrode systems shall be installed in accordance with manufacturer's recommendations, UL listings, ANSI standards, National Electrical and National Electrical Safety Codes.

PART 3 – INSTALLATION:

- 3.1 All grounding conductors shall be protected from mechanical injury and shall be rigidly supported. Where ground conductors are run through flexible conduit and through panelboard switchboard or motor control center feeders, they shall be securely bonded to such conduit thru the use of grounding bushings at the entrance and exit. All connection of equipment shall be made with an approved type of solderless connection and same shall be bolted or clamped to equipment or conduit.

- 3.2 Equipment grounding conductors shall be run to lighting fixtures, switches, devices, receptacles, electric heaters, furnace and other equipment. Equipment grounding conductors not exceeding No. 8 AWG in size shall be green colored Type "THWN". Those larger than No. 6 shall be green (same color everywhere) taped 4" at each termination, pull and junction boxes.
- 3.3 Equipment ground connections to GFI circuit breakers shall be carried and bonded to each outlet on the circuit. Provide a separate equipment grounding conductor with green color insulation.
- 3.4 Resistance to the grounding at the service entrance equipment shall be in accordance with the N.E.C. for style of construction and shall not exceed ten ohms as measured by the described testing method.
- 3.5 All circuits shall have a separate grounding conductor, except as otherwise noted.
- 3.6 When grounding systems are completely installed and all grading in the area of the service grounding electrode has been completed up to finish elevations, perform a fall-of potential or other approved test to determine actual system resistance to earth. Report results to the Engineer in writing. Refer to testing provisions in this section of specifications.
- 3.7 Where separately-derived systems are utilized as part of the power distribution network, the neutral leg of the secondary side of generators, transformers, etc., shall be connected to a grounding electrode in accordance with the manufacturer's recommendations.
- 3.8 The Contractor shall ensure that the ground return path thru building structural steel or other means is electrically continuous back to the service grounding electrode and is of adequate capacity and impedance to carry the maximum expected fault or other current. Where no electrically continuous steel building frame is available, the Contractor shall provide a properly sized ground bar and ground conductor routed back to the main facility ground bus.
- 3.9 Where a building's steel frame is made electrically discontinuous by masonry breaks (as at firewalls, etc.), the Contractor shall provide an accessible thermally welded bonding jumper of #500MCM copper to bond the building steel frame sections together, making the entire steel frame electrically continuous. The installation of these bonding jumpers shall be reviewed by the Engineer prior to their being covered by construction.
- 3.10 Where lightning protection systems are utilized on the work, their electrodes and conductors shall be electrically segregated from the building service ground, except where connections to structural elements are required for the proper installation of these systems. Lightning protection grounds shall only be utilized for lightning grounding applications, in accordance with U.L. and manufacturer's recommendations.
- 3.11 Grounding connections shall **never** be made to natural gas, flammable gas or liquid fuel piping, except where specifically indicated on the plans.
- 3.12 Where dielectric fittings are utilized in piping systems, the piping system shall **not** be utilized as a ground path. Bonding jumpers shall not be utilized to bridge over such fittings. Piping systems shall **not** be utilized as ground paths except where specifically required by codes in the case of water piping.
- 3.13 Perform ground testing, log results, and provide reports of test points, test values, and procedure as required by engineer and/or local authority having jurisdiction. All systems shall be grounded to maintain leakage current below levels required by applicable codes and standards.
- 3.14 **At all metallic outlet boxes, bond the equipment grounding conductor to the box.**

PART 4 – CHEMICAL SERVICE GROUNDING ELECTRODE SYSTEM:

- 4.1 The ground electrode system shall be as specified herein. The system shall not require maintenance throughout the expected life span of the materials.
- 4.2 Ground system shall be an electrolytic rod type, as manufactured by Erico, Lyncole XIT Grounding, Superior Grounding Systems, L.E.C., Inc. (Chem-Rod), or approved equivalent. Electrode(s) shall be placed as shown on the plans, installed exactly per manufacturer's recommendations. Electrodes shall be installed vertically, 12 feet of overall length (or length as indicated), set in a augered hole and backfilled per manufacturer's instructions with a special clay slurry surrounding the rod. Provide a concrete protection box with cast iron grate for the top of the rod termination. After making necessary connections, backfill with Ground Enhancement Material (GEM) in accordance with manufacturer's recommendations. Ground system shall be per the following:
- 4.2.1 Manufacturer: Lyncole XIT Grounding (or approved equivalent).
- 4.2.2 Source: Lyncole XIT Grounding, 22412 S. Normandie Ave., Torrance, CA 90502 1-800-962-2610
- 4.2.3 Shaft Configuration: Straight.
- 4.2.4 Shaft Length: 12 feet (or as otherwise indicated).
- 4.2.5 Listings: U.L.-467J, ANSI 633.8.
- 4.2.6 Material: Type K Copper.
- 4.2.7 Construction: Hollow tube, 2.125" O.D., chemical filled with non-hazardous metallic salts.
- 4.2.8 Weight 3.5 lbs. per foot of length, nominal.
- 4.2.9 Ground Wire Termination: Exothermic ("Cadweld" by Contractor) connection to 4/0 conductor, with U-bolt with pressure plate provided as test point. Utilize electronic ignition for exothermic welding.
- 4.2.10 Average Life Expectancy: 25 Years.
- 4.2.11 Model Number: K2-(length)CS.
- 4.3 Installation of Chemical Ground System:
- 4.3.1 Pipe ground systems shall be installed exactly as required by the system manufacturer. The Contractor shall be diligent to observe the excavation, sealing tape removal, GEM backfill and all other critical requirements.
- 4.3.2 Auger Diameter: 6"
- 4.3.3 Ground Enhancement Material (GEM): GEM25A, Erico (or equal). Never use sand or ordinary earth as a backfill material.
- 4.3.4 Provide grounding system with protective box. Box to be concrete with cast iron, tamper-resistant lid.
- 4.3.5 Pipe grounding system shall be warranted unconditionally by the Contractor for a period of one year from the date of substantial completion.

PART 5 – COPPER-BOUNDED ROD SERVICE GROUNDING ELECTRODE SYSTEM:

- 5.1 The ground electrode system shall be as specified herein. The system shall not require maintenance throughout the expected life span of the materials.
- 5.2 Ground system shall be rod type with Ground Enhancement Material (GEM) backfill. Provide test well around top of one rod for system impedance testing. Auger hole to 6" shorter than ground rod length, drive ground rod 1ft into bottom of hole. After making necessary connections, fill with GEM in accordance with manufacturer's recommendations. Ground system shall be per the following:
 - 5.2.1 Ground rods shall be 3/4" minimum diameter, copper clad steel, 13 mil copper coating. Erico (or approved equivalent).
 - 5.2.2 Shaft Configuration: Straight.
 - 5.2.3 Shaft Length: 10 feet (or as otherwise indicated).
 - 5.2.4 Auger Diameter: 6"
 - 5.2.5 Ground Enhancement Material: GEM25A, Erico (or equal). Never use sand or ordinary earth as a backfill material.
 - 5.2.6 Ground Wire Termination: Exothermic ("Cadweld" by Contractor) connection to 4/0 conductor, with U-bolt with pressure plate provided as test point. Utilize electronic ignition for exothermic welding.

PART 6 – SERVICE GROUND TESTING:

- 6.1 The actual resistance to earth of the service grounding electrode shall be measured by the Contractor via the fall-of-potential method. This testing shall be accomplished after the grounding electrode has been completely installed and the finished grade is achieved.
- 6.2 The results of the testing shall be summarized in a written report by the Contractor, which shall be forwarded to the Engineer for review. The report shall also be included with the operation and maintenance manuals for the Owner's information and future reference. This report is to also contain a detailed description and illustrations of the testing procedure, along with the name and model number of the testing instrument(s).
- 6.3 For the actual testing, the Contractor shall follow the procedures outlined below. A self-contained instrument such as a "Megger" or "Ground OHMMETER" shall be used that is designed to eliminate the influence of stray current effects on the accuracy of the measurements.
 - 6.3.1 Connect one side of the instrument to the grounding electrode conductor where it connects to the facility main ground bus (point C1). Disconnect and isolate the grounding electrode conductor for the test.
 - 6.3.2 Drive a copperweld reference electrode probe (point C2) into earth between 300 and 500 feet away from C1 and connect to measurement instrument.
 - 6.3.3 Drive the movable grounding probe (C3) into earth at ten equally spaced intervals, in a straight line between C1 and C2 points and note the $E/I=R$ resistance readings on a graph at each point.
 - 6.3.4 The resistance measurements in OHMS taken from the flat part of the curve shall be averaged to determine the true grounding electrode resistance to earth.

- 6.3.5 At completion of testing, remove reference electrode C2 and all temporary wiring and connections.
- 6.4 If actual measurements of grounding electrode indicate a resistance greater than five OHMS, contact the Engineer for instructions. If deemed necessary by the Engineer, additional electrodes shall be placed and the measurement process repeated until the desired ground potential achieved.
- 6.5 Record results for each step in the testing process and include a full report in close-out documentation.

PART 7 – PATIENT-CARE VICINITY GROUND TESTING:

- 7.1 Test ground leakage current at all fixed conductive equipment and surfaces in patient care areas as required per NEC and local/state mandates.
- 7.2 Record results for all testing and include a full report in close-out documentation.

END OF SECTION.

DIVISION 26 - ELECTRICAL

SECTION 260533 - RACEWAYS & FITTINGS

PART 1 – GENERAL:

- 1.1 This section is intended to specify the raceways, conduit, conduit fittings, hangers, junction boxes, splice boxes, specialties and related items necessary to complete the work as shown on the drawings and specified herein.
- 1.2 This section specifies basic materials and methods and is a part of each Electrical Section that implies or refers to electrical raceways specified therein.
- 1.3 The types of raceways specified in this section include the following:
 - 1.3.1 Steel electrical metallic tubing. (E.M.T.)
 - 1.3.2 Rigid galvanized steel conduit. (G.R.S.)
 - 1.3.3 Intermediate metal conduit (I.M.C.).
 - 1.3.4 Rigid aluminum conduit.
 - 1.3.5 Flexible metal conduit (aluminum or steel)
 - 1.3.6 Liquid - tight flexible metal conduit.
 - 1.3.7 Rigid nonmetallic conduit.
 - 1.3.8 Surface metal raceways.
 - 1.3.9 Wireways, wall ducts and trench ducts.
 - 1.3.10 Cable tray or cable trough.
 - 1.3.11 Duct banks, and their construction.
- 1.4 All raceways, as listed in 1.3 above and otherwise specified herein shall be provided in compliance with latest editions of all applicable U.L., NEMA, N.E.C. and A.N.S.I. standards. All conduit, raceways and fittings shall be Underwriters Laboratories listed and labeled, or bear the listing of an agency acceptable to the local authority having jurisdiction.
- 1.5 Conduit and raceways, as well as supporting inserts in contact with or enclosed in concrete shall comply with the latest edition of all A.C.I. standards and the equipment manufacturer's recommendations for such work.
- 1.6 P.V.C. or other non-metallic conduit shall be rated for the maximum operating temperature that could be developed by the conductors it encloses, while in normal operation.
- 1.7 The decision of the Engineer shall be final and binding in any case where a question or inquiry arises regarding the suitability of a particular installation or application of raceways, supports or materials, if other than outlined herein.

Designer Note: Change minimum conduit size to 1/2" for HCA project.

- 1.8 Minimum size of conduit shall be 3/4" trade size, unless otherwise noted on the drawings. Switch legs may be 1/2 " trade size. All conduit and raceways shall be sized for the number of conductors contained, in accordance with the latest edition of the National Electrical Code or any other applicable standards.

Designer Note: Delete this for non-HCA project.

- 1.9 1/2" conduit may be used for no more that (5) #12 AWG or (3) #10 AWG wires. Light fixture whips may be 3/8" flexible metal conduit.
- 1.10 The installer of raceway systems shall avoid the use of dissimilar metals within raceway installations that would result in galvanic-action corrosion.
- 1.11 All empty conduit installed anywhere shall have pull-strings installed for future cabling installation. Coordinate with vendors and provide extra pull-strings as required to ensure that when cabling is pulled, conduit still pull-strings installed for future use.

Designer Note: Select one for your project.

- 1.12 (*Fire Alarm Cabling (conduit): All fire alarm conductors shall be installed within conduit and enclosed junction boxes. Provide a completely separate raceway system from power wiring or other raceway systems. All concealed conduit shall be manufactured red – no field painting will be accepted – and exposed conduit in finished spaces shall be painted to match adjacent finishes.

OR

- 1.13 (* Fire alarm Cabling (open): All wiring which is exposed, concealed in walls, concealed above inaccessible ceilings, or otherwise inaccessible shall be installed within conduit and enclosed junction boxes. Provide a completely separate conduit system from power wiring or other raceway systems. All concealed conduit shall be manufactured red – no field painting will be accepted – and exposed conduit in finished spaces shall be painted to match adjacent finishes. Concealed cabling above accessible ceilings shall be an open cabling system ran in dedicated 2" j-hooks. Run j-hooks above or below primary cabling paths used for other systems. Conduit stub-outs shall be run to these paths. Cabling shall be listed by the fire alarm system manufacturer for use with their system. Cabling shall be plenum-rated.

PART 2 – MATERIALS:

2.1 STEEL ELECTRICAL METALLIC TUBING

- 2.1.1 Electrical metallic tubing, (E.M.T.) of corrosion-resistant steel construction shall be permitted for concealed installation in dry interior locations. Electrical metallic tubing shall not be installed in concrete slabs or where exposed to physical damage. Electrical metallic tubing shall be permitted for exposed work where above 6' AFF/AFG and where not subjected to physical damage as determined by the Engineer.

2.2 RIGID GALVANIZED STEEL CONDUIT

- 2.2.1 Rigid galvanized steel conduit shall be used where subject to physical damage for exposed work in mechanical spaces, within factory or other industrial work areas, for exposed fit-up work on machinery, for exposed exterior damp or wet location work, in hazardous atmospheres, in exterior underground locations where installed beneath roadways, where ells occur in underground P.V.C.

conduits, or where turning out of concrete encased duct banks, and at other locations as specifically called out on the drawings.

2.2.2 Rigid galvanized steel conduit shall be used for all building interior power wiring for cables of over 600 Volts.

2.3 INTERMEDIATE METAL CONDUIT

2.3.1 Use for feeders, for interior locations where exposed below 6' AFF/AFG, for hazardous areas where allowed by code, and for wet interior locations.

2.4 RIGID ALUMINUM CONDUIT

2.4.1 Rigid aluminum conduit, shall be permitted for installation indoors in dry locations only. Under no conditions shall it be cast into concrete slabs or pass thru construction where prolonged contact will degrade the aluminum. All ells used in rigid aluminum conduit systems shall be rigid galvanized steel.

2.5 FLEXIBLE METAL CONDUIT

2.5.1 Flexible conduit may be used only where required for connection to light fixtures, motors and other equipment subject to vibration. It shall be constructed of steel. It shall be installed with clamp-on, insulated throat connectors designed for the purpose. All flexible metal conduit shall be installed as a single piece. No joints shall be installed. Flexible conduit shall not be used in wet or dusty locations or where exposed to oil, water or other damaging environments. An equipment grounding conductor or bonding jumper shall be used at all flexible conduit installations. Maximum length shall not exceed 6' for light fixture whips and 3' for other connections.

2.6 LIQUIDTIGHT FLEXIBLE METAL CONDUIT

2.6.1 Weatherproof flexible metal conduit shall be wound from a single strip of steel, neoprene covered, equivalent to "Liquatite" or "Sealtite" Type "UA". It shall be installed in such a manner that it will not tend to pull away from the connectors. Provide strain relief fittings equivalent to "Kellems" as required where subject to vibration. Flexible connections to motors in dusty areas shall be dust-tight, in areas exposed to the weather - weatherproof. Length shall not exceed 3' unless permitted by the Engineer.

2.7 RIGID NON-METALLIC CONDUIT

2.7.1 Rigid non metallic conduit shall be constructed of P.V.C, nominally schedule 40 weight, except where encased in concrete, where it may be "EB" type. If installation will enclose utility company provided conductors, verify exact type required. and install in accordance with their standards, where more stringent than this specification in normal building conditions.

2.7.2 Rigid non-metallic conduit may be used in exterior wet or damp locations where installed underslab or underground. It shall not be run in interior locations, except with special permission from the Engineer for use in corrosive environments, and then only if protected from physical damage. No rigid nonmetallic conduit may be installed in environmental air plenums or cast into above-grade concrete slabs. No rigid nonmetallic conduit may be installed in locations where the ambient temperature might exceed the rating of the raceway.

2.7.3 Where rigid non metallic conduit is placed underground, as for feeder circuits, secondaries or branch circuit runs and where ell is made upward thru a slab on grade, transition the turning ell and the riser to rigid steel conduit to a height of 6" above the concrete slab. Transition may then be made to E.M.T or other approved conduit for remainder of run.

- 2.7.4 Flexible nonmetallic conduit shall not be used, except by special permission, obtained in writing from the Engineer.
- 2.7.5 Provide equipment grounding conductors of copper, sized as required by codes, in all circuits installed in rigid nonmetallic raceways.
- 2.8 SURFACE METAL RACEWAYS
- 2.8.1 Surface metal raceways shall be provided where indicated on drawings or where concealed raceways are not possible.
- 2.8.2 Surface metal raceways shall be constructed of code gauge corrosion-resistant galvanized steel or aluminum extrusions, and finished in an ivory, buff or grey color as selected by the Architect. Finishes shall be suitable for field painting, prepared by the installing Contractor as necessary.
- 2.8.3 Surface metal raceways, where used as raceways only, shall be sized for the conductors indicated. Nominal minimum size of such raceways shall be equivalent to Wiremold Co. Series #700, or equivalent by Walkerduct, Isotrol or other approved manufacturer.
- 2.8.4 Surface metal raceways to be furnished with integral receptacles shall have Simplex Nema 5-20R outlets spaced on centers as indicated on plans. These shall be Wiremold Co. #2200 Series or equivalent Walkerduct, Isotrol or other approved manufacturer.
- 2.8.5 Surface metal raceways and all components and fittings shall be furnished by a single manufacturer, wherever practical. All trim and cover fittings, flush feed boxes, splices, outlet fittings, etc, necessary for a complete installation shall be provided by the installing Contractor. These raceways shall be rigidly mounted with approved fasteners on not to exceed 24" centers in a run, or 6" from ends and on either side of a corner or as recommended by raceway manufacturer. Refer to plans for notations on exact types of these raceways and outlet configurations.
- 2.9 WIREWAYS, WALL DUCT, FLUSH FLOOR TRENCH DUCT
- 2.9.1 Provide grommet material in all opening. Grommet material shall be PVC or nylon, sized properly for the panel or duct thickness, and securely installed so wire pull will not dislodge or displace it, provide adhesive if necessary. For grommet material 0.009"-0.144" thick provide Panduit #GES-.144-F-R for straight runs/continuous wall and Panduit #GEE-0.144-F-R, for sharp curves/slotted wall.
- 2.9.2 WIREWAYS
- 2.9.2.1 Wireways of painted steel construction shall be corrosion-resistant, moisture and oil resistant where indicated or necessary. Wireways shall be furnished in nominal sizes of 2 ½ " X 2 ½ ", 4" X 4", 6" X 6", 8" X 8" or 12" X 12", as indicated on plans. Furnish with hinged covers on all runs and removable covers on all fittings, to allow a continuous unobstructed path for conductor installation. Provide knockouts on all runs, unless otherwise indicated or prohibited by codes.
- 2.9.2.2 Provide wireways with hangers of same manufacturer, installed so as to allow unobstructed access to wireway interior. Install at not to exceed 8'-0" centers, closer as needed at fittings and turns. Use ¼ " rod hangers minimum for up to 4"X 4", 3/8 " rod minimum up to 8"X 8", ½ " rod minimum for 12" X 12".
- 2.9.2.3 Wireways shall be equivalent to Square "D" Co. "LD" series, as a minimum standard of construction and quality.

2.9.3 WALL DUCTS

- 2.9.3.1 Where wall duct type raceways are indicated to be installed flush, they shall be a minimum 3 ½ " deep by 10" wide (or 18" width, as indicated), furnished with screw covers to overlap flange 1" on each side. Covers shall be furnished in nominal 3'-0" lengths. Provide fully grommated openings or bushed nipples as needed in coverplates to pass cables thru. Where indicated or required, provide transition fittings between horizontal runs of wireway and wall ducts to properly interface each raceway system.
- 2.9.3.2 Where wall ducts are installed flush either vertically or horizontally as a collector duct, provide proper blocking and support in stud walls, adding a layer of studs as needed to prevent undercutting major structural elements of walls. Trim flange shall be set tight to wall surface with 1/16" tolerance each way.
- 2.9.3.3 Wall ducts, if indicated to be surface mounted, shall be furnished with flangeless coverplates.
- 2.9.3.4 All completed systems shall be provided with a factory prime painted finish, suitable for field finish painting.
- 2.9.3.5 Wall ducts shall be equivalent to Square D Company "RWT" Series, as a standard of construction and quality.

2.9.4 TRENCH DUCTS

- 2.9.4.1 Trench duct is to be installed flush with finished concrete floor slab with a vertical tolerance to adjacent surfaces of 1/16" plus or minus. Nominal depth of trench duct shall be adjustable from 2 3/8" to 3 ½ ", minimum 12" width unless otherwise noted on plans.
- 2.9.4.2 Trench duct shall be constructed of code-gauge steel, 14 gauge minimum, with corrosion resistant finish. Surfaces of duct or fittings in contact with concrete shall be painted with two coats of "Asphaltum" or receive equivalent coating or taping prior to placement of concrete.
- 2.9.4.3 Furnish trench duct with flat turns, riser transition fittings to wall duct or panelboard as shown, concrete tight couplings, internal barriers as required to separate services, reducers, end closers, tees and all other fittings as indicated or required.
- 2.9.4.4 Furnish coverplates of aluminum, ¼ " thickness minimum, with flush fasteners in nominal 24" lengths. Furnish grommated openings or nipples with insulated bushings as required. Coverplates shall not deflect more than .085" with application of a 200 pound concentrated load. Any compartment over 16" in width shall have additional coverplate support, to meet the deflection criteria above.
- 2.9.4.5 Provide (as standard) an aluminum tile trim flange (verify and coordinate with floor finishes). Refer to architectural drawings, where applicable.
- 2.9.4.6 Trench duct and coverplates shall be equivalent to Square "D" Company RSV/RCP-AL series, as a standard of quality and construction.

2.10 CABLE TRAY OR CABLE TROUGH

- 2.10.1 Cable tray shall be furnished in all-aluminum construction or galvanized steel construction, as noted and sized on the drawings.

- 2.10.2 Galvanized finishes on tray shall be hot-dipped after fabrication for all tray in exterior locations. Mill finished galvanizing may be used where tray is installed indoors in dry locations.
- 2.10.3 The installing Contractor shall carefully follow the manufacturer's recommendations for hanger sizing and hanger support spacing. The weight per linear foot of tray, fully loaded with a 200% safety factor shall be accounted for in sizing hangers. Refer to manufacturer's instructions and/or the drawings, as applicable for hangers and supports. In no case shall supports be spaced further than 8'-0" apart.
- 2.10.4 Cable tray shall be of the size and type as indicated on drawings.
- 2.10.5 Cable trough shall be similar to cable tray, except bottom shall be a ribbed solid piece, depth and width as indicated on the drawings.
- 2.10.6 Cable tray or trough shall be provided with all required fittings for a complete installation. Fittings shall include, but not be limited to: Horizontal and vertical elbows and tees, smooth dropout fittings, end closure plates, fixed (or adjustable) splices as needed for field offsets, reducers, barriers or box connector flanges.
- 2.10.7 Cable tray and trough shall be equivalent to Square "D" Company Series CLA/CLG (ladder tray) or CTA/CTG (trough) as a standard of quality and construction, unless otherwise noted on plans.
- 2.11 DUCT BANKS
- 2.11.1 Duct banks are defined as a raceway or raceways installed in underground locations, enclosed in a steel-reinforced concrete envelope. They shall be installed where indicated on the drawings or otherwise required.
- 2.11.2 All concrete used in duct bank construction shall be 3000 PSI minimum 28 day compressive strength unless otherwise noted, in accordance with latest A.C.I. standards. Testing of concrete shall be the responsibility of the Contractor, as directed by the engineer. Place concrete against undisturbed earth, or provide forming as needed.
- 2.11.3 Duct bank raceways shall receive a minimum of 3" concrete cover all sides. Minimum size of any duct bank shall be 12" x 12" square, in cross section. In all cases, local and national codes shall apply to duct bank construction where they exceed the requirements of this specification.
- 2.11.4 Each corner of duct bank shall receive a minimum No. 4 steel reinforcing bar with 2" minimum concrete cover on all sides. Lap bars fifteen diameters at all splices. Reinforcing steel shall be rigidly supported during pour and vibration, and shall be constructed to ASTM standards.
- 2.11.5 Support for encased raceways shall be as recommended by raceway manufacturer, spaced 8'-0" maximum on centers, rigidly fastened to prevent floating of ducts during concrete pours. Supports shall be of a material compatible with the raceway, and shall be of the interlocking type, forming a rigidly braced installation. Provide base type and intermediate type spacers to suit conduit configurations and sizes.
- 2.11.6 Where rigid nonmetallic raceways leave concrete duct banks, a transition to rigid steel conduit shall be made 18" inside the concrete envelope. Under no circumstances shall PVC, EB or similar ducts exit concrete envelope, except where duct bank ties into a manhole wall. Provide bell ends at such terminations and towel duct bank rebars 4" into manhole wall with grout. Refer to details on drawings, as applicable. Slope all raceways within duct bank systems such that they shall drain into manholes or pull boxes. Provide proper drainage at manholes or pull boxes to prevent water accumulation.

2.11.7 Where ducts transition thru manholes, pull boxes or at terminating end, each duct shall be specifically identified. A nomenclature as shown on the drawings or as agreed upon by the installer and engineer shall be utilized to identify each individual duct. A permanent means of identifying each duct, such as engraved lamacoid plates or stamped metal tags shall be used.

2.12 RACEWAY FITTINGS

2.12.1 Raceway fittings (or condulets) shall be of gray iron, malleable iron or heavy copper-free cast aluminum. They shall be furnished in proper configurations, avoiding excessive plugged openings. Any openings that are left shall be properly plugged. All coverplates shall be gasketed with neoprene or similar approved materials, rated for the environment.

2.12.2 Where required, raceway fittings shall be provided in explosion-proof configurations rated for the atmosphere. Place conduit seal off fittings at each device in accordance with applicable codes. Seal off fittings shall be packed with wadding, and poured with an approved non-shrink sealing compound.

2.12.3 Where conduit transitions in a run from a cold to a warm environment, (such as at a freezer, refrigerator or exterior wall) sealoff fittings shall be placed on the warm side immediately at the boundary to prevent migration of condensation within raceway systems.

2.12.4 Expansion fittings shall be provided at all locations where conduits or other raceways cross over expansion joints. Provide copper ground bonding jumpers across expansion fittings.

2.12.5 Conduit bodies, junction boxes and fittings shall be dust tight and threaded for dusty areas, weatherproof for exterior locations and vapor tight for damp areas. Conduit fittings shall be as manufactured by Crouse Hinds, Appleton, Killark or approved equivalent. All surface mounted conduit fittings as with "FS", "FD", "GUB" Types etc., shall be provided with mounting hubs.

2.12.6 Where lighting fixtures, appliances or wiring devices are to be suspended from ceiling outlet boxes, they shall be provided with ¾ " rigid conduit pendants. Outlet boxes shall be malleable iron, provided with self-aligning covers with swivel ball joint and No. 14 gauge steel locking ring. Provide safety chain between building structure and ballast housing of light fixtures for all fixtures, appliances or devices greater than 10 lbs weight. Fixtures shall be installed plumb and level.

2.12.7 Fittings for threaded raceways shall be tapered thread with all burrs removed, reamed ends and cutting oil wiped clean.

2.12.8 Fittings for E.M.T. conduit shall be of the set-screw type. Fittings for sizes 2" and larger shall have two setscrews each side. Conduit stops shall be formed in center of couplings. All EMT connectors and couplings shall be of formed steel construction.

2.12.9 Indentation or die-cast fittings shall not be permitted in any raceway system.

2.12.10 Compression type fittings shall be utilized for EMT conduit installed in damp or dusty locations, or where otherwise indicated.

2.12.11 All conduit fittings shall be securely tightened. All threaded fittings shall engage seven full threads. Fasteners shall be properly torqued to manufacturer's recommendations.

2.13 SUPPORTS AND HANGERS

2.13.1 Supports and hangers shall be installed in accordance with all applicable codes and standards. They shall be corrosion - resistant, galvanized or furnished with an equivalent protective coating. All

electrical raceways shall be hung independently from the building structure with U.L. listed and approved materials. Hangers and supports depending from the support systems of other trades work shall not be permitted, except with specific approval in writing from the Engineer. The use of tie wire for support or fastening of any raceway system is prohibited. Perforated metal tape shall not be used for raceway support.

- 2.13.2 No raceway shall be installed on acoustic tile ceiling tees, or in any location that will impair the functioning, access or code-required clearances for any equipment or system.
- 2.13.3 Supports for raceways shall be of materials compatible with the raceway, of malleable iron, spring steel, stamped steel or other approved material. Die-cast fittings are not permitted for supports.
- 2.13.4 The installing Contractor shall provide all necessary supports and braces for raceways, in a rigid and safe installation, complying with all applicable codes.
- 2.13.5 Individual conduits run on building walls or equipment shall be secured by two hole galvanized malleable iron or stamped steel pipe strap or "minerallac" 2-piece straps. The straps are to be anchored by an approved means such as expansion anchors, toggle bolts, through bolts, etc. Where required by codes or other standards, provide spacers behind mounting clamps to space conduits off walls.
- 2.13.6 Individual conduits run on building steel shall be secured by means of clamp supports similar and equal to those manufactured by the C.C. Korn Company, Elcen Co., B-Line or approved equivalent. Provide korn clamps, bulb tee clamps, flange clamps, beam clamps, "minerallacs", etc.
- 2.13.7 Where feasible, vertical and/or horizontal runs of conduit shall be grouped in common hangers on "trapezes" of channel stock as manufactured by "Unistrut" or equivalent, 1-5/8" minimum depth. Utilize conduit clamps appropriate to the channel.
- 2.13.8 Channel strut systems for supporting electrical equipment or raceways shall be constructed of 16 gauge minimum hot dip galvanized steel with 9/16" diameter holes on 8" centers, with finish coat of paint as manufactured by Unistrut, B-Line, Kindorf, or approved equivalent.
- 2.13.9 The minimum diameter of round all-thread steel rods used for hangers and supports shall be 1/4", 20 threads per inch. All-thread rod shall be furnished with a corrosion-resistant finish.
- 2.13.10 Welding directly on conduit or fittings is not permitted.
- 2.13.11 Provide riser support clamps for vertical conduit runs. Riser support clamps shall be of heavy gauge steel construction. Install riser support clamps at each floor level penetration, or as otherwise required.
- 2.13.12 Provide conduit cable support clamps for vertical conductor runs as required or indicated on plans. Clamps to be insulating wedging plug, with malleable iron support ring. Install within properly sized and anchored junction box.
- 2.13.13 Spring steel clips and fittings such as those manufactured by HITT-Thomas, Caddy-Erico, or approved equivalent, with black oxide finish are permitted in any indoor dry location for concealed work, where acceptable to the local authority having jurisdiction.

PART 3 – INSTALLATION:

- 3.1 This Contractor shall lay out and install all conduit systems so as to avoid any other service or systems, the proximity of which may prove injurious to the conduit, or conductors which it confines.

- All conduit systems, except those otherwise specifically shown to the contrary, shall be concealed in the building construction or run above ceilings. Size of all conduit shall conform to Table No. 1, Chapter 9, of the National Electrical Code, unless otherwise shown on the Contract Drawings.
- 3.2 No conduit shall be installed in or below poured concrete slabs except with permission of the architect or engineer. Conduit shall be held at least 6" from flues or hot water pipes.
 - 3.3 All exposed conduit shall be installed with runs parallel or perpendicular to walls, structural members or intersections of vertical planes and ceilings, with right angle turns consisting of cast metal fittings or symmetrical bends unless otherwise shown. All conduit shall have supports spaced not more than eight feet apart.
 - 3.4 Conduit shall be installed in such a manner so as to ensure against collection of trapped condensation. All runs of conduit shall be arranged so as to be devoid of traps. Trapped conduit runs shall be provided with explosion proof drains at low points. Runs of conduit between junctions shall not have more than the equivalent of three 90° bends.
 - 3.5 Junction boxes shall be installed so that conduit runs will not exceed 85', or as shown on the Contract Drawings.
 - 3.6 Underground electric, cable TV, telephone service or other rigid steel conduit and underfloor rigid steel conduit below the concrete floor slab shall be painted with two coats of bitumastic paint, such as "Asphaltum".
 - 3.7 All underground or underfloor conduits shall be swabbed free of all moisture and debris before conductors are pulled.
 - 3.8 At least one 1 inch and three ¾ inch conduits shall be stubbed from flush-mounted panelboards into the nearest accessible area for future use. Provide suitable closures for these stubs. Identify each stub with a suitable hang tag.
 - 3.9 Install electrical raceways in accordance with manufacturer's written instructions, applicable requirements of latest edition of the N.E.C., and NECA "Standard of Installation", complying with recognized industry practices.
 - 3.10 Coordinate with other trades, including metal and concrete deck trades, as necessary to interface installation of electrical raceways and components.
 - 3.11 Level and square raceway runs, and install at proper elevations and required heights. Hold tight to structure wherever possible, to maximize available space and not restrict other trades.
 - 3.12 Complete installation of electrical raceways before starting installation of cables or wires within raceways.
 - 3.13 All underground conduits shall be buried to minimum depth of 24" from the top of the concrete encasement or raceway to finished grade, unless otherwise noted on plans. Observe minimum burial requirements of local utility company where their standards or regulations apply. Conduits containing primary power conductors, (higher than 600 volts to ground) shall be 48" to top below finished grade, unless otherwise noted on plans. Conduits containing secondary power conductors, (600 volts and less to ground) shall be 36" to top below finished grade, unless otherwise noted on plans.
 - 3.14 Provide uni-strut racks where multiple conduits are supported at one location.

2.9.3 WALL DUCTS

- 2.9.3.1 Where wall duct type raceways are indicated to be installed flush, they shall be a minimum 3 ½ " deep by 10" wide (or 18" width, as indicated), furnished with screw covers to overlap flange 1" on each side. Covers shall be furnished in nominal 3'-0" lengths. Provide fully grommeted openings or bushed nipples as needed in coverplates to pass cables thru. Where indicated or required, provide transition fittings between horizontal runs of wireway and wall ducts to properly interface each raceway system.
- 2.9.3.2 Where wall ducts are installed flush either vertically or horizontally as a collector duct, provide proper blocking and support in stud walls, adding a layer of studs as needed to prevent undercutting major structural elements of walls. Trim flange shall be set tight to wall surface with 1/16" tolerance each way.
- 2.9.3.3 Wall ducts, if indicated to be surface mounted, shall be furnished with flangeless coverplates.
- 2.9.3.4 All completed systems shall be provided with a factory prime painted finish, suitable for field finish painting.
- 2.9.3.5 Wall ducts shall be equivalent to Square D Company "RWT" Series, as a standard of construction and quality.

2.9.4 TRENCH DUCTS

- 2.9.4.1 Trench duct is to be installed flush with finished concrete floor slab with a vertical tolerance to adjacent surfaces of 1/16" plus or minus. Nominal depth of trench duct shall be adjustable from 2 3/8" to 3 ½ ", minimum 12" width unless otherwise noted on plans.
- 2.9.4.2 Trench duct shall be constructed of code-gauge steel, 14 gauge minimum, with corrosion resistant finish. Surfaces of duct or fittings in contact with concrete shall be painted with two coats of "Asphaltum" or receive equivalent coating or taping prior to placement of concrete.
- 2.9.4.3 Furnish trench duct with flat turns, riser transition fittings to wall duct or panelboard as shown, concrete tight couplings, internal barriers as required to separate services, reducers, end closers, tees and all other fittings as indicated or required.
- 2.9.4.4 Furnish coverplates of aluminum, ¼ " thickness minimum, with flush fasteners in nominal 24" lengths. Furnish grommeted openings or nipples with insulated bushings as required. Coverplates shall not deflect more than .085" with application of a 200 pound concentrated load. Any compartment over 16" in width shall have additional coverplate support, to meet the deflection criteria above.
- 2.9.4.5 Provide (as standard) an aluminum tile trim flange (verify and coordinate with floor finishes). Refer to architectural drawings, where applicable.
- 2.9.4.6 Trench duct and coverplates shall be equivalent to Square "D" Company RSV/RCP-AL series, as a standard of quality and construction.

2.10 CABLE TRAY OR CABLE TROUGH

- 2.10.1 Cable tray shall be furnished in all-aluminum construction or galvanized steel construction, as noted and sized on the drawings.

- 2.10.2 Galvanized finishes on tray shall be hot-dipped after fabrication for all tray in exterior locations. Mill finished galvanizing may be used where tray is installed indoors in dry locations.
- 2.10.3 The installing Contractor shall carefully follow the manufacturer's recommendations for hanger sizing and hanger support spacing. The weight per linear foot of tray, fully loaded with a 200% safety factor shall be accounted for in sizing hangers. Refer to manufacturer's instructions and/or the drawings, as applicable for hangers and supports. In no case shall supports be spaced further than 8'-0" apart.
- 2.10.4 Cable tray shall be of the size and type as indicated on drawings.
- 2.10.5 Cable trough shall be similar to cable tray, except bottom shall be a ribbed solid piece, depth and width as indicated on the drawings.
- 2.10.6 Cable tray or trough shall be provided with all required fittings for a complete installation. Fittings shall include, but not be limited to: Horizontal and vertical elbows and tees, smooth dropout fittings, end closure plates, fixed (or adjustable) splices as needed for field offsets, reducers, barriers or box connector flanges.
- 2.10.7 Cable tray and trough shall be equivalent to Square "D" Company Series CLA/CLG (ladder tray) or CTA/CTG (trough) as a standard of quality and construction, unless otherwise noted on plans.
- 2.11 DUCT BANKS
- 2.11.1 Duct banks are defined as a raceway or raceways installed in underground locations, enclosed in a steel-reinforced concrete envelope. They shall be installed where indicated on the drawings or otherwise required.
- 2.11.2 All concrete used in duct bank construction shall be 3000 PSI minimum 28 day compressive strength unless otherwise noted, in accordance with latest A.C.I. standards. Testing of concrete shall be the responsibility of the Contractor, as directed by the engineer. Place concrete against undisturbed earth, or provide forming as needed.
- 2.11.3 Duct bank raceways shall receive a minimum of 3" concrete cover all sides. Minimum size of any duct bank shall be 12" x 12" square, in cross section. In all cases, local and national codes shall apply to duct bank construction where they exceed the requirements of this specification.
- 2.11.4 Each corner of duct bank shall receive a minimum No. 4 steel reinforcing bar with 2" minimum concrete cover on all sides. Lap bars fifteen diameters at all splices. Reinforcing steel shall be rigidly supported during pour and vibration, and shall be constructed to ASTM standards.
- 2.11.5 Support for encased raceways shall be as recommended by raceway manufacturer, spaced 8'-0" maximum on centers, rigidly fastened to prevent floating of ducts during concrete pours. Supports shall be of a material compatible with the raceway, and shall be of the interlocking type, forming a rigidly braced installation. Provide base type and intermediate type spacers to suit conduit configurations and sizes.
- 2.11.6 Where rigid nonmetallic raceways leave concrete duct banks, a transition to rigid steel conduit shall be made 18" inside the concrete envelope. Under no circumstances shall PVC, EB or similar ducts exit concrete envelope, except where duct bank ties into a manhole wall. Provide bell ends at such terminations and towel duct bank rebars 4" into manhole wall with grout. Refer to details on drawings, as applicable. Slope all raceways within duct bank systems such that they shall drain into manholes or pull boxes. Provide proper drainage at manholes or pull boxes to prevent water accumulation.

2.11.7 Where ducts transition thru manholes, pull boxes or at terminating end, each duct shall be specifically identified. A nomenclature as shown on the drawings or as agreed upon by the installer and engineer shall be utilized to identify each individual duct. A permanent means of identifying each duct, such as engraved lamacoid plates or stamped metal tags shall be used.

2.12 RACEWAY FITTINGS

2.12.1 Raceway fittings (or condulets) shall be of gray iron, malleable iron or heavy copper-free cast aluminum. They shall be furnished in proper configurations, avoiding excessive plugged openings. Any openings that are left shall be properly plugged. All coverplates shall be gasketed with neoprene or similar approved materials, rated for the environment.

2.12.2 Where required, raceway fittings shall be provided in explosion-proof configurations rated for the atmosphere. Place conduit seal off fittings at each device in accordance with applicable codes. Seal off fittings shall be packed with wadding, and poured with an approved non-shrink sealing compound.

2.12.3 Where conduit transitions in a run from a cold to a warm environment, (such as at a freezer, refrigerator or exterior wall) sealoff fittings shall be placed on the warm side immediately at the boundary to prevent migration of condensation within raceway systems.

2.12.4 Expansion fittings shall be provided at all locations where conduits or other raceways cross over expansion joints. Provide copper ground bonding jumpers across expansion fittings.

2.12.5 Conduit bodies, junction boxes and fittings shall be dust tight and threaded for dusty areas, weatherproof for exterior locations and vapor tight for damp areas. Conduit fittings shall be as manufactured by Crouse Hinds, Appleton, Killark or approved equivalent. All surface mounted conduit fittings as with "FS", "FD", "GUB" Types etc., shall be provided with mounting hubs.

2.12.6 Where lighting fixtures, appliances or wiring devices are to be suspended from ceiling outlet boxes, they shall be provided with ¾ " rigid conduit pendants. Outlet boxes shall be malleable iron, provided with self-aligning covers with swivel ball joint and No. 14 gauge steel locking ring. Provide safety chain between building structure and ballast housing of light fixtures for all fixtures, appliances or devices greater than 10 lbs weight. Fixtures shall be installed plumb and level.

2.12.7 Fittings for threaded raceways shall be tapered thread with all burrs removed, reamed ends and cutting oil wiped clean.

2.12.8 Fittings for E.M.T. conduit shall be of the set-screw type. Fittings for sizes 2" and larger shall have two setscrews each side. Conduit stops shall be formed in center of couplings. All EMT connectors and couplings shall be of formed steel construction.

2.12.9 Indentation or die-cast fittings shall not be permitted in any raceway system.

2.12.10 Compression type fittings shall be utilized for EMT conduit installed in damp or dusty locations, or where otherwise indicated.

2.12.11 All conduit fittings shall be securely tightened. All threaded fittings shall engage seven full threads. Fasteners shall be properly torqued to manufacturer's recommendations.

2.13 SUPPORTS AND HANGERS

2.13.1 Supports and hangers shall be installed in accordance with all applicable codes and standards. They shall be corrosion - resistant, galvanized or furnished with an equivalent protective coating. All

- electrical raceways shall be hung independently from the building structure with U.L. listed and approved materials. Hangers and supports depending from the support systems of other trades work shall not be permitted, except with specific approval in writing from the Engineer. The use of tie wire for support or fastening of any raceway system is prohibited. Perforated metal tape shall not be used for raceway support.
- 2.13.2 No raceway shall be installed on acoustic tile ceiling tees, or in any location that will impair the functioning, access or code-required clearances for any equipment or system.
- 2.13.3 Supports for raceways shall be of materials compatible with the raceway, of malleable iron, spring steel, stamped steel or other approved material. Die-cast fittings are not permitted for supports.
- 2.13.4 The installing Contractor shall provide all necessary supports and braces for raceways, in a rigid and safe installation, complying with all applicable codes.
- 2.13.5 Individual conduits run on building walls or equipment shall be secured by two hole galvanized malleable iron or stamped steel pipe strap or "minerallac" 2-piece straps. The straps are to be anchored by an approved means such as expansion anchors, toggle bolts, through bolts, etc. Where required by codes or other standards, provide spacers behind mounting clamps to space conduits off walls.
- 2.13.6 Individual conduits run on building steel shall be secured by means of clamp supports similar and equal to those manufactured by the C.C. Korn Company, Elcen Co., B-Line or approved equivalent. Provide korn clamps, bulb tee clamps, flange clamps, beam clamps, "minerallacs", etc.
- 2.13.7 Where feasible, vertical and/or horizontal runs of conduit shall be grouped in common hangers on "trapezes" of channel stock as manufactured by "Unistrut" or equivalent, 1-5/8" minimum depth. Utilize conduit clamps appropriate to the channel.
- 2.13.8 Channel strut systems for supporting electrical equipment or raceways shall be constructed of 16 gauge minimum hot dip galvanized steel with 9/16" diameter holes on 8" centers, with finish coat of paint as manufactured by Unistrut, B-Line, Kindorf, or approved equivalent.
- 2.13.9 The minimum diameter of round all-thread steel rods used for hangers and supports shall be 1/4", 20 threads per inch. All-thread rod shall be furnished with a corrosion-resistant finish.
- 2.13.10 Welding directly on conduit or fittings is not permitted.
- 2.13.11 Provide riser support clamps for vertical conduit runs. Riser support clamps shall be of heavy gauge steel construction. Install riser support clamps at each floor level penetration, or as otherwise required.
- 2.13.12 Provide conduit cable support clamps for vertical conductor runs as required or indicated on plans. Clamps to be insulating wedging plug, with malleable iron support ring. Install within properly sized and anchored junction box.
- 2.13.13 Spring steel clips and fittings such as those manufactured by HITT-Thomas, Caddy-Erico, or approved equivalent, with black oxide finish are permitted in any indoor dry location for concealed work, where acceptable to the local authority having jurisdiction.

PART 3 – INSTALLATION:

- 3.1 This Contractor shall lay out and install all conduit systems so as to avoid any other service or systems, the proximity of which may prove injurious to the conduit, or conductors which it confines.

- All conduit systems, except those otherwise specifically shown to the contrary, shall be concealed in the building construction or run above ceilings. Size of all conduit shall conform to Table No. 1, Chapter 9, of the National Electrical Code, unless otherwise shown on the Contract Drawings.
- 3.2 No conduit shall be installed in or below poured concrete slabs except with permission of the architect or engineer. Conduit shall be held at least 6" from flues or hot water pipes.
 - 3.3 All exposed conduit shall be installed with runs parallel or perpendicular to walls, structural members or intersections of vertical planes and ceilings, with right angle turns consisting of cast metal fittings or symmetrical bends unless otherwise shown. All conduit shall have supports spaced not more than eight feet apart.
 - 3.4 Conduit shall be installed in such a manner so as to ensure against collection of trapped condensation. All runs of conduit shall be arranged so as to be devoid of traps. Trapped conduit runs shall be provided with explosion proof drains at low points. Runs of conduit between junctions shall not have more than the equivalent of three 90° bends.
 - 3.5 Junction boxes shall be installed so that conduit runs will not exceed 85', or as shown on the Contract Drawings.
 - 3.6 Underground electric, cable TV, telephone service or other rigid steel conduit and underfloor rigid steel conduit below the concrete floor slab shall be painted with two coats of bitumastic paint, such as "Asphaltum".
 - 3.7 All underground or underfloor conduits shall be swabbed free of all moisture and debris before conductors are pulled.
 - 3.8 At least one 1 inch and three ¾ inch conduits shall be stubbed from flush-mounted panelboards into the nearest accessible area for future use. Provide suitable closures for these stubs. Identify each stub with a suitable hang tag.
 - 3.9 Install electrical raceways in accordance with manufacturer's written instructions, applicable requirements of latest edition of the N.E.C., and NECA "Standard of Installation", complying with recognized industry practices.
 - 3.10 Coordinate with other trades, including metal and concrete deck trades, as necessary to interface installation of electrical raceways and components.
 - 3.11 Level and square raceway runs, and install at proper elevations and required heights. Hold tight to structure wherever possible, to maximize available space and not restrict other trades.
 - 3.12 Complete installation of electrical raceways before starting installation of cables or wires within raceways.
 - 3.13 All underground conduits shall be buried to minimum depth of 24" from the top of the concrete encasement or raceway to finished grade, unless otherwise noted on plans. Observe minimum burial requirements of local utility company where their standards or regulations apply. Conduits containing primary power conductors, (higher than 600 volts to ground) shall be 48" to top below finished grade, unless otherwise noted on plans. Conduits containing secondary power conductors, (600 volts and less to ground) shall be 36" to top below finished grade, unless otherwise noted on plans.
 - 3.14 Provide uni-strut racks where multiple conduits are supported at one location.

- 3.15 Raceways installed in exterior locations shall receive one coat of primer, two coats finish paint after preparation of galvanizing, color selected by Architect. Exposed raceways in painted interior areas shall be similarly painted.
- 3.16 Conduits, cables, raceways, and enclosures under metal-corrugated sheet roof decking shall not be located within 1-1/2" of the roof decking, measured from the lowest surface of the roof decking to the top of the conduit, cable, raceway, or box. GRS and IMC are exempt from this.
- 3.17 Conduits, cables, raceways, and enclosures are not permitted in concealed locations of metal-corrugated sheet decking type roofing.
- 3.18 Provide separate a completely separate raceway system of conduits, pull-boxes, etc. for each emergency power branch and for normal power for complete separation per NEC.
- 3.19 Where existing panels are flush-mounted in walls, contractor shall cut, patch, and repair existing construction as required for concealed conduit entry for new connections to those panels.

PART 4 – SPECIALTIES:

- 4.1 All EMT terminations at junction boxes, panels, etc. shall be made with case hardened locknuts and appropriate fittings, with insulated throat liners. Insulating terminations shall be manufactured as a single unit. The use of split sleeve insulators is not permitted.
- 4.2 All rigid conduit, except main and branch feeders, shall have heavy fiber insulating bushings reinforced with double locknuts. All branch and main feeders shall have insulated bushings with grounding lugs and shall be bonded to enclosures with appropriately sized copper jumpers, except at pad mounted transformers. Bonding jumpers shall be installed as required by the N.E.C. and other applicable codes.
- 4.3 All conduit stubbed through floor during construction shall have openings protected with plastic caps approved for this purpose. Connections on both ends of all flexible conduit shall be equivalent to Thomas and Betts, Ideal, Appleton, Efcor, or approved equivalent, rated for the environment.
- 4.4 All pulling lines left in open conduit systems shall be non-metallic, left securely tied off at each end.
- 4.5 Where spare raceways terminate in switchboards or motor control centers a fishtape barrier shall be provided.
- 4.6 All outlet, junction and pull boxes shall be grounded with pigtail to the equipment grounding conductor.

END OF SECTION.

DIVISION 26 - ELECTRICAL

SECTION 260534 - CABINETS, OUTLET BOXES & PULL BOXES

PART 1 – GENERAL:

- 1.1 This section of the specifications covers all electrical cabinets, outlet boxes and pull boxes.
- 1.2 Continuous runs of conduit shall have pull boxes at least each eighty-five (85) feet of run, or as near as possible to that limit.

PART 2 - MATERIALS & INSTALLATION:

2.1 Cabinets, Outlet & Pull Boxes:

- 2.1.1 All backboxes shall be galvanized steel, minimum two-gang, 4" X 4" X 2-1/8" with plaster cover for the number of devices as required. Boxes shall be recessed in building construction with face flush with finished surfaces, unless otherwise noted.
- 2.1.2 Device backbox schedule:
 - 2.1.2.1 Single gang: 4-11/16" square x 2-1/8"d two-gang backbox (STEEL CITY #72171) with single-gang 3/4" raised extension ring. (STEEL CITY #72-C-14)
 - 2.1.2.2 Two-gang: 4-11/16" square x 2-1/8"d two-gang backbox (STEEL CITY #72171) with two-gang 3/4" raised extension ring. (STEEL CITY #72-C-18)
 - 2.1.2.3 Three-gang: 8-5/8" x 4-1/2" x 2-1/2"d three-gang box (STEEL CITY #H3BD) with three-gang 3/4" raised extension ring as required.
 - 2.1.2.4 Four-gang: 10-17/16" x 4-1/2" x 2-1/2"d four-gang backbox (STEEL CITY #H4BD) with four-gang 3/4" raised extension ring as required.
- 2.1.3 Cabinets for lighting and power, telephone, pull boxes, outlet boxes, or any other purposes specified or shown on the Contract Drawings, shall be constructed of code gauge, galvanized steel with sides formed and corner seams riveted or welded before galvanizing. Boxes assembled with sheet metal screws will not be accepted
- 2.1.4 All cabinets and boxes for NEMA 1 and 1A application shall be provided with knockouts, as necessary, or shall be cut in the field by approved cutting tools which will provide a clean, symmetrically cut opening. All boxes, except panelboards, shall be provided with code gauge fronts with hex head or pan head screw fasteners. Outdoor cabinets shall be hinged cover with pad locking provisions. Fronts for panelboards shall be as specified for panelboards.
- 2.1.5 Ceiling outlet boxes shall be galvanized steel, 4" octagonal, not less than 2 1/8" deep, with lugs or ears to secure covers, and those for use with ceiling lighting fixtures shall be fitted with 3/8" fixture studs fastened to the back of the boxes, where applicable. Provide adequate support with at least a 2 x safety factor for the anticipated fixture weight.
- 2.1.6 Special size concealed outlet boxes for clocks, speakers, alarms, TV, etc., shall be provided by the manufacturer of the equipment.
- 2.1.7 Floor outlet boxes shall be as specified in Wiring Devices & Plates specification section, unless noted or specified otherwise.

- 2.1.8 The location of outlets, as shown on the drawings, shall be considered as approximate only. It shall be incumbent upon this Contractor to study the general building drawings, with relation to spaces surrounding each outlet, in order to make his work fit the work of others and in order that when the fixtures are installed, they will be symmetrically located and will not interfere with any other work or equipment. Any change in fixture or layout shall be coordinated with and approved by the A-E before this change is made.
- 2.1.9 All outlets, pull boxes, junction boxes, cabinets, etc., shall be sized per the current edition of the National Electrical Code.
- 2.1.10 Cabinets, outlet boxes and junction or pull boxes shall be threaded for rigid-threaded conduit, dust-tight vapor-tight or weatherproof as required for areas other than for NEMA 1 or 1A application. These shall be as manufactured by Crouse-Hinds, Appleton, Killark, or approved as equivalent.
- 2.1.11 NEMA 1 or 1A cabinets, outlet boxes or pull or junction boxes shall be as manufactured by Appleton, Steel City, T & B, or approved equivalent.
- 2.1.12 Outlet boxes for switches, receptacles, telephone, etc., concealed in walls shall be galvanized steel, 4" X 4" X 2-1/8" with plaster cover for the number of devices as required and to be flush with finished wall. Where outlet boxes are installed in walls of glazed tile, brick, concrete block, or other masonry which will not be covered with plaster or in walls covered by wood wainscot or paneling, deep sectional masonry boxes shall be used and they shall be completely covered with the plates or lighting fixtures. This Contractor shall cooperate with the brick layers, block layers and carpenters to ensure that the outlet boxes are installed straight and snugly in the walls. Receptacles shall be set vertically in walls.
- 2.1.13 Outlet boxes mounted in glazed tile, brick, concrete block or other types of masonry walls shall be mounted above or below the mortar joint. Do Not Split The Mortar Joint.
- 2.1.14 Boxes for more than two devices shall be for number of devices required and shall be one piece. No ganging of single switch boxes will be allowed.
- 2.1.15 Outlets provided shall have only the holes necessary to accommodate the conduit at the point of insulation and shall be rigidly secure in position. Boxes with knockout removed and openings not used shall be replaced or provided with a listed knockout closure.
- 2.1.16 Openings for conduit entrance in cabinets and boxes shall be prefabricated, punched, drilled and/or reamed. The use of a cutting torch for this purpose is prohibited.
- 2.1.17 Where multiple switches are installed at one location, all switches shall be installed in a common box, with dividers as required for separation of normal and emergency power devices and devices of different voltage.
- 2.1.18 Provide separate a completely separate raceway system of conduits, pull-boxes, etc. for each emergency power branch and for normal power for complete separation per NEC.
- 2.2 SPECIAL NOTICE
- 2.2.1 Openings for conduit entrance in cabinets and boxes shall be prefabricated, punched, drilled and/or reamed. The use of a cutting torch for this purpose is prohibited.

END OF SECTION.

DIVISION 26 - ELECTRICAL

SECTION 260553 – IDENTIFICATIONS

PART 1 – GENERAL:

Designer Note: Remove references to healthcare and emergency power when not applicable.

- 1.1 Equipment, disconnect switches, motor starters, pushbutton stations, special device plates, and similar materials shall be clearly marked as to their function and use. Markings shall be applied neatly and conspicuously to the front of each item of equipment with 1/2" black (or red if emergency) lamacoid plate with white letters 1/4" high. Labeling shall indicate use, where fed from and circuit number.
- 1.2 The Contractor shall provide clearly legible typewritten directories in each electrical panel indicating the area, item of equipment, etc. controlled by each switch, breaker, fuse, etc. These directories are to be inserted into plastic card holders in each panel. Provide electronic Excel files of all directories to owner as part of Close-out Documentation. Any existing panels which are affected by this contractor's work shall also be provided with new directories.
- 1.3 Branch circuit panelboards and switch gear shall be provided with a black (or red if emergency) lamacoid plastic plate with 1/2" white letters for panel designation and 1/4" white letters showing voltage and feeder information. Branch circuit switches shall be designated as to function. Panelboard and switchgear labels shall indicate the source they are fed from, and the circuit number at that source. Clearly indicate the exact label legend to be furnished with each panelboard and switchgear on the shop drawings for each item of equipment prior to submission of shop drawings. Refer to drawings for further details.
- 1.4 Where branch circuit panelboards and switchgear are connected to an emergency source, the lamacoid plate shall be red and the word "emergency" shall be incorporated into the legend. In health care applications, the NEC - designated branch (life safety, critical or equipment branch) shall also be incorporated into the legend, all in 1/4" letters. Also provide similar plates and legends for automatic transfer switches, as appropriate. Refer to drawings for further details.
- 1.5 Lamacoid plates shall be located at center of top of trim for branch circuit panels, switch gear, and centered at side for branch circuit switches. Fasten with self-tapping stainless steel screws or other approved method.
- 1.6 All junction boxes utilized for life-safety branch emergency power circuits, connections, devices, etc. shall have the cover painted blue. Mark over paint with panel and circuit number.
- 1.7 All junction boxes utilized for fire alarm circuits, connections, devices, etc. shall have the cover painted red. Mark over paint with letters "FA".

Designer Note: Select method for identifying device coverplates with panel/circuit #.

- 1.8 All emergency power device coverplates in patient care areas shall be permanently engraved with panel and circuit number. All device coverplates which are not engraved shall have clear adhesive labels with panel and circuit number type-written in black lettering.
- 1.9 All systems requiring room names and/or numbers for labeling or programming shall use the owner's actual room name and numbering scheme, not floor plans. All reprogramming shall be included as required to accommodate construction phasing.

- 1.10 All junction, outlet and pull boxes in data/mechanical/electrical rooms and above ceilings shall be identified with panel and circuit designation on outside of covers. All junction, outlet and pull boxes in exposed areas shall be identified with panel and circuit designation on inside of covers.
- 1.11 The inside of all junction and backboxes shall be marked with panel and circuit number in permanent marker.
- 1.12 All identifications shall be consistent with the owner's standard practices, especially within existing facilities. Where the requirements here-in are in conflict with such standard practices, the contractor shall notify the engineer in writing prior to ordering any material for clarification.

END OF SECTION.

DIVISION 26 - ELECTRICAL

SECTION 262300 - ELECTRICAL DISTRIBUTION EQUIPMENT

PART 1 - GENERAL

- 1.1 All equipment shall be listed per the applicable ANSI and UL standards and comply with the applicable versions of the National Electric Code and NFPA.
- 1.2 All equipment with a neutral connection shall have separate ground and neutral bars.

Designer Note: Change copper to aluminum for all HCA projects.
- 1.3 All bussing and ground/neutral bars in all equipment shall be copper.
- 1.4 All actual fault current (AIC) equipment ratings shall exceed the actual available fault current value at the equipment as determined by a study performed by the Contractor and submitted to the engineer for shop drawing review prior to approval of distribution equipment. No series AIC ratings will be allowed. Equipment AIC ratings shall be at least 110% of the actual available fault current.
- 1.5 Labels affixed to equipment by the equipment manufacturer shall comply with drawing and specification labeling requirements or shall be omitted by the manufacturer and field-installed by the Contractor. Labels which are factory-installed and not in compliance shall be removed and replaced and equipment enclosures refinished or replaced by the manufacturer to repair finish.
- 1.6 This Contractor shall submit detailed shop drawings of electrical and central plant rooms indicating all electrical equipment locations including panelboards, transformers, disconnects, etc. to engineer for review. All equipment shall be as included in approved shop drawings. Coordinate exact locations of all equipment with mechanical and plumbing Contractors to ensure proper fit of equipment by all trades and to ensure piping, ductwork, fire protection heads, etc. are not routed over electrical equipment. Equipment locations shall maintain service clearances required by code and by equipment manufacturer. These service clearances shall be indicated on the shop drawing layouts.
- 1.7 All new breakers in existing panels shall match existing panel AIC ratings. New breakers shall be provided with all required mounting hardware, accessories, etc. as required for installation in existing panels. Contractors shall review existing equipment on-site prior to bid and include all necessary work.
- 1.8 All service entrance equipment shall be service entrance labeled and listed by U.L.
- 1.9 All distribution equipment shall be shipped from the manufacturer with factory-applied arc flash warning labels affixed to the outside front of the equipment (as it will be installed per the plans). All labeling shall be in compliance with NFPA 70 requirements.
- 1.10 All circuit breakers 1200A or larger or that may be adjusted to 1200A trip or greater (via plug or any other means) shall be provided with a means of arc flash reduction. Provide ARM switch for thermal-magnetic breakers and zone-selective interlocking for electronic-trip breakers.
- 1.11 All panelboards shall be ordered with "door-in-door" option.
- 1.12 Distribution equipment sizes and equipment layout shall be considered basis of design. Equipment sizes vary by manufacturer. If proposed equipment is larger than the sizes illustrated, the burden shall be on the Contractor to provide equipment which fits in the space allotted while maintaining all code-required and manufacturer-recommended clearances.

- 1.13 All spare circuit breakers shall be so labeled in circuit directories and shall be left in the OFF position.
- 1.14 Where panels, switchboards, etc. are noted to have “space” or “space only”, this shall be prepared space with all bussing, lugs, etc. as required to accept future installation of over-current devices.
- 1.15 Acceptable manufacturers for Electrical Distribution Equipment shall be Square "D", G.E., Siemens and Eaton.

PART 2 - MAIN SWITCHBOARD - FUSIBLE SWITCH STYLE:

- 2.1 Switchboard shall be dead front, totally enclosed, free standing type consisting of sections housing the equipment as indicated. The structure height shall be nominally 92" high, including the base channels. The structure shall be constructed of formed steel channels and angles (12 gauge minimum) to support cover plates, bussing, distribution equipment and other devices to be installed therein. Neutral and ground shall be separate busses. Removable cover plates shall be provided on all sides and top with opening for conduit in bottom. Cover plates and trim shall have formed edges so that no sheared surfaces are exposed. Housing shall be given a rust inhibiting treatment inside and out and finished in light gray baked enamel, per ANSI #49. Connection will be made by entering the switchboard as indicated on the drawings. Provide concrete housekeeping pad, 4" high, with #4 rebar on 6" X 6" centers, per A.C.I. standards. Chamfer edges of pad 1/2".
- 2.2 All bussing shall be tin-plated extruded aluminum. The temperature rise above ambient of the bus bars shall not exceed 50NC. Heat rise test shall be conducted in accordance with U.L. Standard UL-67. All joints are to be rigidly bolted to ensure maximum conductivity. All bus bars shall extend full length of equipment to permit future additions.
- 2.3 Neutral bussing shall be of the same ampacity as the phase bussing and shall be insulated from the enclosure. Ground bussing shall be sized and shall be bonded to the enclosure per N.E.C. current edition. Service grounding electrode connection shall be made between ground and neutral busses. Provide ground bushings and equipment ground conductor connection on each feeder conduit leaving the switchboard and at the terminal end for each continuous metallic feeder conduit.
- 2.4 The main buss shall be adequately braced to withstand short circuits of 100,000 asymmetric RMS amperes. The line side of branch units shall be bussed with connectors of same material as the buss unless otherwise indicated or required.
- 2.5 Main switches indicated for service entrance duty of more than 601 ampere rating shall have a bolted pressure contact fusible load break switch. All current carrying parts of the switch shall be silver plated. Fuse compartment shall have a hinged door interlocked with the handle so door cannot be opened with switch in the "ON" position and switch cannot be closed with the door open. Provisions for padlocking switch in the "ON" or "OFF" position shall be provided. Fuses of 601 or greater rating shall be the bolted-on type.
- 2.6 Main switches on 277/480 volt systems rated for 1000 amps or above shall have ground fault protection equipment and comply with Article 230-95 of the National Electrical Code.
- 2.7 Distribution section(s) shall consist of the number of quick-make, quick-break fusible switches of sizes as indicated. Units shall be mounted in group type construction and supplied as indicated. Each switch shall be enclosed in a steel enclosure having a hinged cover with an interlock to prevent opening the cover when the switch is in the "ON" position.

PART 3 - MAIN SWITCHBOARD - CIRCUIT BREAKER STYLE:

- 3.1 Switchboard shall be dead front, totally enclosed, free standing or wall mounted, as required or herein specified, housing the equipment as indicated. The switchboard shall meet Underwriters' Laboratories enclosure requirements, and be furnished with an Underwriters' Laboratories label. Where switchboards are floor-mounted, provide concrete housekeeping pad, 4" high, with #4 rebar on 6" X 6" centers, per A.C.I. standards. Chamfer edges of pad ½".
- 3.2 The switchboard shall be dead-front with front accessibility. The switchboard framework shall consist of steel channels bolted to the frame to rigidly support the entire shipping section for moving on rollers and floor mounting. The framework is to be formed of code gauge steel, rigidly welded together to support all cover plate, bussing and component devices. All unused positions shall have closures.
- 3.3 Each switchboard section shall have an open bottom (closed for wall-mounted style) and a top plate for installation and termination of conduit. Top and bottom conduit areas are to be clearly shown and dimensioned on the shop drawings. The wireway front covers shall be secured by screws and hinged, to permit access to the branch circuit breaker load side terminals. The paint finish shall be medium light gray, per ANSI #49, applied by the electro-deposition process over an iron phosphate pre-treatment. Enclosure shall be NEMA 1, with drip shield on top. Provide top covers without knockouts. All conduit entries to be field cut. At top conduit entries, provide weatherproof sealing lock nuts on terminator.
- 3.4 The switchboard bussing shall be of sufficient cross-sectional area to meet UL Standard 891 on temperature rise. Main and/or through busses shall be tin plated extruded aluminum. The through bus shall have an ampacity in amperes as indicated on the drawings and shall be braced to have a short circuit current rating of 100,000 RMS symmetrical amperes unless otherwise indicated. (Where through bus is provided, it shall have provisions for the addition of future sections on the branch or distribution side.) The through bus supports, connections and joints are to be bolted with hex head bolts and belleville washers to minimize maintenance requirements.
- 3.5 Neutral bussing shall be of the same ampacity bussing and insulated from the enclosure. Ground bussing shall be sized and shall be bonded to the enclosure per N.E.C., current edition. Service grounding electrode connection shall be made between ground and neutral busses. Provide ground bushings and equipment ground conductor connection on each feeder conduit leaving switchboard and at the terminal end for each continuous metallic feeder conduit.
- 3.6 Each switchboard, as a complete unit, shall be given a single short circuit current rating by the manufacturer. Such a rating shall be established by actual tests by the manufacturer, in accordance with UL specifications, on equipment constructed similarly to the subject switchboard.
- 3.7 The service disconnect device(s) shall be thermal-magnetic molded case circuit breaker(s) installed totally front accessible and front connectable. Line side of branch circuit breaker connections are to be jaw type plug-on.
- 3.8 Group mounted molded case circuit breakers for branch distribution are to be totally front accessible. These circuit breakers are to be mounted in the switchboard to permit installation, maintenance and testing without reaching over any line side bussing. The circuit breakers are to be removable by the disconnection of only the load side cable terminations. All line and load side connections are to be individual to each circuit breaker. Common mounting brackets or electrical bus connectors will not be acceptable. Line side circuit breaker connections are to be jaw type plug-on, arranged to withstand the anticipated fault currents.
- 3.9 Each circuit breaker is to be furnished with an externally operable mechanical means to trip the circuit breaker, enabling maintenance personnel to verify the ability of the circuit breaker trip mechanism to operate as well as exercise the circuit breaker operating mechanisms.

- 3.10 Main buss and all circuit breakers shall have a minimum ISCA rating of 100,000 amps, A.I.C., unless otherwise noted on the One-Line Diagram.
- 3.11 Main switches on 277/480 volt systems rated for 1000 amps or above shall have ground fault protection equipment and comply with Article 230-95 of the National Electrical Code.
- 3.12 In healthcare facilities, provide two levels of ground fault protection per NEC 517.

PART 4 - DISTRIBUTION PANELBOARDS (600 AMPERE OR GREATER):

- 4.1 Panelboard assembly shall be enclosed in a steel cabinet. The rigidity and gauge of steel to be as specified in UL Standard 50 for cabinets. The size of wiring gutters shall be in accordance with UL Standard 67. Cabinets to be equipped with latch and tumbler-type lock on door of trim. Doors over 48" long shall be equipped with three-point latch and vault lock. All locks shall be keyed alike. End walls shall be removable. Fronts shall be of code gauge steel, with gray baked enamel finish electrodeposited over cleaned, phosphatized steel.
- 4.2 The panelboard interior assembly shall be dead front with panelboard front removed. Main lugs or main breakers shall have barriers on five sides. The barrier in front of the main lugs shall be hinged to a fixed part of the interior. The end of the bus structure opposite the mains shall have barriers. Bus structure shall be full height of panel.
- 4.3 Panelboard bus structure and main lugs or main breaker shall have current ratings as shown on the panelboard schedule. Such ratings shall be established by heat rise tests with maximum hot spot temperature on any connector or buss bar not to exceed 50 degree C. rise above ambient. Heat rise tests shall be conducted in accordance with Underwriters Laboratories Standard UL 67. The use of conductor dimensions will not be accepted in lieu of actual heat tests. All panelboards unless otherwise noted shall have space to accept forty-two 20 amp one pole circuit breakers.
- 4.4 Circuit breakers shall be equipped with individually insulated, braced and protected connectors. The front faces of all circuit breakers shall be flush with each other. Large, permanent, individual circuit numbers shall be affixed to each breaker in a uniform position. Tripped indication shall be clearly shown by the breaker handle taking a position between "ON" and "OFF." Provisions for additional breakers shall be such that no additional connectors will be required to add breakers. All panelboards shall be capable of accepting 225 amp 3 pole branch breakers as a minimum unless otherwise noted. All circuit breakers shall be bolt-in type.
- 4.5 Each panelboard, as a complete unit, shall have a short circuit current rating equal to or greater than the equipment rating shown on schedules on the plans or as determined by verification with local utility company. This rating shall be established by testing with the overcurrent devices mounted in the panelboard. The short circuit tests on the overcurrent devices and on the panelboard structure shall be made simultaneously by connecting the fault to each overcurrent device with the panelboard connected to its rated voltage source. Method of testing shall be per Underwriters Laboratories Standard UL 67. The source shall be capable of supplying the specified panelboard short circuit current or greater. Testing of panelboard overcurrent devices for short circuit rating only while individually mounted is not acceptable. Also, testing of the bus structure by applying a fixed fault to the bus structure alone is not acceptable. Panelboards shall be marked with their maximum short circuit current rating at the supply voltage and shall be UL listed. Series ratings are not acceptable.

PART 5 - BRANCH PANELBOARDS:

- 5.1 This section covers lighting and power panelboards (refer to schedules, notes on Drawings and the Electrical One-Line Diagram, of the Contract Drawings).

- 5.2 All panelboards shall be of the circuit breaker type, and shall be of one manufacturer.
- 5.3 Branch panelboards shall be as indicated on the drawings and as specified herein. Panelboards shall be of the dead-front, quick-make, quick-break, bolt-in circuit breaker type, with trip indicating and trip free handles. All circuits shall be clearly and properly numbered and shall be provided with thermal magnetic protection. The panelboards shall be enclosed in code gauge, galvanized steel cabinets with smooth finished hinged doors without visible external fasteners and heavy chrome locks. Locks shall all be keyed alike. Each door shall have a directory card inside, covered with a plastic shield, typewritten with circuit numbers and description indicated. Room numbers shall be coordinated with final room numbers as selected by Owner – not numbers on Contract Documents.
- 5.4 Special Note: The room numbers used to fill out the panel directories shall match the actual final name and numbering scheme selected by the Owner. They shall not be filled out per the construction drawing numbering scheme, unless the Contractor is directed to do so by the Architect or Engineer.
- 5.5 Branch panelboards shall be surface or flush mounted as indicated on the Contract Drawings.
- 5.6 Circuit breakers for 120/208 volt systems shall be of 10,000 A.I.C. RMS symmetrical rating unless otherwise indicated on the Contract Drawings. For 277/480 volt systems, provide circuit breakers with 14,000 A.I.C. ratings unless otherwise indicated.
- 5.7 All main buss connections in branch panelboards shall be of the same material as the buss. All buss bars shall extend full length of panelboards. Provide separate neutral and ground bars.
- 5.8 All circuit breakers used to switch lights shall be SWD (switching duty) rated.

PART 6 - INSTALLATION INSTRUCTIONS:

- 6.1 Panelboards with circuit breakers installed before the building has been finished and cleaned shall be masked.
- 6.2 All dust and debris shall be removed from the panels before they are energized and placed in service.

PART 7 - SAFETY SWITCHES:

- 7.1 Provide heavy duty safety switches as a final disconnecting means as required by NEC and/or as indicated on the Contract Drawings.
- 7.2 All safety switches shall be NEMA Type 1, NEMA 3R, or as required by the operating environment, Heavy Duty Type HD, UL listed, with arc shield.
- 7.3 All safety switches shall have switch blades that are fully visible in the "OFF" (open) position with the door open.
- 7.4 All current carrying parts shall be plated by an electrolytic process to resist corrosion and to promote cooling.
- 7.5 Switch mechanism shall be quick-make, quick-break, load break rated, such that during normal operation of the switch, the operation of the contacts shall not be capable of being restrained by the operating handle after the closing and opening action of the contacts has started. The handle and mechanism shall be an integral part of the box (not cover) with facilities for pad locking in the open

or closed position with up to three padlocks. Switch doors shall be interlocked with switch handle so that the door can only be opened when the switch is in the "OFF" (open) position.

- 7.6 Switches shall be capable of interrupting locked rotor currents of motors which they protect.
- 7.7 Lugs shall be UL listed for the conductors to which they will be connected. All lugs shall be minimally dual-rated for 75 degree C conductors, copper or aluminum.
- 7.8 Switches shall have a minimum rating of 100kAIC with fuses installed.
- 7.9 In all locations where disconnect switches are required and available fault current exceeds 10kAIC, provide a heavy duty safety switch per this section.

PART 8 – FUSES:

- 8.1 Upon completion of the building, the Contractor shall provide the owner with spare fuses as shown below. All fuses shall be Bussmann, Shawmut, Gould or Reliance.
 - 8.1.1 10% (minimum of 3) of each type and rating of installed fuses shall be supplied as spares:
 - 8.1.2 Bussmann spare fuse cabinets - Catalog No. SFC - shall be provided to store the above spares.
- 8.2 No fuses shall be installed in the equipment until the installation is complete, including tests and inspections required prior to being energized. All fuses shall be of the same manufacturer to ensure retention of selective coordination, as designed.
- 8.3 Circuits 601 to 6000 amperes shall be protected by current limiting BUSSMANN HI-CAP TIME DELAY FUSES KRP-C. Fuses shall employ "O" rings as positive seals between the end bells and the fuse barrel. Fuses shall be a time-delay type and must hold 500% of rated current for a minimum of 5 seconds, clear 20 times rated current in .01 seconds or less and be listed by Underwriter's Laboratories, Inc., with an interrupting rating of 200,000 amperes R.M.S. symmetrical. The fuses shall be UL Class L.
- 8.4 Circuits 0 to 600 amperes shall be protected by current limiting BUSSMANN LOW-PEAK Dual Element Fuses, LPN-RK (250 volts) or LPS-RK (600 volts). All dual element fuses shall have separate overload and short circuit elements. Fuse shall incorporate a spring activated thermal overload element having a 284NF melting point alloy and shall be independent of the short-circuit clearing chamber. The fuse shall hold 500% of rated current for a minimum of 10 seconds and be listed by Underwriters Laboratories, Inc. with an interrupting rating of 200,000 amperes r.m.s. symmetrical. The fuses shall be UL Class RK1.
- 8.5 Motor Circuits - All individual motor circuits rated 480 amperes or less shall be protected by BUSSMANN LOW PEAK DUAL-ELEMENT FUSES LPN-RK (250 volts) or LPS-RK (600 volts). The fuses for 1.15 service factor motors shall be installed in rating approximately 125% of motor full load current except where high ambient temperatures prevail, or where the motor drives a heavy revolving part which cannot be brought up to full speed quickly, such as large fans. Under such conditions the fuse should be 150% to 200% of the Type KRP-C HI-CAP Time Delay Fuses of the rating shown on the drawings. 1.0 service factor motors shall be protected by BUSSMANN LOW-PEAK Dual-Element Fuses LPN RK (250 volts) or LPS-RK (600 volts) installed in rating approximately 115% of the motor full load current except as noted above. The fuses shall be UL Class RK1 or L.
- 8.6 Circuit breaker panels shall be protected by BUSSMANN LOW-PEAK Dual Element fuses LPN-RK (250 volts) or LPS-RK (600 volts) as shown on the drawings. The fuses shall be UL Class RK1.

PART 9 - DISTRIBUTION TRANSFORMERS:

Designer Note: Keep for HCA projects ONLY.

- 9.1 In addition to the approved manufacturers for Electrical Distribution Equipment, the following manufacturers are approved for Distribution Transformers only: Olsun Electrics Corporation, Powersmiths.
- 9.2 The Contractor shall provide dry-type transformers with kVA ratings as indicated on the electrical plans.
- 9.3 Three phase transformers are to have 480 volt Delta primary and 120/208V/3 ϕ /4W secondary. Transformers larger than 10kVA are to be supplied with 2-2½% full capacity taps above and 4-2½% full capacity taps below primary voltage. Transformers smaller than 10kVA are to be supplied with 2-5% full capacity taps below primary voltage. Exceptions to the above will be shown on the electrical plans.
- 9.4 Transformers shall have Class 220 insulation and shall have the ability to carry a continuous 15% overload without exceeding a 150°C rise above 40° ambient.
- 9.5 Transformer coils shall be vacuum impregnated with non-hygroscopic, thermosetting varnish. Each layer shall have end fillers or tie downs to provide maximum mechanical strength. Insulation systems and their construction techniques shall be listed by Underwriters Laboratories.
- 9.6 Transformer coils shall have a final wrap of electrical insulating material designed to prevent injury to the coil wire. Transformers having coils with magnet wire visible will not be acceptable.
- 9.7 All cores to be manufactured from a high grade, non-aging, silicon steel with high magnetic permeabilities, low hysteresis and eddy current losses. Magnetic flux densities are to be kept well below saturation to allow for a minimum of 10% over voltage excitation. The cores shall be clamped with structural angles (formed angles not acceptable) and bolted to the enclosure to prevent damage during shipment or rough handling.
- 9.8 The core and coil unit shall be completely isolated from the enclosure by means of a vibration isolating system and shall be so designed as to provide for continual securement of the core and coil unit to the enclosure. Sound isolating systems requiring the removal of all tie down facilities will not be acceptable.
- 9.9 Transformers 15 KVA thru 45 KVA shall be provided with interchangeable mounting for floor or wall.
- 9.10 The maximum top of case temperature shall not exceed 35°C above ambient.
- 9.11 The entire transformer enclosure shall be degreased, cleaned, phosphatized, primed and finished with baked enamel. Air dry finishes will not be accepted.
- 9.12 The core and coils shall be visibly grounded to the frame of the transformer cubicle by means of a flexible grounding strap of adequate size.
- 9.13 Sound levels shall be guaranteed by the manufacturer and substantiated by certified tests on each unit furnished. The sound levels are not to exceed the following values: 10 to 45 kVA - 42 dB; 75 to 150 kVA - 47 dB; 225 to 300 kVA - 52 dB; 500 kVA - 57 dB; 750kVA - 61 dB.
- 9.14 All transformers shall have copper windings.

PART 10 - CONTACTORS:

10.1 GENERAL

- 10.1.1 Contactors shall be continuously rated at the specified amperes per pole for all types of ballast and tungsten lighting, resistance and motor load. Contactors shall have totally enclosed, double-break silver-cadmium-oxide power contacts. Auxiliary arcing contacts will not be acceptable. Contact inspection and replacement shall be possible without disturbing line or load wiring. Contactors shall have straight-through wiring with all terminals clearly marked. Contactors shall have a gasketed NEMA Type 1 (NEMA 12 for electrically-held) enclosure, unless otherwise noted or required.
- 10.1.2 Contactors shall be approved per UL 508 and/or CSA, and be designed in accordance with NEMA Standards. They shall be industrial-duty rated for applications to 600 volts maximum. I.E.C.-style contactors are not acceptable.
- 10.1.3 Contactors shall have provisions for factory or field addition of:
 - 10.1.3.1 Four N.O. or N.C. auxiliary contacts rated 6 amperes continuous at 600 volts.
 - 10.1.3.2 Single or double circuit, N.O. or N.C., 30 or 60 ampere 600 volt power-pole adder.
 - 10.1.3.3 Control-circuit fuse holder, one or two fuses.
 - 10.1.3.4 0.2-60 second adjustable interval timer attachment, if so indicated on plans.
 - 10.1.3.5 Transient-suppression module for coil control circuit. Coil control to be 120 volts. Provide circuit or step-down transformer.

10.2 MECHANICALLY HELD LIGHTING CONTACTORS

- 10.2.1 Coil-clearing contacts shall be supplied so that the contactor coils shall be energized only during the instance of operation. Both latch and unlatch coils shall be encapsulated. Coils shall be rated for 120 volt operation.
- 10.2.2 Lighting contactors shall be Asco #917 or equivalent.

PART 11 – POWER SYSTEM STUDIES:

11.1 GENERAL

- 11.1.1 Provide power system studies as specified in this section. The studies shall be performed with the aid of a computer program and shall be in accordance with the latest applicable IEEE and ANSI standards. For computer software, use the most recent version of SKM power tools for windows or approved equal.
- 11.1.2 Provide reports for all studies. Reports shall be submitted as shop drawings to the engineer prior to ordering equipment. Any equipment submitted prior to submission of the reports will not be reviewed. Note: If the final studies (based on actual project conditions) cannot be completed in time to meet project schedule requirements, then preliminary studies may be submitted based on worst-case project conditions (estimated wire lengths, infinite-buss transformer calculations, etc.). Final studies are still required to be completed and submitted after the exact project conditions are determined and prior to substantial completion.
- 11.1.3 Reports shall include a detailed description, purpose, basis and scope of the study. Reports shall include single line diagram. Protective device time versus current coordination curves, circuit breaker

and fuse selection with commentary regarding any component shall be provided for each section.

11.1.4 Recommended size for power fuses and recommended settings for ground fault relays and for all adjustable trip relays/breakers shall be provided.

11.1.5 The equipment manufacturer shall provide the services of a qualified field engineer and necessary tools and equipment to test and calibrate the protective relays, ground fault relays and circuit breaker trip devices as recommended by the studies. Field settings of devices, adjustments, upgrading and modifications to the new equipment to accomplish conformance with the accepted studies shall be provided out by the Contractor. The Contractor shall be responsible for modifying settings on existing equipment only at the nearest existing over-current protection device which serves new equipment. All settings shall be adjusted per the studies prior to substantial completion.

11.1.6 Equipment shall not be energized until all breakers or protective relays are set either to the recommended values indicated by the studies or to minimum trip settings.

11.1.7 All equipment labels shall be affixed prior to final punch or final electrical inspections.

11.2 COORDINATION STUDY

11.2.1 Provide a complete coordination study for equipment on this project. Study shall include all new over-current protection devices on the project and shall extend to the main lugs or breaker of the furthest new device downstream. For renovations, extend the study to one level of existing overcurrent devices upstream of the last new device on each radiating branch.

11.2.2 All new breakers on the emergency power system (all branches) and ATS feeder breakers in normal power switchboard shall be selectively coordinated to 0.1 seconds per NEC (NFPA-70) #700.25. Equipment indicated on plans is the basis of design - other manufacturers listed as equals may need to modify layouts and equipment in order to meet this requirement. All manufacturers must utilize electronic trip breakers with adjustable trip settings where required to meet selective coordination requirements.

11.2.3 Where modification to equipment indicated on these drawings is required in order to achieve coordination, these changes shall be clearly noted in the study. Where actual breaker ampacities are increased to achieve coordination, the Contractor is responsible for including all cost associated with these changes in their bid (including increases in feeder sizes).

11.2.4 Study report shall include the following for each overcurrent device:

11.2.4.1 Ampere rating

11.2.4.2 Interrupting ampere rating

11.2.4.3 Frame size, sensor or plug rating

11.2.4.4 Trip settings

11.2.4.5 Fault available at line terminals

11.2.4.6 Ground fault trip settings

11.2.4.7 Type of cable, cable size

11.2.5 Include plots that show the entire path from the largest breaker in each panel to the source(s) on a common graph. Curves shall also include but not be limited to the following information on 8.5x11 log-log graph paper.

11.2.5.1 Cable damage curves for all feeders (Florida projects only).

11.2.5.2 Generator decrement, damage and protective relay curves.

11.2.5.3 Transformer inrush currents and damage curves with inrush value set to 8.

11.2.6 A coordinated system of over-current devices that provide for the isolation of fault and over-current

conditions to the over-current device located electrically closest to the fault or over-current shall be provided. The coordination shall extend from 0 to 10,000 seconds.

11.3 FAULT CURRENT STUDY

11.3.1 Provide a complete fault current study for equipment on this project. Study shall include all power distribution equipment on the project and shall extend to the main lugs or breaker of the furthest device downstream.

11.3.2 Service equipment shall be field-marked with the maximum available fault current at the equipment. Apply an engraved lamacoid label similar to equipment label detailed on drawings.

11.4 ARC FLASH STUDY

11.4.1 Provide a complete arc flash analysis for equipment on this project. Study shall include all power distribution equipment on the project and shall extend to the main lugs or breaker of the furthest device downstream.

11.4.2 Provide all arc flash labels, warning signage, etc. as recommended by NFPA 70E. Labels shall include, at a minimum, an arc flash hazard warning, the incident energy at that location, the arc flash boundary, the level of PPE required, safe approach distances, safe working distances, and any other information recommended or required per NFPA 70E and the NEC. Provide pressure sensitive vinyl sign indoors and 30-gauge baked enamel sign outdoors.

11.4.3 Where an overcurrent device is provided with arc flash reduction provisions, an additional complete arc flash label shall be provided which indicates the arc flash hazard, PPE requirements, incident energy, etc. when the arc flash reduction provisions are implemented. The label shall also indicate the location and type of the arc flash reduction provisions for each device affected.

11.5 QUALIFICATIONS

11.5.1 The electrical distribution equipment manufacturer shall perform the studies and prepare a complete and detailed report.

11.5.2 The firm performing the studies should be currently involved in high- and low-voltage power system evaluation. The studies shall be performed, stamped and signed by a registered professional electrical engineer.

11.5.3 A minimum of ten (10) years experience in power system analysis is required for the individual in charge of the studies.

11.5.4 The firm performing the studies should demonstrate capability and experience to provide assistance during start up as required.

PART 12 - TESTING:

12.1 Test all new equipment buss voltages and terminal device voltages. Test all lugs for proper torque. Voltages shall be within 2% of nominal for feeders and 3% of nominal for branch circuits. Inspect and record all transformer tap values. Transformer taps shall be adjusted as required to achieve proper voltages. Include all results in a report to be submitted to the engineer.

END OF SECTION.

DIVISION 26 - ELECTRICAL

SECTION 262726 - WIRING DEVICES AND PLATES

PART 1 – GENERAL:

- 1.1 This section of the specifications includes wiring devices, cover plates, weatherproof and dust-tight closures, communications devices and floor outlets.
- 1.2 Wiring devices are listed by manufacturer and catalog numbers to establish the quality and type required. Equivalent devices of other manufacturers will be acceptable with prior approval of the Engineer. Submit cutsheets and/or samples of each type ten days prior to bid date for review and written approval to bid. Insofar as possible, standard application or special application devices shall be by one manufacturer.

PART 2 – MATERIALS:

TYPE	RATING	CONFIGURATION	COLOR	VENDOR - CAT. #
RECEPTACLE - DUPLEX PREMIUM GRADE	125V, 20A	NEMA 5-20R	*	HUBBELL 5362 GE 5362 LEVITON 5362
RECEPTACLE - DUPLEX G.F.I.	125V, 20A	NEMA 5-20R	*	HUBBELL GF-5352 GE GF-5342 LEVITON 6898
RECEPTACLE, DUPLEX AND DUAL USB	125V, 20A, 3A USB	NEMA 5-20R	*	HUBBELL USB 20 X 2 LEVITON OR P & S Equal
G.F.C.I. DEVICE - NO RECEPTACLE	125V, 20A		*	HUBBELL GFR8300 (FOR HEALTHCARE FACILITIES) OR HUBBELL GFBF20 (FOR OTHER FACILITIES)
RECEPTACLE - SIMPLEX	125V, 20A	NEMA 5-20R	*	HUBBELL 5361
RECEPTACLE - DUPLEX, SAFETY TYPE, TAMPER- RESISTANT RATED (WITH TAMPER-RESISTANT SCREWS)	125V, 15A	NEMA 5-15R	*	HUBBELL SG-62H - NO SUBSTITUTIONS
RECEPTACLE, DUPLEX NEON PILOT FACE-RED	125V, 15A	NEMA 5-15R	*	HUBBELL 5262-LHR GE 5362-LHR LEVITON 5362-LHR
RECEPTACLE, SIMPLEX WITH CLOCK HANGER TAB, STAINLESS STEEL PLATE	125V, 15A	NEMA 5-15R	METAL	HUBBELL 5235 LEVITON 658-BR ARROW-HART 5760

RECEPTACLE, DUPLEX ISOLATED GROUND (WITH ORANGE LEGEND PLATE)	125V, 20A	NEMA 5-20R	ORANGE	HUBBELL IG-5362 GE 5362-IG LEVITON 5362-IG
RECEPTACLE, DUPLEX HOSPITAL GRADE (TO BE USED IN ALL PATIENT CARE AREAS, PER N.E.C., ART. 517)	125V,20A	NEMA 5-20R	*	HUBBELL 8200H GE 8200 LEVITON 8200 HUBBELL 8300H GE 8300 LEVITON 8300
RECEPTACLE, DUPLEX RED COLOR NYLON FACE (FOR EMERGENCY POWER OUTLETS)	125V, 20A	NEMA 5-20R	RED	HUBBELL 5352-RDB GE 5362-RDB LEVITON 5362-RDB
RECEPTACLE, DUPLEX ISOLATED GROUND WITH SURGE SUPPRESSION, INCLUDING INDICATOR LIGHT	125V, 20A	NEMA 5-20R	BLUE DEVICE OR BLUE COVER PLATE	HUBBELL 5250S LEVITON 5380 ARROW-HART 5362
RECEPTACLE, SINGLE	250V, 20A	NEMA 10-20R	BLACK	HUBBELL 6810 GE 4124 LEVITON 5032
RECEPTACLE, SINGLE	250V, 30A	NEMA 6-30R	BLACK	HUBBELL 9330 GE 4139 LEVITON 5372
RECEPTACLE, SINGLE	250V, 50A	NEMA 6-50R	BLACK	HUBBELL 9367 GE 4141 LEVITON 5374
SWITCH, SINGLE POLE	120/277V, 20A	SPST	*	HUBBELL 1221 GE 5951 LEVITON 1221
SWITCH, SINGLE POLE - RED TOGGLE (FOR EMERGENCY LIGHTING CONTROL)	120/277V, 20A	SPST	RED	HUBBELL 1221-RDB GE 5951-RDB LEVITON 1221-RDB
SWITCH, THREE-WAY	120/277V, 20A	3-WAY	*	HUBBELL 1223 GE 5953 LEVITON 5953
SWITCH, FOUR-WAY	120/277V, 20A	4-WAY	*	HUBBELL 1224 GE 5954 LEVITON 5954
SWITCH, KEYED	120/277V, 20A	SPST	N/A	HUBBELL 1221-L GE 5951-L LEVITON 1221-L

SWITCH, KEYED	120/277V, 20A	3-WAY	N/A	HUBBELL 1223-L GE 5953-L LEVITON 1223-L
SWITCH, KEYED	120/277V, 20A	4-WAY	N/A	HUBBELL 1224-L GE 5954-L LEVITON 1224-L
<p><u>NOTE:</u> SWITCH, KEYED TO <u>EACH</u> BE FURNISHED WITH ONE HUBBELL #1209 KEY. TURN OVER TO OWNER AT CLOSE OF PROJECT AND OBTAIN RECEIPT FOR VERIFICATION THAT KEYS HAVE BEEN DELIVERED.</p>				
SWITCH, MOMENTARY, 3-POSITION, CENTER OFF SWITCH, PILOT (TOGGLE LIT IN OFF POSITION)	120/277V, 20A (VERIFY VOLTAGE USED)	SPDT	*	HUBBELL 1221 GE EQUIVALENT LEVITON EQUIVALENT
SWITCH, PILOT (TOGGLE LIT IN OFF POSITION)	120/277V, 20A (VERIFY VOLTAGE USED)	SPDT OR AS NOTED	CLEAR "LEXAN"	HUBBELL 1221 GE EQUIVALENT LEVITON EQUIVALENT
SWITCH, ILLUMINATED (TOGGLE LIT IN ON POSITION)	120/277V, 20A (VERIFY VOLTAGE USED)	SPST OR AS NOTED	CLEAR "LEXAN"	HUBBELL 1221-PL7 GE EQUIVALENT LEVITON EQUIVALENT
TIMER SWITCH	120V	SPST, 15 MINUTE	*	NUTONE VS63 GE EQUIVALENT LEVITON EQUIVALENT

NOTES:

1. PROVIDE MATCHING CAP (PLUG) FOR ALL RECEPTACLES 30 AMP RATED AND ABOVE AS REQUIRED FOR EQUIPMENT
2. ALL RECEPTACLES SHALL BE BACK OR SIDE-WIRED, CLAMPING TYPE
3. OUTDOOR RECEPTACLES SHALL BE WEATHER-RESISTANT RATED, GFCI TYPE, WITH WEATHER-PROOF ENCLOSURE AS LISTED IN THESE SPECIFICATIONS.
4. ALL RECEPTACLES INSTALLED THE FOLLOWING LOCATIONS SHALL BE GFCI TYPE: BATHROOMS, ROOFTOPS, OUTDOORS, W/IN 6' OF SINKS (EXCEPT AT PATIENT ROOM HEADWALLS), MECHANICAL AND JANITOR ROOMS, GARAGES, MAINTENANCE SHOPS, LOCKER ROOMS WITH SHOWERS, WHERE READILY ACCESSIBLE IN KITCHENS.
5. ALL WIRING DEVICES IN PATIENT CARE AREAS SHALL BE HOSPITAL GRADE PER NEC 517.

Designer Note: Use for HCA projects ONLY. Delete note 5 above.

6. ALL WIRING DEVICES, IN ALL AREAS SHALL BE HOSPITAL-GRADE, WHETHER IN PATIENT CARE AREAS OR NOT.
7. EQUIVALENT DEVICES TO THOSE SPECIFIED, FROM THE FOLLOWING MANUFACTURERS, WILL BE ACCEPTED: PASS & SEYMOUR, LEVITON, COOPER, LEGRAND. ALL DEVICES SHALL BE FROM A SINGLE MANUFACTURER IN-SO-FAR AS POSSIBLE.

* SEE ARTICLE 3, COLOR.

2.2 Small Motor Control Switches:

- 2.2.1 For small line-to-neutral motor loads of 3/4 HP or less, single phase, rated at 120 or 277 volts, provide snap-type, H.P. rated motor starter switch without thermal overloads. Provide with NEMA 1, NEMA 3R or other enclosure suitable for the location and atmosphere. All manual starters in finished areas shall be in flush-mounted enclosures. If the motor to be controlled is not equipped with internal thermal overload protection, overload heaters sized to match the motor nameplate amperes and the ambient temperature shall be provided. Provide Square D Class 2510 or equal.

PART 3 – COLOR:

- 3.1 Color of devices shall be as selected by the Architect. Samples (devices, plates or both) may be required to be submitted with other architectural color items by the Contractor. The Contractor shall coordinate any such submission required with other trades, the Prime Contractor or as needed.
- 3.2 Where devices are connected to emergency power from a standby source, the device color shall be red, as with switch toggles or receptacle fronts.

PART 4 - PLATES AND COVERS:

Designer Note: Choose One (*). Use nylon for HCA projects, stainless for behavioral.

- 4.1 (*) Unless otherwise specified or noted, all wiring device plates and covers shall be smooth high-impact nylon - Hubbell "P" Series or equivalent G.E. or Leviton. Color shall match device unless otherwise indicated.

- 4.2 (*) Unless otherwise specified or noted, all wiring device plates and covers shall be 302 stainless steel –Hubbell “SS” Series or equivalent G.E. or Leviton.
- 4.3 All kitchen, gymnasium, mechanical/electrical room, central plant, central sterile, materials management and food service area plates shall be 302 stainless steel - Hubbell “SS” Series or equivalent G.E. or Leviton.
- 4.4 Cover plates shall be of one manufacture insofar as possible.
- 4.5 Weatherproof covers for exterior receptacles shall be cast aluminum, self-closing, gasketed, suitable for standard box mounting, U.L. listed for wet location use, while in-use rated. Vertical mount shall be Leviton #M5979-GY, horizontal mount shall be Leviton #M5999-GY.
- 4.6 Weatherproof switch plates for toggle-handle switches shall be clear silicone rubber, for standard outlet boxes. Hubbell 1795 or equivalent G.E., or Leviton.
- 4.7 Weatherproof switch plates for keyed switches shall be cast-aluminum with hinged, gasketed cover, for standard outlet boxes. Hubbell HBL7420 or equivalent G.E., or Leviton.
- 4.8 All coverplates for wiring devices connected to emergency power circuits shall be red thermoplastic unless stainless steel coverplates are used. Where normal and emergency devices are ganged under a common plate, the plate shall be the color of normal power plates.

PART 5 - STANDARD FLOOR BOXES AND POKE-THRUS

- 5.1 Recessed floor boxes to be used flush in concrete floors shall be of one-piece cast iron construction, deep style, fully adjustable. Provide Wiremold Resource #RFB Series or equivalent for up to four gangs. Provide Wiremold Evolution #EFB Series or equivalent for larger than four gangs.
- 5.2 Recessed floor boxes to be used in raised/suspended slabs shall be fire-rated, poke-thru style devices. Provide Wiremold Evolution #6ATC Series or equivalent for up to two and one-half gangs. Provide Wiremold Evolution #8ATC Series or equivalent for three or four gangs.
- 5.3 Provide number of gangs as indicated on plans. Multiple-gang boxes shall be provided with removable partitions between each section in accordance with N.E.C.
- 5.4 In general, all cover plates for floor boxes shall be flush metal. Provide number of gangs as listed on plans.
- 5.5 Furnish floor boxes with threaded hubs as required to suit conduit routings, 3/4" minimum.
- 5.6 Furnish carpet flanges for all boxes installed in carpeted areas. Furnish cover for all devices within box.
- 5.7 Floor outlet boxes shall be installed dead level flush with wood, VCT, concrete or other hard surface type floor. Furnish special stop trims for terrazzo where required.
- 5.8 Outlets within floor boxes shall be as specified elsewhere in these specifications.
- 5.9 Finishes and colors shall be as selected by Architect.

PART 6 – INSTALLATION:

- 6.1 All wiring devices in dusty areas, exposed to weather and moisture shall be installed in Type "FS" or similar conduit fittings having mounting hubs, with appropriate cover plates.
- 6.2 Devices that have been installed before painting shall be masked. No plates or covers shall be installed until all finishing and cleaning has been completed.
- 6.3 Provide G.F.C.I. duplex feed-thru style receptacles where indicated or required by the National Electrical Code, whether specifically called out or not. When a G.F.C.I. receptacle is on a circuit with other non-G.F.C.I. receptacles, it shall NOT be wired to ground-fault interrupt power to the downstream outlets on that circuit unless specifically indicated to the contrary.
- 6.4 Where surge suppression outlets are provided, they shall be ANSI Category "A" style. They shall be installed as dedicated-circuit outlets or where indicated with multiple outlets on a circuit, they shall be placed at the homerun point of that circuit and feed-thru wired to protect the downstream outlets on that circuit.
- 6.5 All receptacles shall be installed with ground prong at **top** position.
- 6.6 All outlets not provided with wiring devices shall be closed with a blank plate matching other plates in the area.
- 6.7 All receptacles indicated as weather-proof shall be weather-resistant rated, G.F.C.I. protected, and provided with in-use weather-proof covers as listed in this specification.

END OF SECTION.

DIVISION 26 - ELECTRICAL

SECTION 264313 - SURGE SUPPRESSION SYSTEMS

PART 1 - GENERAL

- 1.1 This section describes the materials and installation requirements for Surge Protective Devices (SPDs), formerly TVSS, for the protection of AC electrical circuits.
- 1.2 Each Contractor's attention is directed to Section, GENERAL PROVISIONS-ELECTRICAL and all other contract documents as they may apply to their work.

PART 2 - SCOPE OF THE WORK

- 2.1 The Contractor shall provide the necessary labor, materials, wiring and services necessary to provide the complete electrical surge protection systems as specified herein. This work shall include, but is not necessarily limited to:
- 2.2 Provision of Surge Suppression Units at certain points in the power distribution network and on telephone and television service lines.
- 2.3 Proper installation of surge suppression unit(s), in accordance with shop drawings. Wiring routing, grounding and all connections shall be in exact accordance with manufacturer's recommendations.

PART 3 - QUALITY ASSURANCE

- 3.1 STANDARDS – Most Recent Edition of
 - 3.1.1 Underwriters Laboratories: UL1449, 3RD Edition
 - 3.1.2 ANSI/IEEE C62.41.1-2002, C62.41.2-2002, C62.45-2002
 - 3.1.3 National Electrical Code: Article 285
- 3.2 Manufacturer shall be regularly engaged in production of surge protection equipment of types, sizes and ratings required, whose products have been satisfactorily used in similar service for not less than three years.
- 3.3 LISTING REQUIREMENTS: Comply with NEC and NFPA requirements, as applicable to materials and installation of surge protection components and wiring. Surge protection equipment shall be UL listed and labeled for its intended use. "Manufactured in accordance with" is not equivalent to UL listing and does not meet the intent of this specification. Where applicable, equipment shall comply with ANSI standards for such equipment. All equipment shall be tested per IEEE testing standards listed in this section.
- 3.4 SPECIAL NOTE: The physical routing, length, and connections of the unit's phase, neutral and ground conductors are critical to the performance of surge suppression units. Provide direct buss-connected SPD's wherever possible. Where wiring is required, all wiring shall be installed by the manufacturer prior to shipping equipment and total lead impedance shall not exceed the impedance of 18" of #8 AWG copper conductors.

PART 4 - SUBMITTALS

- 4.1 Product Data: Submit manufacturer's data on surge protection systems and components as part of shop drawing submissions. Indicate all capacity ratings, clamp times, maximum capacities, physical construction and listing agency approvals. Submittals shall include UL 1449, 3rd Edition Listing documentation verifying:
 - 4.1.1 Short Circuit Current Rating (SCCR).
 - 4.1.2 Voltage Protection Ratings (VPRs) for all modes.
 - 4.1.3 Maximum Continuous Operating Voltage rating (MCOV). The MCOV shall be a tested value per UL1449 3rd Edition, section 37.7.3. MCOV values bases solely on the components used in the construction of the SPD will not be accepted.
 - 4.1.4 I-nominal rating (I-n).
Type 1 or Type 2 Device Listing.
 - 4.1.5 Manufacturer shall provide written test report showing the SPD can survive a single surge at its rated value without the use of circuit breakers or fuses.
 - 4.1.6 kA rating per phase.
 - 4.1.7 kA rating per mode.
- 4.2 Submittals shall also include the following:
 - 4.2.1 Line drawings detailing dimensions and weight of enclosure.
 - 4.2.2 Listing and rating of all modes of protection in each type of SPD required.
 - 4.2.3 Breaker sizes used for SPD service disconnects.
 - 4.2.4 Wiring diagram showing all manufacturer installed wiring including wire size, type, routing, and exact length of conductors.
 - 4.2.5 Listing of equipment where each type of SPD is installed.
 - 4.2.6 Maintenance Data: Submit maintenance instructions for surge suppression system. Include this data in Operation and Maintenance manuals.

PART 5 – ACCEPTABLE MANUFACTURERS

- 5.1 Available Manufacturers: Subject to compliance with requirements, the manufacturer providing panelboards and/or switchgear on this project may also provide SPD's. Other acceptable manufacturers are Liebert and Current Technologies.

PART 6 – PRODUCTS

6.1 GENERAL

- 6.1.1 Provide UL listed and labeled lightning and transient surge protection devices (SPD's), installed where shown on the drawings and in accordance with the manufacturer's recommendations. The surge protection devices shall be shunt type and poly-phase, with the ability to conduct high energy transients from line to neutral and neutral to ground.

- 6.1.2 SPD shall be UL labeled with 200kA Short Circuit Current Rating (SCCR). Fuse ratings shall not be considered in lieu of demonstrated withstand testing of SPD, per NEC 285.6.
- 6.1.3 Internal Device Overcurrent Protection (Fusing): All protection modes (including Neutral to Ground) of each surge suppression device shall be internally fused at the component level with fuse I²T capability allowing the suppressor's maximum rated transient current to pass through the suppressor without fuse operation. If the rated I²T characteristic of the fusing is exceeded, the fusing shall be capable of opening in less than one millisecond and clear both high and low impedance fault conditions. The fusing shall be capable of interrupting up to 200kA symmetrical fault current with 600 VAC applied. This overcurrent protection circuit shall be monitored, to provide indication of suppression failure. Conductor level fuses or circuit breakers internal or external to the surge suppression units are not acceptable as meeting this requirement.
- 6.1.4 SPD shall be UL labeled as Type 1 or Type 2, intended for use without need for external or supplemental overcurrent controls. Every suppression component of every mode, including N-G, shall be protected by internal overcurrent and thermal over-temperature controls.
- 6.1.5 Each MOV shall be individually fuse-protected to avoid cascading faults. This shall be certified by Manufacturers letter of compliance.
- 6.1.6 SPD shall be UL labeled with 20kA nominal (I-n) (verifiable at UL.com) for compliance with UL 96A Lightning Protection Master Label and NFPA 780.
- 6.1.7 SPD shall provide surge current paths for all modes of protection: L-L, L-N, L-G, and N-G for Wye systems; L-L, L-G in Delta and impedance grounded Wye systems.
- 6.1.8 UL 1449, 3rd Edition Listed Voltage Protection Ratings (VPRs) shall not exceed the following:

<u>System Voltage</u>	<u>L-N</u>	<u>L-G</u>	<u>L-L</u>	<u>N-G</u>
208Y/120	700V	700V	1200V	700V
480Y/277	1200V	1200V	1800V	1200V

Note : Numerically lower values are allowed/preferred; out-dated Suppressed Voltage Ratings (SVRs) shall not be submitted.

- 6.1.9 UL 1449, 3rd Edition Listed Maximum Continuous Operating Voltage (MCOV):

<u>System Voltage</u>	<u>Allowable System Voltage Fluctuation (%)</u>	<u>MCOV</u>
208Y/120	25%	150V
480Y/277	15%	320V

- 6.1.10 SPD enclosures shall be surface-mounted in mechanical spaces, flush-mounted for units in finished areas, or as noted. Provide in a NEMA 1 gasketed or NEMA 12 enclosure with hinged front panel. Where devices are indicated on drawings to be recessed, provide with flush enclosure for recessed mounting. Units may be provided integral to switchgear where possible.
- 6.1.11 Where separately mounted, SPD's shall be installed above or below equipment being protected to minimize lead length.
- 6.1.12 For each SPD, provide unit function status indicators. These indicators may be mounted in the face of the equipment panel or remotely, immediately adjacent to the panel. Provide minimum one green L.E.D. per phase illuminated for normal operation, red L.E.D. for trouble/fault or reduction of surge suppression capacity.

6.1.13 Proposed substitutions for the manufacturer's model numbers listed here shall meet or exceed the current published performance data for the units listed, and shall be submitted to the Engineer ten working days prior to bid for review.

6.2 MAIN SERVICE SWITCHBOARD SURGE SUPPRESSION

6.2.1 Main service entrance switchboard units shall be installed as indicated on the contract documents and shall be heavy duty type. All units shall be 3 phase, 4 wire and shall have the following surge current capability (single pulse rated): Line to Neutral 200,000 amperes; Line to Ground 200,000 amperes; Line to Line 200,000 amperes; and Neutral to Ground 200,000 amperes. Per phase surge current rating shall be 400kA minimum. All MOV's shall be individually fused. The unit shall have a NEMA designed and certified safety interlocked integral disconnect switch with an externally mounted manual operator.

6.2.2 Provide an audible alarm with silence switch to alarm at unit on malfunction. Provide a surge counter for each unit to indicate each suppression operation of the unit. Provide with self-diagnostic test function.

6.2.3 Provide integral fused disconnecting means for each surge protection device. Integral disconnect shall be able to withstand the single surge rating of the SPD.

6.2.4 Provide 100A circuit breaker in switchboard being protected for unit disconnecting means. Utilize #1/0 AWG wire for connection to switchboard. Maximum wire length is three feet.

6.2.5 SPD shall be UL labeled as Type 1, intended for use without need for external or supplemental over-current controls.

6.2.6 ANSI/IEEE C3 wave repetitive surge withstand capabilities: 12,000 strikes.

6.3 BRANCH AND DISTRIBUTION PANELBOARD SURGE SUPPRESSION

6.3.1 Branch and distribution panelboard units shall be installed as indicated on the contract documents and shall be as manufactured by distribution equipment manufacturer. All units shall be 3 phase, 4 wire and shall have the following surge current capability (single pulse rated): Line to Neutral 100,000 amperes; Line to Ground 100,000 amperes; Line to Line 100,000 amperes; and Neutral to Ground 100,000 amperes. Per phase surge current rating shall be 200kA minimum. All MOV's shall be individually fused.

6.3.2 Provide 60A circuit breaker in panel being protected for unit disconnecting means. Utilize #3 AWG wire for connection to panelboard. Maximum wire length is three feet.

6.3.3 SPD shall be UL labeled as Type 1 or Type 2.

6.3.4 ANSI/IEEE C3 wave repetitive surge withstand capabilities: 10,000 strikes.

6.4 TELEPHONE AND TELEVISION SURGE SUPPRESSION

6.4.1 As a part of this section of work, the Contractor shall provide U.L. listed lightning and surge arrestors on the incoming telephone, video, and television service lines.

6.4.2 Arrestors shall be U.L. listed, properly grounded per N.E.C., and shall be located at the service entrance points for each cable. Also provide surge arrestors of the proper type for copper cables that are installed between buildings by the Contractor.

- 6.4.3 Arrestors for telephone lines shall be RJ-45 in/out, complete with RJ-45 jumpers as needed. Provide quantity as required, connecting one to each phone line. Provide two spare units to Owner for future use.
- 6.4.4 Arrestors for coaxial lines shall be 25 to 250 MHZ on cable T.V. lines (with BNC jacks in/out or as required by antenna connectors).
- 6.4.5 Provide a ground lug for individual surge suppression unit installations, with the recommended ground wire size routed back to the building main electrical ground.
- 6.4.6 Where multiple surge suppression units are installed, as at service entrance locations, provide a ground bar, copper with multiple tapped holes and a properly sized ground lead routed back to the building main electrical ground.

PART 7 - EXECUTION

- 7.1 Installation of Surge Protection Systems:
 - 7.1.1 Install surge protection systems as indicated and in accordance with equipment manufacturer's written instructions, in compliance with applicable requirements of NFPA, local prevailing codes and with UL lightning and power surge protection standards to ensure that surge suppression systems comply with requirements.
 - 7.1.2 Coordinate with other work, including electrical wiring work as necessary to interface installation of units.
 - 7.1.3 Install conductors with direct, shortest possible phase, neutral and ground paths from all in/out connections, avoiding sharp bends and narrow loops.
 - 7.1.4 Install surge suppression units as close as practical to equipment they are protecting. Install appropriate units at main electrical service entrance equipment and secondary branch panelboards as indicated.
 - 7.1.5 Suppressors shall be installed such that conductor lengths are no more than three feet to panel connections.
 - 7.1.6 Refer to the drawings for installation of individual surge suppression devices to protect branch circuits. Also see Section, WIRING DEVICES AND PLATES for (receptacle type) device requirements. All receptacle type surge suppression units shall be wired as feed-thru type, to protect all downstream outlets on that branch circuit unless otherwise indicated.
 - 7.1.7 Where devices are indicated on drawings to be recessed, provide with flush enclosure for recessed mounting.
 - 7.1.8 Provide owner with two spare module units for each type and voltage of SPD employed.

PART 8 - WARRANTIES

- 8.1 All surge suppression equipment shall be unconditionally warranted by the Contractor for a period of ten years from the date of substantial completion. If longer manufacturer's warranties are offered, they shall be made available to the Owner. Note these extended warranties in the Operations and Maintenance Manuals.

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Behavioral Health Program Expansion
West Palm Beach, Florida

SHA HCA1609
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END OF SECTION

DIVISION 26

SECTION 270100 - STRUCTURED VOICE AND DATA CABLING INFRASTRUCTURE

PART 1 - GENERAL:

1.1 SUMMARY

1.1.1 Section Includes: Equipment, materials, labor, and services to provide telephone and data distribution system including, but not limited to:

- Cable raceway, boxes, and cable tray.
- Telephone and data cabling terminations.
- Optical fiber and terminations.
- Telecommunications outlets.
- Terminal blocks/cross-connect systems.
- Equipment racks and cabinets.
- System testing and administration.
- Documentation and submissions.

1.1.2 Supply and install a complete Belden Structured Cable System for this construction project at the hospital facility, consisting of the following components:

1.1.3 Belden Structured Cabling System Components:

- Plenum rated 8 micron single mode fiber optic backbone cable.
- Plenum multi-pair voice distribution backbone cable.
- Plenum rated horizontal Unshielded Twisted Pair (UTP) Category 6 cable for voice and data applications.
- Fiber and Copper termination hardware.
- Modular Category 6 patch panels.
- Category 6 connectors, jacks and faceplates.
- Equipment racks, cable tray, ladder rack and wire supports.

1.1.4 Pre-qualified bidders for these low voltage systems are listed below.

- James Kwiatkowski - FiberPlus Inc.- P 804-212-2798
- Tom Banks – MTS Services - (910) 332-3929
- Lynn Neely – Seacom – 804-262-0052

1.1.5 Questions with regard to this section shall be directed to the facility IT&S Manager. or Tim Flannagan Accu-tech tim.flannagan@accu-tech.com 800-227-0628 ext for help with materials. Refer to Paragraph 1.8.B.2 for contact information.

1.1.6 Work not included:

1.1.6.1 The following work will be done by others:

- Offsite services.
- Providing data concentrators, hubs, servers, computers, and other active devices.
- Telephone switch (PBX) and handsets.

1.1.7 Painting will be done by the General Contractor.

1.1.8 The contractor is required to utilize the pricing sheets at the end of this specification identified as

“Attachment A”.

1.2 RELATED WORK – Where applicable, refer to drawings and specifications:

1.2.1 Raceways & Fittings.

1.2.2 CATV/Video.

1.2.3 Wiring Devices & Plates.

1.2.4 Paging/Intercom Systems.

1.2.5 Employee Timeclock.

1.2.6 CCTV/Security Cameras.

1.2.7 Nurse Call Systems.

1.3 REFERENCES

1.3.1 Design, manufacture, test, and install telecommunications cabling networks per manufacturer's requirements and in accordance with NFPA70 (*National Electrical Code*®), state codes, local codes, requirements of authorities having jurisdiction, and particularly the following standards:

1.3.1.1 ANSI/NECA/BICSI568 - Standard for Installing Commercial Building Telecommunications Cabling.

1.3.1.2 ANSI/TIA/EIA Standards:

- ANSI/TIA/EIA568B.1 Commercial Building Telecommunications Cabling Standard, Part 1: General Requirements.
- AANSI/TIA/EIA568B.2 Commercial Building Telecommunications Cabling Standard, Part 2: Balanced Twisted Pair Cabling Components.
- ANSI/TIA/EIA568B.Optical Fiber Cabling Components Standard.

1.3.1.3 ANSI/TIA/EIA569A Commercial Building Standard for Telecommunications Pathways and Spaces.

1.3.1.4 ANSI/TIA/EIA606(A) The Administration Standard for the Telecommunications Infrastructure of Commercial Buildings.

1.3.1.5 ANSI/TIA/EIA607(A) Commercial Building Grounding and Bonding Requirements for Telecommunications.

1.3.2 Install cabling in accordance with the most recent edition of BICSI® publications:

1.3.2.1 BICSI Telecommunications Distribution Methods Manual.

1.3.2.2 BICSI Cabling Installation Manual.

1.3.2.3 BICSI LAN Design Manual

1.3.3 Federal, state, and local codes, rules, regulations, and ordinances governing the work, are as fully part of the specifications as if herein repeated or hereto attached. If the contractor should note items in the drawings or the specifications, construction of which would be code violations, promptly call them to the attention of the owner's representative in writing. Where the requirements of other sections of the

specifications are more stringent than applicable codes, rules, regulations, and ordinances, the specifications shall apply.

1.4 PERMITS, FEES, AND CERTIFICATES OF APPROVAL

1.4.1 The General Contractor will make application and pay for building permit.

1.4.2 As prerequisite to final acceptance, supply to the owner certificates of inspection from an inspection agency acceptable to the owner and approved by local municipality and utility company serving the project.

1.5 SYSTEM DESCRIPTION

1.5.1 A telecommunications cabling system generally consists of one telecommunications outlet in each workstation, wall telephones in common and mechanical areas, Intermediate Distribution Frames (IDF) located on each floor, and the Main Distribution Frame (MDF). Rate demarcation point (RDP) is located in the MDF.

1.5.2 All voice cables will consist of Category 6 cable terminated with a RJ45 jack and terminated on 110 blocks in the IDF. (T568B)

1.5.3 All Data cables will consist of Category 6 cable terminated with a RJ45 jack and terminate the cables on rack mounted modular patch panels located in the appropriate IDF. (T568B)

1.5.4 A typical workstation will consist of one voice jack and two data jacks. The number of cables are indicated on the drawings.

1.5.5 Vertical/horizontal copper backbone cabling consists of multiple pair unshielded twisted-pair installed from the main cross-connect (MC) located in the MDF to the horizontal cross-connect (HC) located in each IDF. This copper backbone will serve as the telephone riser backbone.

1.5.6 Vertical/horizontal backbone cabling consists of 24 strands of 8 micron single mode optical fiber cable installed from the MC to the HC and will serve as the data communications fiber backbone.

1.5.7 Plenum cable is required for this facility.

1.6 BID REQUIREMENTS

1.6.1 Certificate of insurance. Contractor cannot begin installation of the system or be paid for any material or labor until this document is provided to the General Contractor.

1.6.2 Bid sheets, included as Attachment A to this specification. The general contractor shall forward copies of all bids to CMTA, Inc., for his participation in the selection of the cabling contractor.

1.7 PRE-CONSTRUCTION SUBMITTALS

1.7.1 The following submittals must be provided thirty (30) days prior to start of construction.

1.7.1.1 Manufacturer product data sheets for each material and equipment specified. Mark each sheet to clearly identify the specific products and component parts, and data applicable to installation.

1.7.1.2 Assurance/Quality Control Submittals:

- Proposed test forms for fiber riser, copper riser and horizontal UTP cable.
- List of test equipment to be used for copper and fiber testing, (i.e., Fluke, JDSU, etc.)
- List of all tests to be performed as part of the certification process.
- Documentation of manufacturer’s current qualification of contractor as an approved Belden Certified System Vendor (CSV) of the IBDN Plus System, IBDN 1200 System, IBDN System 2400, IBDN System 4800LX and IBDN Optical Fiber System.
- Provide references of a minimum of three completed Belden installations.
- Provide number of Belden certified installers. Owner may request a list by name and proof of training.
- Installation work shall not begin prior to approval of all pre-construction submittals required in this section.

1.8 CONSTRUCTION SUBMITTALS

1.8.1 Submit project timeline to include, but not limited to, the following milestones:

1.8.1.1 Material order date.

1.8.1.2 Material receipt date.

1.8.1.3 Project start date (by phase, if required.)

- Rough-in (backbone cabling, horizontal cabling, all associated hardware).
- Terminations.
- Testing.

1.8.2 Weekly status report, to be submitted each Friday, of work progress until project is complete. Status reports should be submitted to the following:

1.8.2.1 General Contractor, Representative

1.8.2.2 Engineer/Architect.

1.8.3 Invoices should be submitted to, and as directed by, the general contractor.

1.8.4 As built drawings showing horizontal outlet and backbone cable labeling. Outlets should be numbered with a scheme that is consistent with the numbering scheme currently in use at the hospital (if renovation or addition project). This numbering scheme must be approved by the HDIS. These drawings must be provided to the PBX equipment vendor for set installation and station cross connections. The general contractor shall meet with the equipment vendor to establish an equipment installation schedule.

1.9 FINAL SUBMITTALS

1.9.1 The following submittals must be submitted and approved prior to final billing and payment. They should be submitted within thirty days of completion of the project.

1.9.1.1 Certification of level of performance as evidenced by comprehensive test results for UTP horizontal cabling, copper voice backbone cabling and single-mode fiber optic cabling as specified in this document. Electronic test results should be submitted to the HDIS at the hospital.

1.9.1.2 Record drawings with as-built information and finalized versions of the shop drawings. Numbered outlets in each room shall be shown on these drawings using a numbering scheme consistent with the current numbering scheme in use at the hospital. This numbering scheme shall be approved by the HDIS. These submittals shall be on the base plan as provided by the Architect or Owner. These

submittals shall be four copies in reproducible print form and one in electronic format (AutoCAD or DXF file.) One copy of these drawings shall be provided to the PBX vendor, as required in Paragraph 1.5.D, and the remaining copies submitted to the HDIS.

- 1.9.1.3 Manufacturer's system certification supporting the product warranty. It is the contractor's responsibility to arrange a job inspection by a Belden representative who is authorized to approve the cabling system 25-year warranty. Contractor shall contact Mr. Scott Fencik at 678-450-8090, HCA's Belden Representative, to schedule a site visit.

1.10 VENDOR QUALIFICATIONS

- 1.10.1 Vendor shall be Belden certified as a Certified System Vendor (CSV.)
- 1.10.2 Manufacturer must provide a 25-year system warranty for cable system installed.
- 1.10.3 No sub-contractors are permitted unless specified in this document or approved by the Owner.
- 1.10.4 The contractor will be responsible for any damage caused, either to the physical structure or communications cables or systems. Any damage will be repaired as a part of the basic service to be provided under this specification, at no additional cost to the owner.
- 1.10.5 Since much of the work to be performed under this specification will be in the existing hospital, the contractor shall be familiar with construction standards for performing work under these conditions. The contractor shall adhere to the owners Infection Control Risk Assessment procedures.

1.11 QUALITY ASSURANCE

- 1.11.1 The contractor shall have worked satisfactorily for a minimum of five (5) years on systems of this type and size. Installers must be certified and approved by the manufacturer with a minimum of three years experience installing that manufacturer.
- 1.11.2 Upon request by the engineer/designer, furnish a list of references with specific information regarding type of project and involvement in providing of equipment and systems.
- 1.11.3 Equipment and materials of the type for which there are independent standard testing requirements, listings, and labels, shall be listed and labeled by the independent testing laboratory.
- 1.11.4 Where equipment and materials have industry certification, labels, or standards (i.e., NEMA National Electrical Manufacturers Association), this equipment shall be labeled as certified or complying with standards.
- 1.11.5 Material and equipment shall be new, and conform to grade, quality, and standards specified. Equipment and materials of the same type shall be a product of the same manufacturer throughout.
- 1.11.6 Subcontractors shall assume all rights and obligations toward the contractor that the contractor assumes toward the owner and engineer/designer.

1.12 WARRANTY

- 1.12.1 The installed system shall be a certified Belden System the Contractor to, unconditionally guarantee in writing the materials, equipment, and workmanship for a period of not less than twenty five (25) years from date of acceptance by the owner. The owner shall deem acceptance as beneficial use.

1.12.2 Transfer manufacturer's warranties to the owner in addition to the General System Guarantee. Submit these warranties on each item in list form with shop drawings. Detail specific parts within equipment that are subject to separate conditional warranty. Warranty proprietary equipment and systems involved in this contract during the guarantee period. Final payment shall not relieve you of these obligations.

1.13 DELIVERY, STORAGE, AND HANDLING

1.13.1 Protect equipment during transit, storage, and handling to prevent damage, theft, soiling, and misalignment. Coordinate with the owner for secure storage of equipment and materials. Do not store equipment where conditions fall outside manufacturer's recommendations for environmental conditions. Do not install damaged equipment; remove from site and replace damaged equipment with new equipment.

1.14 SEQUENCE AND SCHEDULING

1.14.1 Submit schedule for installation of equipment and cabling. Indicate delivery, installation, and testing for conformance to specific job completion dates. As a minimum, dates are to be provided for bid award, installation start date, completion of station cabling, completion of riser cabling, completion of testing and labeling, cut-over, completion of the final punch list and owner acceptance.

PART 2 – PRODUCTS:

2.1 MATERIAL PRICING

2.1.1 Pricing shall be obtained from Accu-Tech Corporation for project material pricing. Accu-Tech is the owner of a single source pricing advantage for all HCA Hospital projects. Contractors are encouraged to contact Tim Flannagan tim.flannagan@accu-tech.com with Accu-Tech Corporation at (800) 227-0628 ext. 106 for special pricing.

2.2 MANUFACTURERS

2.2.1 Acceptable Manufacturer: Belden

2.2.2 Where no manufacturer is specified, provide products of manufacturers in compliance with requirements.

2.3 FABRICATION

2.3.1 Fabricate custom-made equipment with careful consideration given to aesthetic, technical, and functional aspects of equipment and its installation.

2.4 SUITABILITY

2.4.1 Provide products that are suitable for intended use, including, but not limited to environmental, regulatory, and electrical. All cabling, copper riser, and fiber shall be provided with suitable insulation for installing in an air plenum.

2.5 VOICE/DATA TELECOMMUNICATIONS SERVICE BACKBONE CABLE

2.5.1 [100 pair solid copper, 24 AWG, 100 OHM balanced twisted-pair (UTP) backbone cable, with mechanical and transmission performance specifications that meet or exceed ANSI/TIA/EIA568B.2. Belden Part Number DIW100/DPLN100.

2.5.1.1 ***Note: Listed Type CMR, CMP, MPR and/or MPP (as required in the NEC 2008 and authority**

having jurisdiction).]

2.5.2 [24 Strand single mode 8 µm diameter tight-buffered optical fiber, with mechanical and transmission performance specifications that meet or exceed ANSI/TIA/EIA568B.3. Belden Part Number B9W232/B9W242.

2.5.2.1 ***Note: Listed type OFNP, OFNR, OFCR, and/or OFCP (as required in the NEC 2008 and authority having jurisdiction).]**

2.6 VOICE TELECOMMUNICATIONS STATION CABLE

2.6.1 Solid copper, 24 AWG, 100 OHM balanced twisted-pair (UTP) Category 6 cables with four individually twisted-pairs, which meet or exceed the mechanical and transmission performance specifications in ANSI/TIA/EIA568B.2 up to 250 MHz. Cable shall be white in color. Belden Part Number 2412009U1000/2413009U1000.

2.6.1.1 ***Note: Listed Type CMR, CMP, MPR and/or MPP (as required in the NEC 2008 and authority having jurisdiction).**

2.7 DATA STATION CABLE (Copper)

2.7.1 Solid copper, 24 AWG, 100 OHM balanced twisted-pair (UTP) Category 6E cables with four individually twisted-pairs, which meet or exceed the mechanical and transmission performance specifications in ANSI/TIA/EIA568B.2 up to 250 MHz. Cable shall be black in color. Belden Part Number 2412010U1000/2413010U1000.

2.7.1.1 ***Note: Listed Type CMR, CMP, MPR and/or MPP (as required in the NEC 2008).**

2.8 CCTV SECURITY CAMERA CABLE (Copper)

2.8.1 Solid copper, 24 AWG, 100 OHM balanced twisted-pair (UTP) Category 6E cables with four individually twisted-pairs, which meet or exceed the mechanical and transmission performance specifications in ANSI/TIA/EIA568B.2 up to 250 MHz. Cable shall be black in color. Belden Part Number 2412010U1000/2413010U1000.

2.8.1.1 ***Note: Listed Type CMR, CMP, MPR and/or MPP (as required in the NEC 2008).**

2.9 UNDERGROUND TELECOMMUNICATIONS CABLE

2.9.1 Optical Fiber: Single-mode 8.7 µm to 10 µm diameter, armored, gel-filled optical fiber, 24 strands, which meet or exceed the mechanical and transmission performance specifications listed in ANSI/TIA/EIA568B.3 and ANSI/TIA/EIA758(A). Belden Part Number M9W384T.

2.9.2 Multi Pair Copper: 100 pair, 24 AWG, solid conductor cable which meet or exceed ANSI/ICEA S-84-608-2002: RUS 7 CFR (PE-39) standards. Superior/Essex Part Number 04-104-21 or equivalent.

2.10 VOICE/DATA – WORK AREA OUTLETS

2.10.1 Single-gang mounting plate with four (4) openings Belden Part Number AX101783 containing the following devices:

2.10.1.1 Voice Outlet 8pin modular, Category 6, unkeyed, almond, pinned to T568 B standards. Belden Part Number AX101064.

- 2.10.1.2 Data Outlet 8pin modular, Category 6, unkeyed, black, pinned to T568 B standards. Belden Part Number AX101066.
- 2.10.2 Surface Mount Outlet: Almond Belden Part Number A0645272.
- 2.11 WALL VOICE OUTLETS
 - 2.11.1 Single-gang stainless steel faceplate with EIGHT-conductor jack and wall telephone mounting lugs Belden Part Number AX104126 (Plate) and AX101319/AX101321 (Jack).
- 2.12 DATA ONLY WORK AREA OUTLET
 - 2.12.1 Single-gang faceplate with 8-pin modular, Category 6, unkeyed, black data jack, pinned to T568 B configuration. Belden Part Number AX101066.
- 2.13 VOICE ONLY WORK AREA OUTLET
 - 2.13.1 Single-gang faceplate with 8-pin modular, Category 6, unkeyed, almond telephone jack, pinned to T568 B configuration. Belden Part Number AX101064
- 2.14 TERMINATION BLOCKS
 - 2.14.1 Distribution Cable: Riser cable shall be terminated on BELDEN 300 pair 110-type hardware equipped with C5 modules, Part Number AX100696 (110 Cross-Connect Kit). Wire management troughs, Part Number AX100706, shall be mounted vertically and horizontally between columns of blocks to provide management of cross-connect wire. Blocks shall be oriented with backbone terminations located on the left and horizontal terminations located on the right of the termination field when facing the frame assembly.
 - 2.14.2 Distribution Cable: Riser cable shall be terminated on 19 inch rack mountable 48 port patch panels with rear insulation displacement (IBC) meeting Category 6 performance standards and pinned to T568B standards. Belden Part Number AX103255. Terminate one pair of the riser cable per port and spare back the violet isolate of each 25 pair bundle. Riser cable is category 3 and will not meet the cat 6 standard
 - 2.14.3 Horizontal Cable: In the communications room, horizontal cable shall be terminated on Belden 300 pair 110-type hardware equipped with C4 modules, Part Number AX100695 (110 Cross-Connect Kit). Wire management rings shall be mounted vertically and horizontally between columns of blocks to provide management of cross-connect wire, Part Number AX100706. Blocks shall be oriented with backbone termination located on the left and horizontal terminations located on the right of the termination field when facing the frame assembly.
- 2.15 PATCH PANELS
 - 2.15.1 19 in. rack mountable, 24 or 48port 8pin modular to insulation displacement connector (IDC) meeting Category 6 performance standards, and pinned to T568 B standards. Belden Part Number AX103253 (24 Port) AX103255 (48 Port). Provide number of spare ports for a minimum of 25% future capacity.
- 2.16 RACK MOUNTED OPTICAL FIBER TERMINATION PANEL
 - 2.16.1 Interconnect Units for IDF locations shall be Belden 1U FiberExpress Rack Mount Patch Panel, Part Number AX100041, equipped with double density, six (6) LC compatible optical fiber adapter strips, Part

Number AX101731. Interconnect Units for the MDF location shall be Belden 4U FiberExpress Rack Mount Patch Panel, Part Number AX100116, equipped with double density, twelve (12) LC compatible optical fiber adapter strips, Part Number AX101743.

2.17 OPTICAL FIBER CONNECTORS

2.17.1 Ceramic tipped field installed LC connectors, which meet or exceed the performance specifications in ANSI/TIA/EIA568B.3. Belden #AX101983 or AX105203-S1

2.18 OPEN FRAME EQUIPMENT RACK

2.18.1 Open frame, 19 in. equipment rack, 7 foot overall height with flange base, mounting rails drilled front and back and tapped to EIA standards, and a front-rack mountable 10 outlet multiple outlet electrical strip. Belden Part Number BHRR194.

2.19 4-POST OPEN FRAME EQUIPMENT RACK

2.19.1 Open frame, 19 in. equipment rack, Black, 7 foot overall height with flange base, mounting rails drilled front and back and tapped to EIA Standards, 28" depth, and a front-rack mountable 10 outlet multiple outlet electrical strip. Belden Part Number XDR8419-31228

2.20 LADDER RACK

2.20.1 B-Line Cable Runway, Part Number SB-17-18-TG and SB-17-24-TG, with the associated mounting hardware, shall be installed in the communications rooms as shown on the room layout drawings. All cable runways shall be securely fastened above the freestanding racks.

2.21 CABLE SUPPORTS

2.21.1 Cable support devices along primary cabling paths shall be Snake Tray #CM501-5-8. Utilize CM201-6-8 where wall mounting is not possible. Installation shall include all associated hardware for mounting in conjunction with Snake Tray provide two (2) 2" J-Hooks every 4 feet. Primary cabling pathways are shown on the drawings. Cable support devices above the drop ceiling off of the main corridors and in the communication rooms shall be provided by the cabling contractor.

2.22 CROSS OVER CABLING

2.22.1 In the communications room, eight Belden Cat 5E twenty five pair cables, Part Number IBDN25P, shall be extended from a forty eight port panel located at the top of the cabling equipment rack to a 100 pair 110 connecting block AX100694, located on the right side of the horizontal voice connecting blocks. Contractor to punch down 4 pairs per port.

2.23 PATCH CABLES

2.23.1 Patch cables are NOT required for this project.

2.24 WIRE MANAGEMENT

2.24.1 Vertical wire management shall be Part Number BHVHH06 between racks and Part Number BHVHH03 on the racks. Horizontal management shall be Part Number BHH192U

2.25 LISTED BUILDING ENTRANCE PROTECTORS

2.25.1 Building entrance terminal utilizing a two (2) foot fuse link between the outside cable plant splice and the protector module with IDC type input and output terminals, 100pair capacity and female mounting base, equipped with 230 volt solid state protector modules. Provide sufficient protector modules to completely populate all building entrance terminals.

2.26 DATA WIRELESS CABLES

2.26.1 Contractor shall install Category 6 cables to the locations identified on the drawings. Contractor shall leave 25' of slack on each cable. Cables shall be independently terminated on surface mount boxes (i.e., one jack per surface mount box). Contractor shall be responsible at the end of the project for the final placement of cables after the wireless survey is completed by the owner's vendor. Contractor shall be responsible for hanging owner provided wireless access points. Belden Part Number 2412004A1000.

2.27 IN-WALL A/V CABLING

2.27.1 Contractor shall install in-wall A/V cabling identified on the drawings. Length of cable to be determined by contractor. Rapid Run Part Number 2212-40860-XXX, 2212-40858-022 and 2212-408870-022.

PART 3 – EXECUTION:

3.1 PRE-INSTALLATION SITE SURVEY

3.1.1 Prior to start of systems installation, meet at the project site with the owner's representative and representatives of trades performing related work to coordinate efforts. Review areas of potential interference and resolve conflicts before proceeding with the work. Facilitation with the General Contractor will be necessary to plan the crucial scheduled completions of the equipment room and telecommunications closets.

3.1.2 Examine areas and conditions under which the system is to be installed. Do not proceed with the work until satisfactory conditions have been achieved.

3.2 HANDLING AND PROTECTION OF EQUIPMENT AND MATERIALS

3.2.1 Be responsible for safekeeping of your own and your subcontractors' property, such as equipment and materials, on the job site. The owner assumes no responsibility for protection of above named property against fire, theft, and environmental conditions.

3.3 PROTECTION OF OWNER'S FACILITIES

3.3.1 Effectively protect the owner's facilities, equipment, and materials from dust, dirt, and damage during construction.

3.3.2 Remove protection at completion of the work.

3.4 INSTALLATION

3.4.1 Receive, check, unload, handle, store, and adequately protect equipment and materials to be installed as part of the contract. Store in areas as directed by the owner's representative. Include delivery, unloading, setting in place, fastening to walls, floors, ceilings, or other structures where required, interconnecting wiring of system components, equipment alignment and adjustment, and other related work whether or not expressly defined herein.

- 3.4.2 Install materials and equipment in accordance with applicable standards, codes, requirements, and recommendations of national, state, and local authorities having jurisdiction, and *National Electrical Code®* (NEC) and with manufacturer's printed instructions.
 - 3.4.3 Adhere to manufacturer's published specifications for pulling tension, minimum bend radii, and sidewall pressure when installing cables.
 - 3.4.3.1 Where manufacturer does not provide bending radii information, minimum-bending radius shall be 15 times cable diameter. Arrange and mount equipment and materials in a manner acceptable to the engineer and the owner.
 - 3.4.4 Penetrations through floor and fire-rated walls shall utilize intermediate metallic conduit (IMC) or galvanized rigid conduit (GRC) sleeves and shall be firestopped after installation and testing, utilizing a firestopping assembly approved for that application.
 - 3.4.5 Install station cabling to the nearest Intermediate Distribution Frame (IDF), unless otherwise noted.
 - 3.4.6 Installation shall conform to the following basic guidelines:
 - 3.4.6.1 Use of approved wire, cable, and wiring devices.
 - 3.4.6.2 Neat and uncluttered wire termination.
 - 3.4.7 Attach cables to permanent structure with suitable attachments at intervals of 48 to 60 inches. Support cables installed above removable ceilings.
 - 3.4.8 Install adequate support structures for 10 foot of service slack at each IDF.
 - 3.4.9 Support riser cables every three (3) floors and at top of run with cable grips.
 - 3.4.9.1 Limit number of four-pair data riser cables per grip to fifty (50).
 - 3.4.10 Install cables in one continuous piece. Splices shall not be allowed except as indicated on the drawings or noted below:
 - 3.4.11 Provide over-voltage protection on both ends of cabling exposed to lightning or accidental contact with power conductors.
 - 3.4.12 Notify the owner/engineer immediately of any horizontal cable run exceeding TIA/EIA specifications.
 - 3.4.13 System inspection shall be provided through pre-construction, in-progress and final inspections by Owner/Engineer. The Owner/Engineer or the Contractor may, at his/her discretion, perform tests in addition to those specified in this document if there is any reason to question the condition of the material as furnished or installed.
- 3.5 GROUNDING
- 3.5.1 Grounding shall conform to ANSI/TIA/EIA 607(A) *Commercial Building Grounding and Bonding Requirements for Telecommunications*, *National Electrical Code®*, ANSI/NECA/BICSI568 and manufacturer's grounding requirements as minimum.
 - 3.5.2 Bond and ground equipment racks, housings, messenger cables, and raceways.

3.5.3 Connect cabinets, racks, and frames to single-point ground which is connected to building ground system via #6 AWG green insulated copper grounding conductor.

3.6 LABELING

3.6.1 Labeling shall conform to ANSI/TIA/EIA606(A) standards. In addition, provide the following:

3.6.1.1 Label each outlet with permanent self-adhesive label with minimum 3/16 in. high characters.

3.6.1.2 Label each cable with permanent self-adhesive label with minimum, 1/8 in. high characters, in the following locations:

- Inside receptacle box at the work area.
- Behind the communication closet patch panel or punch block.

3.6.1.3 Use labels on face of data patch panels. Provide facility assignment records in a protective cover at each telecommunications closet location that is specific to the facilities terminated therein.

3.6.1.4 Use color-coded labels for each termination field that conforms to ANSI/TIA/EIA606(A) standard color codes for termination blocks.

3.6.1.5 Labels shall be machine-printed. Hand-lettered labels shall not be acceptable.

3.6.1.6 Label cables, outlets, patch panels, and punch blocks with room number in which outlet is located, followed by a single letter suffix to indicate particular outlet within room, i.e., S2107A, S2107B. Indicate riser cables by an R then pair or cable number. Contractor is to submit labeling scheme for approval.

3.6.1.7 Mark up floor plans showing outlet locations, type, and cable marking of cables. Turn these drawings over to the owner four (4) weeks prior to move in to allow the owner's personnel to connect and test owner-provided equipment in a timely fashion.

3.6.1.8 Three (3) sets of as-built drawing shall be delivered to the owner within four (4) weeks of acceptance of project by the owner. A set of as-built drawings shall be provided to the owner in electronic media form (compact disk) and utilizing AutoCAD software that is acceptable to the owner. The CD shall be delivered to the owner within six (6) weeks of acceptance of project by owner.

3.7 TESTING

3.7.1 Testing shall conform to ANSI/TIA/EIA568B.1 standard. Testing shall be accomplished using level IIe or higher field testers.

3.7.2 Test each pair and shield of each cable for opens, shorts, grounds, and pair reversal. Correct grounded and reversed pairs. Examine open and shorted pairs to determine if problem is caused by improper termination. If termination is proper, tag bad pairs at both ends and note on termination sheets.

3.7.2.1 Perform testing of copper cables with tester meeting ANSI/TIA/EIA568B.1 requirements.

3.7.2.2 If horizontal cable contains bad conductors or shield, remove and replace cable.

3.7.3 Initially test optical cable with a light source and power meter utilizing procedures as stated in ANSI/TIA/EIA52614A: OFSTP14A Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant and ANSI/TIA/EIA5267 Measurement of Optical Power Loss of Installed Singlemode Fiber Cable Plant. Measured results shall be plus/minus 1 dB of submitted loss budget calculations. If loss figures are outside this range, test cable with optical time domain reflectometer to determine cause of variation. Correct improper splices and replace damaged cables at no charge to the owner.

- 3.7.3.1 Cables shall be tested at 850 and 1300 nm for multimode optical fiber cables. Cables shall be tested at 1310 and 1550 nm for single mode optical fibers.
- 3.7.3.2 Testing procedures shall utilize the one jumper reference.
- 3.7.3.3 Bi-directional testing of optical fibers is required.
- 3.7.4 Perform optical time domain reflectometer (OTDR) testing on each fiber optic conductor. Measured results shall be plus/minus 1 dB of submitted loss budget calculations.
 - 3.7.4.1 Submit printout for each cable tested.
 - 3.7.4.2 Submit compact disk with test results and program to view results.
- 3.7.5 Where any portion of system does not meet the specifications, correct deviation and repeat applicable testing at no additional cost to the owner.
- 3.8 FIELD QUALITY CONTROL
 - 3.8.1 Employ job superintendent or project manager during the course of the installation to provide coordination of work of this specification and of other trades, and provide technical information when requested by other trades. This person shall maintain current RCDD® (Registered Communications Distribution Designer) registration and shall be responsible for quality control during installation, equipment setup, and testing.
 - 3.8.2 All installation personnel shall meet manufacturer's training and education requirements for implementation of extended warranty program.
- 3.9 REMOVAL OF UNUSED VOICE AND DATA HORIZONTAL CABLE
 - 3.9.1 The cabling contractor shall remove an unused voice and data cable located in the construction area. The contractor shall work with the HDIS to identify unused cable. No cable is to be removed unless approved by the HDIS.

ATTACHMENT A
STRUCTURED CABLING BID SUMMARY

Vendor _____
 Contact _____
 Telephone _____ Fax # _____ Email _____
 Cabling System Proposed _____

HORIZONTAL CABLING			
COMPONENT	QUANTITY	UNIT PRICE	TOTAL PRICE
Cable – CAT 6 PVC Black			
Cable – CAT 6 PVC White			
Cable – 25 Pair CAT 5e			
RJ-45 CAT 6 Jack – Black			
RJ-45 CAT 6 Jack – Almond			
Surface Mount Outlet – AO645272			
Face Plate – Almond – AX101783			
Stainless Wall Plate– AX102006			
Patch Panels – CAT 6 48 port			
Patch Panels – CAT 6 24 port			
Patch Panels – CAT 5E 48 port			
Patch Panels – CAT 5E 24 port			
110type hardware – 300 Pr. equipped with C4			
110type hardware – 100 Pr. equipped with C4			
Voice Block Wire Management AX100706			
Equipment Rack – 84” – BHRR194			
4 – Post Equipment Rack – XDR8419-31228			
Horizontal Wire Management – BHH192U			
Vertical Wire Management 3” – BHVHH03			
Vertical Wire Management 6” – BHVHH06			
Cable Runway (Ladder Rack) 18”			
Misc Materials			
HILTI 2” Speed Sleeve 236323			
HILTI 4” Speed Sleeve 236324			
EZ PATH #EZD22			
EZ PATH #EZDP33FWS			
EZ PATH #EZDP433GK			
SNAKE TRAY – CM501-5-8			
J-HOOK – 2”			
Material Total			\$
Labor Total			\$
Tax			\$
HORIZONTAL CABLE TOTAL			\$

STRUCTURED CABLING BID SUMMARY			
COPPER BACKBONE CABLE		TOTAL PROJECT	
COMPONENT	QUANTITY	UNIT PRICE	TOTAL PRICE
200 Pair D-[Riser][Plenum] Cable			
100 Pair D-[Riser][Plenum] Cable			
110-type Hardware- 300 Prequipped with C5 connectors			
Minor materials			
Material Total			\$
Labor Total			\$
Tax			
COPPER BACKBONE CABLE TOTAL			\$

OPTICAL FIBER BACKBONE		TOTAL PROJECT	
COMPONENT	QUANTITY	UNIT PRICE	TOTAL PRICE
24 Strand 8/125 Fiber Cable			
Inter Connect Unit - 1U			
Adapter Strip			
Inter Connect Unit - 4U			
Connector Module			
Optical Fiber LC Connector			
Minor materials			
Material Total			\$
Labor Total			\$
Tax			
OPTICAL FIBER BACKBONE TOTAL			\$

TOTAL CABLE SYSTEM PRICE			
Horizontal Cabling			\$
Copper Backbone Cable			\$
Optical Fiber Backbone			\$
TOTAL			\$

CABLE/SATELLITE DISTRIBUTION SYSTEM		SECTION 275101	
COMPONENT	QUANTITY	UNIT PRICE	TOTAL PRICE
Cable - CAT 5E PVC/Plenum Blue			
RJ-45 CAT 5E Jack - Blue			
RG6 PVC/Plenum Cable			
RG6 F Connectors			
Stainless Steel Faceplates			
Patch Panels - CAT 5E 48 port			
Patch Panels - CAT 5E 24 port			
Horizontal Wire Management - BHH192U			
Minor materials			
Material Total			\$
Labor Total			\$
Tax			
TELEVISION DISTRIBUTION TOTAL			\$

PAGING SYSTEM		SECTION 275113	
COMPONENT	QUANTITY	UNIT PRICE	TOTAL PRICE
Misc. Cable			
Minor materials			
Material Total			\$
Labor Total			\$
Tax			
PAGING SYSTEM TOTAL			\$

INTERCOM SYSTEMS (AIPhone)		SECTION 275122	
COMPONENT	QUANTITY	UNIT PRICE	TOTAL PRICE
Misc. Cable			
Minor materials			
Material Total			\$
Labor Total			\$
Tax			
INTERCOM SYSTEMS TOTAL			\$

CLOSED CIRCUIT TV (CCTV)			
COMPONENT	QUANTITY	UNIT PRICE	TOTAL PRICE
Cable - Cat 6 PVC/Plenum Black			
Minor materials			
Material Total			
Labor Total			
Tax			

Material Total			\$
Labor Total			\$
Tax			
CLOSED CIRCUIT TV (CCTV) TOTAL			\$

DIVISION BID SUMMARY	SECTION NUMBER	SECTION TOTALS
STRUCTURED CABLING	16710	\$
COPPER RISER CABLE	16710	\$
OPTICAL FIBER BACKBONE	16710	\$
TELEVISION CABLE SYSTEM	16780	\$
PHYSIOLOGICAL PATIENT [AND FETAL] MONITORING		\$
NURSE CALL AND CODE BLUE SYSTEMS		\$
INFANT PROTECTION SYSTEM		\$
CLOSED CIRCUIT TV (CCTV)	28 2300	\$
DIVISION TOTAL		\$

UNIT PRICES		
COMPONENT	ON SITE DURING CONSTRUCTION	RETURN TRIP REQUIRED AFTER CONSTRUCTION
Wall Telephone Outlet	\$	\$
One Jack Outlet	\$	\$
Two Jack Outlet	\$	\$
Three Jack Outlet	\$	\$
Four Jack Outlet	\$	\$

HOURLY LABOR RATES		
COMPONENT	ON SITE DURING CONSTRUCTION	RETURN TRIP REQUIRED AFTER CONSTRUCTION
Regular Time/HR	\$	\$
Overtime/HR	\$	\$
Holiday Time/HR	\$	\$

END OF SECTION.

DIVISION 26 - ELECTRICAL

SECTION 275300 - CATV/VIDEO SYSTEMS

PART 1 - GENERAL:

- 1.1 Each Electrical Contractor's attention is directed to Section 16000, General Provisions, Electrical, and all other contract documents as they may apply to his work.
- 1.2 Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.
- 1.3 Complete TV system shall be commissioned, tested, and verified operational and reports submitted to engineer including actual signal dB at outlets. Televisions shall be installed, tested, and all functionality verified by this contractor.
- 1.4 The work includes furnishing all labor, materials, tools, equipment, mounting hardware and documentation required for cabling the cable/satellite media distribution system.

PART 2 - SUBMITTALS:

- 2.1 Provide complete product and design submittals including all system component specifications and floor plan drawings with wiring diagrams of all system wiring. Include on plans all devices, components, cabling and associated calculations.

PART 3 - PRODUCTS:

3.1 EQUIPMENT REQUIREMENTS:

- 3.1.1 All TV's and mounts in this section will be provided by the owner. Contractor will be required to mount and install all owner provided equipment.

3.2 COMPONENTS

- 3.2.1 Indoor distribution amplifiers to be provided as required, equal to QRF Model QDAX750.
- 3.2.2 Provide two-way ready indoor/outdoor directional couplers equal to DigiTop Series 2-4-8 port taps.
- 3.2.3 All coax station cabling is to be RG6/U designed for CATV/MATV installations Model 5339Q5/6339Q8.
- 3.2.4 All riser cabling shall be RG11 with banded tape, 60% braid, non-bonded tape, 60% aluminum braid shield, flame retardant Black PVC jacket Model Number: 1523R.
- 3.2.5 Each outlet shall have an Unshielded Twisted Pair (UTP) cable in the same outlet box. Cable shall be blue Category 6 cable. Belden Part Number 1212006U1000.
- 3.2.6 Each outlet box shall require an MDVO 106 adapter module with number of blank inserts. Belden Part Number AX100309.
- 3.2.7 Each outlet shall require an MDVO Video "F" connector module. Belden Part Number A040700.

PART 4 - EXECUTION:

- 4.1 COORDINATION

- 4.1.1 All mounting heights are to be coordinated with architectural elevations and shall meet ADA requirements of 80" AFF to bottom of any obstruction from wall.
- 4.1.2 All backing in the walls and wall bracket installation shall be coordinated with television vendor.
- 4.2 INSTALLATION
 - 4.2.1 Install system per the manufacturer's guidelines.
 - 4.2.2 System to be free of RF noise and loss of dB signal. Precautions are to be made to prevent and filter out any visible noise.
 - 4.2.3 Grounding shall be sufficient to meet manufacturer requirements.
 - 4.2.4 This contractor is to provide a surge suppressor on the cables entering the head end equipment from the cable service provider and satellite dish.
- 4.3 WARRANTY
 - 4.3.1 The product shall be warranted to be free from defects in material and workmanship under normal use for a period of one (1) year from the date of first beneficial of all or any part of the product, or 12 months after product shipment, whichever is earlier.
 - 4.3.2 Designer reserves the right to accept or reject any part of installation which does not successfully meet requirements as set out in these specifications.
 - 4.3.3 Contractor shall and hereby does guarantee all work installed under this division shall be free from defects in workmanship and materials. The above parties further agree that they will repair and replace any defective material or workmanship which becomes defective within the terms of this warranty-guarantee.

END OF SECTION

DIVISION 28 – ELECTRONIC SAFETY AND SECURITY

SECTION 283111 - FIRE ALARM AND DETECTION SYSTEMS

PART 1 - SCOPE AND RELATED DOCUMENTS:

- 1.1 The work covered by and the intent of this section of the specifications includes the furnishing of all labor, equipment, materials, testing, programming and performance of all operations in connection with the installation of the Fire Alarm System as shown on the drawings, as herein specified and as required by the applicable codes.
- 1.2 The requirements of all other applicable conditions of the Contract, Supplementary Conditions and General Requirements, apply to the work specified in this section.
- 1.3 The complete installation shall conform to the applicable sections of NFPA-71, NFPA-72A, B, C, D, Local Code Requirements and National Electrical Code (Article 760). The requirements of any local fire department and the Authority Having Jurisdiction shall also be observed in the system installation and device layout. The complete installation shall satisfy all applicable codes and standards for locations, coverage, alarm sequence, etc. Provide all components as required for a complete and operational system per UL, NFPA, ADA, and all applicable local and state regulations.
- 1.4 The work specified under this section shall be coordinated with related work specified elsewhere in these specifications.

PART 2 - QUALITY ASSURANCE:

- 2.1 Each and all items of the intelligent Fire Alarm System shall be listed as a product of a single fire alarm system manufacturer. Exception as needed of: Door holders, keyed institutional pull stations, sprinkler water flow and tamper switches. All fire alarm devices used within the system shall be listed for fire alarm service under the appropriate category by the Underwriters' Laboratories, Inc. (UL), and shall bear the "U.L." label.
- 2.2 The system controls shall be UL listed for Power Limited Applications per NEC 760. All circuits shall be marked in accordance with NEC Article 760.
 - 2.2.1 All work specified in this section shall be performed by a technician certified in the state/local jurisdiction (NICET Level II certified).

PART 3 – GENERAL:

Designer Note: For Federal projects and COPS systems, find and replace all instances of Class "B" wiring with Class "A" wiring.

- 3.1 Furnish and install a peer-to-peer network intelligent addressable multiplex fire alarm system as a complete system as described herein and as shown on the plans; to be wired, connected, completely tested, and left in first class operating condition. The system shall use individually-addressable digital multiplex devices, communicating on a Class "B" Signal Line Circuit(s) (SLC) with individual device supervision, appliance circuit supervision, SLC loop isolation when called for, and incoming normal and stand-by power supervision. In general, systems shall include a control panel, manual pull stations, automatic fire detectors, horns, flashing strobe lights, annunciator(s) (if indicated), raceways, all wiring, connections to devices, connections to valve tamper switches, water flow switches and mechanical controls, outlet boxes, junction boxes, protective covers, and all other necessary materials for a complete, operating fire alarm system.

- 3.2 Fire Alarm Control Panel Spare capacity: For new systems, the FACP system shall not exceed 80% of it's rated capacity on it's address SLC loop, indicating and supervisory lines, allowing for 20% spare capacity for future growth.
- 3.3 The fire alarm control panel shall allow for loading or editing of any special instructions or operating sequences as required. No special tools, chips, modems, or an off-board programmer shall be required to program the system to facilitate future system expansion, building parameter changes, or changes as required by local codes. All instructions shall be stored in a resident non-volatile programmable memory. Provide three disk copies of final panel program at close of project, to be included in with the operation and maintenance manuals.
- 3.4 All panels and peripheral devices shall be the standard product of a single manufacturer and shall display the manufacturer's name of each component. The devices specified under this section constitute the type, quality of design, materials, and operating features desired.
- 3.4.1 The listing of specific catalog numbers and equipment parameters is not intended to limit competition among other manufacturers that propose to supply equivalent equipment and services. Acceptable manufacturers for Fire alarm systems are:
- Simplex
 - Edwards EST
 - Notifier
 - Siemens
- 3.5 Equipment submissions for shop drawing review must include a minimum of the following:
- 3.5.1 Complete descriptive data indicating UL listing for all system components.
- 3.5.2 Complete sequence of operations of the system.
- 3.5.3 Complete system wiring diagrams for components capable of being connected to the system and interfaces to equipment supplied by others.
- 3.5.4 A copy of any state or local Fire Alarm System equipment approvals.
- 3.5.5 An AutoCAD Version 2010 or later, produced wiring diagram illustrating the basic floor plan of the building, showing all system wiring and equipment, as well as addressable device locations, with device addresses and schedule of device legends as intended to appear on the main panel and annunciator displays. Provide three disk copies of as-built drawings at close of project, to be included in operation and maintenance manuals.
- 3.6 Device colors/finishes shall be selected by the architect.
- Designer Note: Parts 3.7 & 3.8 should be deleted for new systems or system replacements.**
- 3.7 Where existing systems are being modified or expanded, existing fire alarm control units and power supplies may be utilized where they have capacity. The fire alarm contractor is responsible for verification of existing components prior to bid. The contractor shall visit the site and verify that all work required for fire alarm installation and connection to existing systems is included in their bid.
- 3.8 The existing system shall be expanded and connected to the new system/components. New components shall be of the same manufacturer as the existing system and shall be capable of full two-way communication with existing control units. Provide all new modules as required to connect to and communicate with existing systems. All system modifications shall be provided by the owner's preferred fire alarm vendor.

PART 4 – OPERATION:

- 4.1 Under normal condition the front panel shall display a SYSTEM NORMAL message and the current time and date.
- 4.2 Should an abnormal condition be detected the appropriate LED (Alarm, Supervisory, or Trouble) shall flash. The panel audible signal shall pulse for alarm conditions and sound steadily for trouble and supervisory conditions.
- 4.3 The panel shall display the following information relative to the abnormal condition of a point in the system:
 - 4.3.1 Custom location label (80 character LCD display minimum)
 - 4.3.2 Type of device (i.e. smoke, pull station, water flow)
 - 4.3.3 Point status (i.e. alarm, trouble)
- 4.4 Pressing the appropriate acknowledge button shall acknowledge the alarm or trouble condition. The acknowledge functions may be passcode protected if the user has insufficient privilege to acknowledge such conditions. A message shall indicate insufficient privilege but allow the user to view the points without acknowledging them. Should the user have sufficient privilege to acknowledge, a message will be displayed informing the user that the condition has been acknowledged. Systems not capable of password protected manual command operations shall provide key operated switches for these functions. Function key switches shall be keyed differently from any other keyed switches or locks used within the system.
- 4.5 After all the points have been acknowledged, the LEDs shall glow steady and the panel audible signal will be silenced. The total number of alarms, supervisory, and trouble conditions shall be displayed along with a prompt to review each list chronologically. The end of the list shall be indicated.
- 4.6 Alarm Silencing:
 - 4.6.1 Should the Alarm Silence button be pressed all alarm signals shall cease operation.
 - 4.6.2 Signals shall not be silenced during alarm silence inhibit mode.
- 4.7 System Reset:
 - 4.7.1 The System Reset button shall be used to return the system to its normal state after an alarm condition has been remedied. The display shall step the user through the reset process with simple English language messages. Messages shall provide operator assurance of the sequential steps (i.e.: IN PROGRESS, RESET COMPLETED, and SYSTEM NORMAL) as they occur, should all alarm conditions be cleared.
 - 4.7.2 Should an alarm condition continue to exist, the system will remain in an abnormal state. System control relays shall not reset. The panel audible signal and the Alarm LED shall be on. The display will indicate the total number of alarms and troubles present in the system along with a prompting to review the points. These points will not require acknowledgment if they were previously acknowledged.
 - 4.7.3 Should the Alarm Silence Inhibit function be active, the System Reset key press will be ignored and a RESET INHIBITED message will be displayed for a short time to indicate the action was not taken. For operator assurance, a RESET NO LONGER INHIBITED message will be displayed when the inhibit function times out.

4.8 Function Keys:

4.8.1 Additional function keys shall be provided to access status data for all system points. As a minimum the status data shall include Disable/Enable Status, Verification Tallies of Initiating Devices, Acknowledge Status, etc.

4.9 History Logging:

4.9.1 In addition to any required printer output, the control panel shall have the ability to store a minimum of three hundred (600) events in an alarm log plus a minimum of three hundred (600) events in a separate trouble log. These events shall be stored in a battery protected random access memory (RAM). Systems not having discrete alarm and trouble logging memory shall include an alternate supervised (e.g.: disc drive, tape cassette) historic recording method with battery backup. Real time and date shall accompany all history event recording.

4.10 Walk Test with History Logging:

4.10.1 The system shall be capable of being tested by one person. While in testing mode, the alarm activation of an initiating device circuit shall be silently logged as an alarm condition in the historical data file. The panel shall automatically reset itself after logging of the alarm.

4.10.2 The momentary disconnection of an initiating or indicating device circuit shall be silently logged as a trouble condition in the historical data file. The panel shall automatically reset itself after logging of the trouble condition.

4.10.3 Optionally, the walk test sequence will have the capability of activating the alarm indicating appliances for a maximum of 2 seconds to signal a unique code associated to the alarm device. If this option is selected, any momentary opening of an initiating or indicating appliance circuit wiring shall cause the alarm indicating appliances to sound for 4 seconds to indicate the trouble condition.

4.10.4 Should the walk test feature be on for an inappropriate programmable amount of time, it shall revert to the normal mode automatically.

4.10.5 The control panel shall be capable of supporting up to eight (8) separate testing groups whereby one group of points may be in a testing mode and the other (non-testing) groups may be active and operate as programmed per normal system operation. After testing is considered complete, testing data may be retrieved from the system in chronological order to ensure device/circuit activation. Should an alarm condition occur from an active point, not in walk test mode, it shall perform all standard programmed alarmed sequences.

4.10.6 Suppliers of systems not having this feature as functionally specified above shall include a testing agreement meeting the requirements of NFPA-72H in their base bid quotation. As a minimum, two (2) years of scheduled testing shall be included.

4.11 LED Supervision:

4.11.1 All slave module LEDs shall be supervised for burnout or disarrangement. Should a problem occur, the panel shall display the module and the LED location numbers to facilitate location of that LED.

4.12 System Trouble Reminder:

4.12.1 Should a trouble condition be present within the system and the audible trouble signal silenced, the trouble signal shall resound at preprogrammed time intervals to act as a reminder that the fire alarm

system is not 100% operational. Both the time interval and the trouble reminder signal shall be programmable to suit the owner's application.

4.13 Access Levels:

4.13.1 There shall be a minimum of four (4) access levels. Passcodes shall consist of up to ten (10) digits. Changes to passcodes shall only be made by authorized personnel. Systems not capable of password protected manual command operations shall provide key operated switches for these functions. Function key switches shall be keyed differently from any other keyed switches or locks used within the system.

4.13.2 In order to maintain security when entering a passcode, the digits entered will not be displayed. All key presses will be acknowledged by a local audible momentary tones.

4.13.3 When a correct passcode is entered, an ACCESS GRANTED message shall be displayed. The new access level shall be in effect until the operator leaves the keypad inactive for ten (10) minutes or manually logs out.

4.13.4 Should an invalid code be entered, the operator shall be notified with a message and shall be allowed up to three chances to enter a valid code. After three unsuccessful tries, an ACCESS DENIED message shall be displayed.

4.13.5 Access to a level will only allow the operator to perform all actions within that level and all actions of lower levels, not higher levels.

4.13.6 The following keys/switches shall have access levels associated with them:

- Alarm Silence
- System Reset
- Set Time/Date
- Manual Control
- On/Off/Auto Control
- Disable/Enable
- Clear Historical Alarm Log
- Clear Historical Trouble Log
- Walk Test
- Change Alarm Verification

4.13.7 Acknowledge keys shall also require privileged access to acknowledge points. If the operator presses an acknowledge key with insufficient access, an error message will be displayed. The points will scroll with each key press to view the points on the list, but the points will not get acknowledged in the database.

PART 5 - ALARM SEQUENCE:

5.1 The system alarm operation subsequent to the alarm activation of any manual station, automatic detection device, or sprinkler flow switch is to be as follows:

5.1.1 All audible alarm indicating appliances (horns) shall sound a continuous fire alarm signal in the building until silenced by the alarm silence switch at the control panel. Should a paging announcement be in progress the program hierarchy shall disconnect to paging announcement as activate the alarm signal as defined above.

5.1.2 All visible alarm indicating appliances Strobes shall display a temporal pattern in the building until extinguished by the Alarm Silence Switch.

5.1.3 All electric locks shall be released via interface to door locking system.

- 5.1.4 Activate digital alarm communicator to call UL Listed Central Station for notification to local fire department.
- 5.1.5 Annunciate alarm device on remote annunciator.
- 5.1.6 Activation of a smoke sensor from an elevator lobby, machine room, or shaft shall in addition to the above sequences; initiate fireman’s recall service of elevator via programmable addressable control relay.
- 5.1.7 Activation of elevator machine room or shaft heat detector shall in addition to the above sequences; initiate elevator shunt trip via programmable addressable control.
- 5.2 The control panel is to have a dedicated supervisory service LED and a dedicated supervisory service acknowledge switch.
 - 5.2.1 The activation of any standpipe or sprinkler valve tamper switch shall activate the system supervisory service audible signal and illuminate the Supervisory LED at the control panel [and the remote annunciator]. Differentiation between valve tamper activation and opens and/or grounds on fire alarm initiation circuit wiring shall be provided.
 - 5.2.2 Activating the Supervisory Service Acknowledge Switch will silence the supervisory audible signal while maintaining the Supervisory Service LED on indicating the tamper contact is still in the off-normal state.
 - 5.2.3 Restoring the valve to the normal position shall cause the Supervisory Service LED to extinguish thus indicating restoration to normal position.
 - 5.2.4 Alarm and trouble conditions shall be immediately displayed on the control panel front Alphanumeric display as well any applicable remote annunciators. If more alarms or troubles are in the system the operator may scroll to display new alarms.
 - 5.2.5 The system shall have an alarm list key that will allow the operator to display all alarms, troubles, and supervisory service conditions with the time of occurrence. This shall allow for the determination of not only the most recent alarm but also may indicate the path that the fire is taking.

PART 6 - MULTIPLE IDNET PERIPHERAL NETWORK (IDNET):

- 6.1 Communication with addressable devices: The system must provide communication with all initiating and control devices individually. All of these devices are to be individually annunciated at the control panel. Annunciation shall include the following conditions for each point:
 - Alarm
 - Trouble
 - Open
 - Short
 - Ground
 - Device Fail/or Incorrect Device
- 6.2 All addressable devices are to have the capability of being disabled or enabled individually.
- 6.3 Up to 250 addressable devices may be multi-dropped from a single pair of wires. Systems that require factory reprogramming to add or delete devices are unacceptable.
- 6.4 Format:

- 6.4.1 The communication format must be a poll/response protocol to allow t-tapping of the wire to addressable devices and be completely digital. A high degree of communication reliability must be obtained by using parity data bit error checking routines for address codes and check sum routines for the data transmission protocol. Systems that do not utilize full digital transmission protocol (i.e. that may use time pulse width methods to transmit data etc.) will not be acceptable since they are considered unreliable and prone to errors.
- 6.5 Identification of Addressable Devices:
- 6.5.1 Each addressable device must be uniquely identified by an address code entered on each device at time of installation. The use of jumpers to set address will not be acceptable due to the potential of vibration and poor contact.
- 6.6 Wiring Type, Distances, Survivability and Configurations:
- 6.6.1 Wiring types will be approved by the equipment manufacturer. The system must allow up to 2,500 feet wire length to the furthest addressable device. Class B (Signaling Line Circuit as defined by NFPA-72A) communications will be provided where shown on the drawings. Wire will be so routed to maintain sufficient distance between the forward and return loop as called for by the Authority Having Jurisdiction (AHJ). To minimize wire routing and to facilitate future additions, t-tapping of the communications channel will be supported except where Class B wiring is required.

PART 7 – SUPERVISION:

- 7.1 The system shall contain Style "4" SLC addressable initiation circuits per area/floor as required. A SLC loop shall be so arranged that a fault in any one addressable loop shall not affect any other loop. If one SLC circuit serves more than one floor, each floor shall utilize an isolator per floor (per manufacture specs for isolator use) If the SLC wiring leaves the building, it shall have an isolator and be surge protected with the appropriate device per the NEC. The alarm activation of any initiation circuit shall not prevent the subsequent alarm operation of any other initiation circuit.
- 7.2 Supervisory initiation circuit(s) shall be wired "Class B" from addressable modules as required, for connection of all sprinkler valve tamper switches. If the "Class B" wiring leaves the building, it shall be surge protected with the appropriate device per the NEC. Wiring methods which affect any fire alarm initiation circuits to perform this function shall be deemed unacceptable; i.e.: sprinkler and standpipe tamper switches (N/C contacts) shall NOT be connected to circuits with fire alarm initiation devices (N/O contacts). These independent initiation circuit(s) shall be each labeled "Sprinkler Supervisory Tamper Switch" and shall differentiate between tamper switch activation and wiring faults. Provide individual annunciation for each tamper switch as indicated by the zoning schedule on the plans or as otherwise indicated.
- 7.3 There shall be independently supervised and independently fused indicating appliance circuits as required for alarm audible signals and flashing alarm lamps. If remote NAC power extenders are used, a single indicating appliance circuit or module will be used to drive remote NAC(s), with device label as to the NAC's physical location.
- 7.4 When building smoke control is called for, all auxiliary manual controls shall be supervised so that all switches must be returned to the normal (automatic) position to clear system trouble. Each independently supervised circuit shall include a discrete (amber color) "Trouble" indicator to display status condition per each circuit.
- 7.5 The incoming power to the system shall be supervised so that any power failure shall be audible and visually indicated at the control panel and the annunciator. A green color "power on" indicator shall be displayed continuously while incoming power is present.

- 7.6 The system batteries shall be supervised so that disconnection or failure of a battery shall be audibly and visually indicated at the control panel (and the annunciator).
- 7.7 Wiring to a remote annunciator (if provided for system) shall be supervised for open and ground conditions. An independent annunciator trouble indicator shall be activated and an audible trouble signal shall sound at the control panel.

PART 8 - POWER REQUIREMENTS:

- 8.1 The control panel shall receive 120 VAC power via a dedicated circuit. The incoming circuit shall have suitable over current protection within the control panel, as well as at the circuit source. If additional circuits are required for this or other control units, they shall be provided by the Contractor.
- 8.2 If the facility is equipped with an emergency standby power generator, the fire alarm equipment shall be connected to this system, per N.E.C.
- 8.3 The system shall be provided with sufficient battery capacity to operate the entire system upon loss of normal 120 VAC power in a normal supervisory mode for a minimum of 24hrs, or a period of time as required by codes for the building occupancy. There shall be reserve battery capacity to drive all alarm appliances for five minute indication at the end of this period. The system shall automatically transfer to the standby batteries upon power failure. All battery charging and recharging operating shall be automatic. Batteries, once discharged, shall recharge at a rate that will provide a minimum of 70% capacity in 12 hours, or sooner if required by codes. All batteries used within the system shall be of the same manufacturer, and labeled with their date when put in service.
- 8.4 All circuits requiring system operating power shall be 24 VDC and shall be individually fused at the control panel.

PART 9 - FIRE ALARM CONTROL PANEL:

- 9.1 Where shown on the plans, provide and install a Network Node Intelligent Addressable Multiplex Fire Alarm System.
- 9.2 The Fire Alarm Control Panel construction shall be modular with solid state, microprocessor based electronics. The FACP cabinet shall not be filled to over 80% capacity to allow for future expansion. All visual indicators shall be high contrast, LCD and LED as needed.
- 9.3 Provide for (5) Disable/Enable Zone Levels. Levels can be software or front panel switch controlled. Allows for devices in disabled zone to report to panel and DPS monitoring, but no other alarm output shall function, e.g. A/V's, door release, HVAC Shutdown etc. When engaged, shall initiate a trouble condition at the control panel.
Provide for the following levels:
- Disable/Enable Smoke Detection zones. Pulls, Heats & Flows can initiate an alarm.
 - Disable/Enable Smoke & Heat Detection zones. Pulls & Flows can initiate an alarm.
 - Disable/Enable Flow & Tamper zones. Smoke, Pulls & Heats can initiate an alarm.
 - Disable/Enable All initiating zones & output controls. Alarms displayed at panel only.
- 9.4 A manual evacuation switch shall be provided at the panel to operate the system indicating appliances and/or initiate "Drill" procedures. If a drill switch is not provided on the front of the FACP, a manual pull station shall be installed adjacent to panel. Exception, unless a manual pull station is within 15 feet of FACP.

- 9.5 The control panel shall include a built-in walk test mode to facilitate testing and system inspection. Dependant on system/manufacturer chosen, contractor shall fully explain functionality of walk test feature.
- 9.6 System amplifiers: Amplifiers shall be 25 Volts rms and supply a minimum of 30 Watts, utilize system battery back-up and supervision for amplifier failure. A back-up amplifier of equal power with auto switch over shall be used, or if specifically called for in spec.
- 9.7 The control panel shall contain the minimum following features as per plans:
- Minimum Capacity of 1000 Control or Monitor Points
 - Addressable Initiation Device Circuits (SLC) (Style 4 or 6 capable)
 - Alarm Indicating Appliance Circuit
 - Alarm verification per point, and tally
 - Nonvolatile history files for Alarms, Troubles, and Supervisory events.
 - Supervised Annunciator Circuits
 - Local Energy City Connection, as required
 - Form C Alarm Contacts (2.0 Amps ea., 3 total)
 - Earth Ground Supervision Circuit
 - Automatic Battery Charger
 - Standby Batteries
 - Resident non-volatile programmable operating system memory for all operating requirements
 - Power supplies and batteries as required for auxiliary functions as indicated. Note: Bolt-on terminals shall be used on battery sets if their back-up power current exceeds nine (9) amps in AC off mode. Fast-on terminals to be used otherwise.
 - Front panel controls, or programmed software zones for disabling/enabling system functions to facilitate testing or normal building maintenance operations.
 - Auxiliary contacts or relays for auxiliary functions as indicated
 - All Custom Software and Programming as required to suit the project requirements.

PART 10 - REMOTE ANNUNCIATOR:

- 10.1 Where indicated on the plans, provide and install annunciator/control panel, and LCD annunciator display. The panel shall be of vandal-resistant construction and shall contain a liquid crystal illuminated display for alphanumeric indication of all required functions. The panel shall also contain the following control functions, activated by a master system enable key switch on front panel:
- Manual Control Switches shall be provided for the following functions:
 - System Reset
 - Alarm Silence
 - Trouble Silence
 - Manual Evacuation
 - Alarm Acknowledge [NFPA-72]
 - Trouble Acknowledge [NFPA-72]
- 10.2 Wiring between main control panel and annunciator(s) shall be fully supervised and accomplished over twisted shielded pair and/or THWN wiring as required by the manufacturer, per N.E.C.
- 10.3 Annunciator panel shall be recessed in wall with flush trim.
- 10.4 Install panel on outlet box, 54" AFF to centerline.
- 10.5 Annunciator window English language legends shall be custom, to display both zone number and brief legend indicating the area or device associated with that zone. The fire alarm system vendor shall coordinate the legends with the Engineer at shop drawing review.

- 10.6 Provide all programming and software necessary to place annunciators and controls in full operation. System set-up shall allow for expansion of annunciators without rewiring or addition of supervision modules.

PART 11 - PERIPHERAL DEVICES:

- 11.1 Note: On fully digital multiplex systems, provide addressable bases, heads or modules for devices listed herein. Each device shall be an individual address on the system. Addressable bases, heads or modules shall be U.L. listed for the device served.

11.2 MANUAL PULL STATIONS:

- 11.3 Manual stations shall be installed within 5ft of all building entrances and exits and mounted no higher than 48 inches above the finished floor.

- 11.4 The manual station shall be non-coded, dual action and shall be constructed of high impact lexan or cast metal with raised contrasting lettering and a smooth high gloss finish. Stations that utilize screwdrivers, allen wrenches, or other commonly available tools shall not be used. Stations shall be keyed alike with the fire alarm control panel. When the station is operated, the handle shall lock open in a protruding manner.

- 11.5 When the station is operated, the handle shall lock in a visually indicating manner. Furnish one key for each manual station to owner at close of project.

- 11.6 During installation, new and as not operable devices shall have paper covers that read "This device not in service" then removed when placed in service.

- 11.7 Provide pull stations with protective shields with audible alarms as noted on the drawings. Shield shall be "Stopper II" or equal. Stoppers shall not be required for non-public areas, e.g. mechanical rooms, penthouse locations etc.

- 11.8 Keyed pull stations shall be institutional, vandal resistant type with key operator only. Provide with tamper-resistant torx head mounting hardware and install completely flush with finished walls.

11.9 CEILING-MOUNTED SMOKE DETECTORS, PHOTOELECTRIC TYPE:

- 11.9.1 Furnish and install where indicated on the plans, ceiling-mounted photoelectric smoke detectors. Provide base with auxillary relay, standard base as required. Normal operation: Detector is programmed for verification. Detection of smoke or heat by unit will cause general alarm.

- 11.9.2 Smoke Detectors shall be listed to U.L. Standard 268 and shall be compatible with their control equipment. Detectors shall be listed for this purpose by Underwriters' Laboratories, Inc. The detectors shall obtain their operating power from the fire alarm panel supervised SLC detection loop. Loss of the operating voltage shall cause a trouble signal to be generated at the control panel. Detectors shall be capable of being reset at the main control panel.

- 11.9.3 No radioactive materials shall be used. Detector construction shall provide mounting base with twist-lock detector head. Contacts between the base and head shall be of the spring-type, self-wiping contacts. Removal of the detector head shall cause a trouble signal at the control panel and display of its location. The removal of a single detector head shall not cause an open on the SLC loop. Detector design shall provide full solid state construction, and compatibility with other fire alarm detection loop devices such as heat detectors, pull stations, etc.

- 11.9.4 To minimize nuisance alarms, voltage and RF transient problems, suppression techniques shall be employed as well as a smoke verification circuit and an insect screen. The detector head shall be easily disassembled to facilitate cleaning. Where indicated or required, provide wire guard that are U.L.-listed for the device and that correctly covers the unit.
- 11.9.5 Remote LED alarm indicators shall be installed for Duct Detection units where required.
- 11.9.6 Special Note: The Contractor installing smoke detectors shall use care in the final positioning of all devices. They shall not be installed closer than 36" from an air diffuser or return grille, closer than 24" from a ceiling/wall intersection, or similar location that would diminish detector performance. Refer to NFPA 72E, "Standard On Automatic Fire Detectors".
- 11.10 AUTOMATIC HEAT DETECTORS: Automatic addressable heat detectors shall be combination rate-of-rise and fixed-temperature type. When the fixed-temperature portion is activated, the units shall be restorable. Heat detectors shall be 135, 165 or 195F, as indicated on plan. Where not indicated, provide 135F units. Where detector requires or is indicated to be furnished with a wire guard, utilize a U.L. listed unit, correctly covering and compatible with the device.
- 11.11 AUTOMATIC HEAT DETECTORS (FIXED TEMPERATURE TYPE): Where indicated on the plans, provide automatic (conventional) heat detectors of the non-restorable type, of the temperature rating as indicated or required. Detector heads shall be mounted to an outlet-box mounted base. Provide addressable module for each detector as required. Wire Class "B".
- 11.12 WATER FLOW AND SPRINKLER SUPERVISORY SWITCHES: Where indicated on the plans, interconnect to water flow and supervisory switches with addressable modules. Flow switches shall give the flow alarm description by area involved e.g. Water Flow "FLR1 W. Wing Areas". Supervisory switches shall be monitored by one module per switch, and programmed to indicate their physical location, and area they control as described earlier.
- 11.13 AUDIO/VISUAL UNITS:
- 11.13.1 Alarm horn/strobe assemblies shall include separate wire leads or terminals for proper in/out wiring of each leg of the associated signal circuit. T-tapping of signal device conductors to signal circuit conductors shall not be accepted. The horns shall have field selectable wattage taps. Horn tap shall be ½ watt per location unless otherwise noted on prints. The audio visual units shall be equipped with a Xenon-type strobe which shall be semi-flush mounted on compatible 4" square outlet box. The horn/strobes shall be listed under UL 1971 for signal devices for the hearing impaired. All building strobes shall be synchronized.
- 11.13.2 If an Audio/Visual unit is required to mounted in at exterior, swimming pool area, or shower room location, units shall be weather proof, and mounted upon appropriate weather proof back box. One audio/visual device shall be located at each building fire department access location and/or fire department connection location as required per local/state mandate.
- 11.13.3 The output intensity of all visual units, their locations and mountings shall be in compliance with the latest version of the Americans with Disabilities Act requirements. Provide additional units as needed to meet these requirements.
- 11.13.4 Units shall be high-impact lexan and shall have the word "FIRE" in contrasting lettering on the sides and/or face. Lettering shall be oriented upright to the standing viewer.
- 11.13.5 All visual signals shall develop an output of 15, 30, 75, 110 or higher candela as required to suit the size of coverage area.

11.14 VISUAL UNITS:

11.14.1 Visual only indicating appliances shall be Xenon type strobe with selectable candela rating settings. These devices shall be UL listed and be capable of either ceiling or wall mounting. The "LEXAN" lens shall project out from back plate. Lettering shall be oriented upright to the standing viewer.

11.14.2 The output intensity of all visual units, their locations and mountings shall be in compliance with the latest version of the Americans with Disabilities Act requirements. Provide additional units as needed to meet these requirements.

11.14.3 Units shall be high-impact lexan and shall have the word "FIRE" in contrasting lettering on the sides and/or face. Lettering shall be oriented upright to the standing viewer.

11.14.4 All visual signals shall develop an output of 15, 30, 75, 110 or higher candela as required to suit the size of coverage area.

11.15 DOOR HOLDERS: Install new door holders where shown on prints. Magnetic door holders shall be 24 volt D.C., and shall have an approximate holding force of 35 lbs. The door portion shall have a plated steel pivot mounted armature with shock absorbing nylon bearing. Unit shall be flush mounted. Door holders shall be UL listed for their intended purpose. Where door mounted, locate armature 6" down from top and 6" in from strike side of leaf. Where door swing prevents direct contact between armature and holder pole piece, provide plated chain to close gap as tightly as possible. Verify holder positioning with architect prior to mounting any devices.

11.16 DUCT SMOKE DETECTORS:

11.16.1 Duct smoke detectors shall be of the solid-state photoelectric type operating on the light scattering photodiode principle. The detectors shall ignore invisible airborne particles or smoke densities that are below the set alarm point. No radioactive materials shall be used. The basic construction of duct smoke detectors shall be the same as that listed above for ceiling-mounted smoke detectors. Duct housing couplings shall be slotted to ensure proper alignment of the sampling and exhaust tubes. Detector shall have an alarm LED visible through a transparent cover or view panel.

11.16.2 The Electrical Contractor shall furnish air duct smoke detectors with template to the Mechanical Contractor for installation. Coordinate length of sampling probe required with the Mechanical Contractor and furnish appropriate length. Probe tube shall be located in accordance with manufacturer's recommendations, to give maximum sampling rate of airflow. Provide multiple detectors, as required, if a single device will not provide adequate sensing due to duct size or air velocity. Wire multiple detectors as separate zones.

11.16.3 **The Mechanical and Electrical contractors shall coordinate location of these probes and housing in accordance with manufacturer's recommendations. Detectors not so done will be relocated at the contractor's expense.**

11.16.4 Detector supervised power and alarm wiring (from F.A. control panel) is to be provided by the Electrical Contractor. Interlock wiring from auxiliary contacts to stop air handling unit fan motor is to be provided by the Mechanical Contractor. Provide auxiliary contacts as required. Zone wiring and indication for air duct smoke detectors shall be maintained separate from area detection devices. Detector shall be capable of being reset at the main control panel, in addition to the reset station indicated below.

11.17 At each duct smoke detector, a remote alarm/power indicating L.E.D. key reset station shall be installed. Locate these stations typically adjacent to an automatic temperature control panel as directed. These remotes shall be ganged together, if required, and labeled accurately as to which unit is reporting an alarm condition.

- 11.18 Where air duct smoke detectors are indicated to be furnished at concealed air handling units above ceilings or smoke damper locations, furnish as outlined above. Also provide remote indicating alarm L.E.D. flush in corridor wall at 7'-0" A.F.F. immediately below installation, or as close as practical to installation. The Mechanical Contractor is to provide control wiring, E.P. switches, etc., as required to operate smoke dampers.
- 11.19 Ionization - type detectors shall not be utilized for air duct smoke detection.
- 11.20 All air duct smoke detector installations and materials shall be in accordance with NFPA, and any other applicable codes.
- 11.21 Written documentation shall be provided to prove proper air flows at and thru sampling tubes.
- 11.22 REMOTE REPORTING TELEPHONE DIALER
- 11.22.1 Provide either an internal fire alarm panel or a remote digital alarm communicator/transmitter (D.A.C.T.). Install at telephone terminal board or telephone service entrance and provide supervised wiring to fire alarm control panel as required. Also provide wiring to telephone system, two dedicated lines as required for reporting to central station.
- 11.22.2 The installation and connection of the D.A.C.T. shall be in compliance with all provisions of N.F.P.A. 71 and any and all other applicable codes. The installation and connection shall be acceptable to the Authority Having Jurisdiction, as well as the telephone company (or companies) over whose lines the signal(s) will be transmitted. Include any costs associated with telephone company work and services required in bid. Telephone connection shall be in compliance with NFPA 71, chapter five.
- 11.22.3 The D.A.C.T. shall be capable of transmitting all information relative to system status changes due to alarm, trouble, water flow, and any other information as required by current codes applicable to the facility. This information shall be transmitted to a U.L. listed Central Receiving Station that also is maintained in accordance with the requirements of NFPA 71.
- 11.22.4 As a part of this contract, the services of a Central Receiving Station (as above) shall be engaged for a period of one year from the date of substantial completion, this date as defined elsewhere in these documents. The Contractor shall initiate this service, provided on a contract basis, and shall include any costs associated with this provision in his bid. The actual beginning date of the contract with the central receiving station may be adjusted at the discretion of the Engineer, but in no case shall be for less than one year. The contractor shall notify the owner in writing by certified mail that this service has been contracted for and explain the provisions of this service adequately. A copy of this communication and the return receipt shall be forwarded to the Architect and the Engineer. Coordinate preferred central station monitoring station and service with owner prior to ordering.
- 11.23 ISOLATED LOOP CIRCUIT PROTECTOR (LCP)
- 11.23.1 Furnish and install an isolated loop circuit protector device on all fire alarm initiating device circuit, alarm indicating appliance circuit, signaling line circuit wiring (including shields), which extends beyond the main building by either aerial, underground or other methods [walkways, bridges or other above ground connectors.
- 11.23.2 The ILCP is to be located as close as practicable to the point at which the circuits leave or enter a building.

11.23.3 The ILCP grounding conductor is to be a No. 12 AWG wire having a maximum length of 28 feet to be run in as straight a line as practicable and connected to a building ground electrode system (unified ground) per Article 800-31 of the (1987) National Electrical Code.

11.23.4 The ILCP furnished is to have a line to line response time of less than one (1) nanosecond capable of accepting greater than 2000 amps (35 joules each line) to earth. Shield to earth current is to be 5000 amps maximum. The ILCP is to be protected by a high dielectric insulating material and of small enough size to mount in a standard 4@ square 2-1/8@ deep electrical box. Spark gap devices or devices incorporated in or installed within the fire alarm control panel in lieu of the specified ILCP are not acceptable.

11.23.5 All Isolated Loop Circuit Protectors must comply with UL #497B requirements.

11.23.6 In addition to the UL-UOJZ requirement mentioned above, the system controls shall be UL listed for Power Limited Applications per NEC 760. All circuits must be marked in accordance with NEC article 760-23.

11.24 AUTOMATIC CARBON MONOXIDE DETECTOR

11.24.1 Automatic Carbon Dioxide Detectors: Provide manufacturer's standard construction Carbon Monoxide detector. Control panel shall be programmed to provide supervisory trouble alert at carbon monoxide level determined by the owner and engineer. Control panel shall be programmed to go into alarm at higher carbon monoxide level determined by the owner and engineer.

11.24.2 Where carbon monoxide alarms are indicated, provide with sounder base for local audible notification.

11.24.3 All carbon monoxide detection/alarm devices and components shall be UL 2034 or UL 2075 listed, as applicable.

PART 12 - WEATHERPROOF DEVICES AND EXPLOSION-PROOF DEVICES:

12.1 Where the anticipated atmosphere or installation conditions require weather-proof, explosion-proof or other specially housed devices, they shall be U.L.-listed and NFPA-compliant and provided as indicated or required. Verify installation conditions and indicate type of device on shop drawing submission. Provide weather-proof device and backbox.

PART 13 - INSTALLATION:

13.1 Provide and install the system in accordance with the plans and specifications, all applicable codes and the manufacturer's recommendations.

13.2 All junction boxes shall be colored red and manufactured to designate "Fire Alarm". The number of wiring splices shall be minimized throughout. Excessive wire splicing shall be cause for rejection of the work, if so determined by the Engineer.

13.3 Installation of equipment and devices that pertain to other work in the contract shall be closely coordinated with the appropriate tradesmen or other contractors.

13.4 The Contractor shall clean all dirt and debris from the inside and the outside of the fire alarm equipment after completion of installation.

13.5 The manufacturer's authorized representative shall provide on-site supervision of installation, and shall perform the initial "power-up" of the system after he has thoroughly checked the installation.

- 13.6 All submittals for this project shall list names, license numbers, and telephone numbers of two installers that are employed full time by the manufacturer to install and test fire alarm systems in the installation location.
- 13.7 A floor plan drawing indicating fire alarm devices, their addresses, and labels shall be provided by the installing company for job site use. These drawings must be approved by the State Fire Marshal's Office or local authority having jurisdiction, as appropriate and in accordance with their requirements. A copy of this drawing shall be submitted to the Engineer for his review and project records.
- 13.8 Wall mounted audio/visual devices shall be mounted 80" above the floor or 6" below the ceiling, whichever is lower.
- 13.9 Coordinate connections to access controlled doors with door hardware specifications and actual door hardware. Provide all connections for release of locking mechanisms in egress paths as required.
- 13.10 Verify exact connection requirements to all equipment and devices of other trades with those trades prior to ordering equipment.
- 13.11 All connections to fire alarm devices shall be made by a technician both certified by the state/local jurisdiction and NICET Level II. No exceptions. Electrical contractor can install raceways and pull cables only. Demolition also can only be made by NICET Level II and state/local jurisdiction certified fire alarm technicians.
- 13.12 Provide wire guards for all devices in areas where prone to physical damage such as gyms. Wireguards shall allow for proper clearance around devices.
- 13.13 All surface boxes shall be as manufactured by the device manufacturer for the installed device and shall match devices in size.
- Designer Note: Parts 13.14 & 13.15 should be deleted for non-renovation projects.**
- 13.14 Contractor shall monitor troubles on existing panel equipment on a daily basis. Where a trouble is indicated, it shall be reported to the owner and construction shall stop until trouble is resolved unless otherwise indicated by owner.
- 13.15 Contractor shall modify and/or expand existing control panels, annunciators, etc. as required to accommodate new work. Existing display and control units shall be updated to reflect all new or renamed zones, devices, etc.

PART 14 – TESTING:

- 14.1 The completed fire alarm system shall be fully tested in accordance with NFPA-72H by the contractor in the presence of the Owner's representative prior to the Fire Marshal inspection. Note: Where modifying or expanding existing systems, this testing may be limited to the circuits and devices affected during the course of the work. Upon completion of a successful test, the Contractor shall certify the test results in writing to the Fire Marshal, Owner and Engineer. Provide written 72 hour advance notice of the test to all concerned parties.
- 14.2 All auxiliary devices the fire alarm system is connected to, including tamper switches, flow switches, etc., shall be fully tested for proper operation where interfacing with the fire alarm system.
- 14.3 The Contractor shall provide a minimum of eight hours of instructional time to the Owner in the operation and maintenance of all equipment and components. A receipt shall be obtained from the Owner that this has been accomplished, and a copy forwarded to the Engineer.

- 14.4 Contractor and manufacturer shall be required to accompany the engineer on a complete system verification after the installation has been certified. This shall include physically testing each device and reviewing descriptive device readout.

PART 15 – WARRANTY:

- 15.1 The Contractor shall unconditionally guarantee (except for vandalism or misuse) the completed fire alarm system wiring and equipment to be free from inherent mechanical and electrical defects for a period of one (1) year from the date of beneficial occupancy.
- 15.2 The equipment manufacturer shall make available to the owner a maintenance contract proposal to provide a minimum of two (2) inspections and tests per year in compliance with NFPA-72H guidelines.

END OF SECTION.



SECTION 321313
CONCRETE PAVING

PART 1 - GENERAL

1.01 WORK INCLUDED:

- A. Formwork complete with required shoring, bracing and anchorage.
- B. Concrete reinforcing, complete with required supports, spacers and related accessories.
- C. Cast-in-place concrete.
- D. Construction, expansion and contraction joints.

1.02 QUALITY ASSURANCE:

- A. Perform work in accordance with ACI 301. Maintain one copy at the job site.
- B. Obtain materials from the same source throughout.
- C. Do not place concrete when base surface temperature is less than 40°F or forecast to go below 40° for 24 hours, and when surfaces are wet or frozen.

1.03 REGULATORY REQUIREMENTS:

- A. Comply with local codes and ordinances for concrete work on public property.

1.04 TESTS:

- A. Testing and analysis will be performed in accordance with practices specified elsewhere in the specifications.
- B. Submit the proposed mix design of each type of concrete at least two weeks prior to commencement of concrete work.
 - 1. Base material proportions on ACI procedures.
 - 2. Show type of materials, slump range, air content, aggregate gradation and 28 day compressive strength.
- C. The testing agency will take cylinders and perform slump and air entrainment tests in accordance with ACI 301.
 - 1. Four test cylinders will be taken for every 75 (or less) cubic yards of concrete placed each day.
 - 2. One slump test and air entrainment test will be taken for each set of cylinders taken.
- D. Verify results of tests for compliance with the Contract Documents.

1.05 SUBMITTALS:

- A. Submit product data on joint filler, admixtures and curing compounds including properties, chemical composition and installation instructions.
- B. Submit shop drawings showing sizes and locations of reinforcing, splicing details and other pertinent installation details.
- C. Submit certification that concrete materials comply with referenced standards.

PART 2 - PRODUCTS

2.01 MATERIALS:

- A. Concrete materials:
 - 1. Cement: ASTM C150 Type I Portland cement, gray color.
 - 2. Aggregates: ASTM C33.
 - 3. Water: Clean and not detrimental to concrete.
- B. Form materials:
 - 1. Forms: Wood or steel form material profiled to suit conditions.
 - 2. Joint filler: ASTM D994 bituminous type, 1/2 inch thick.
 - 3. Form release agent: Colorless mineral oil which will not stain concrete or absorb moisture.
 - 4. Fillets for chamfered corners: Wood or plastic strips sized to make a 3/4 inch chamfered corner, maximum possible lengths.
- C. Reinforcement:
 - 1. Reinforcing steel: ASTM A615 Grade 60, deformed billet steel bars, uncoated finish.
 - 2. Welded wire fabric: ASTM A185 plain type in flat sheets, uncoated finish.
 - 3. Tie wire: Minimum 16 gauge annealed steel.
 - 4. Dowels: ASTM A615 Grade 40 plain steel, uncoated finish.
- D. Admixtures:
 - 1. Air entrainment: ASTM C260.
 - 2. Water reducing: ASTM C494 Type F high range.
 - 3. Accelerating: ASTM C494 Type C.
 - 4. Set-retarding: ASTM C494 Type B.
 - 5. Bomanite concrete coloring and hardening materials in accordance with manufacturer's requirements.
- E. Joint sealer: ASTM D5329-96 hot poured elastic type.
- F. Curing compound: ASTM C309, Type 1-D, Class 2, 30% solids.

2.02 CONCRETE MIX:

- A. Mix concrete in accordance with ASTM C94.

- B. Compressive strength:
 - 1. Sidewalks, pads, curbs and gutters: 3500 psi at 28 days.
 - 2. Vehicular pavements: 4000 psi at 28 days.
- C. Accelerating Admixtures: Use in cold weather only when approved by the Owner's Representative. Use of admixtures will not relax cold weather placement requirements.
- D. Set Retarding Admixtures
 - 1. Use set-retarding admixtures in hot weather only when approved by the Owner's Representative.
- E. Do not add calcium chloride to concrete.

PART 3 - EXECUTION

3.01 PREPARATION OF BASE:

- A. Verify that the supporting base is properly prepared and compacted, and true to line and grade. The subgrade should be compacted to 96% standard proctor density.
- B. Moisten base to minimize absorption of water from fresh concrete.
- C. Notify the Owner's Representative a minimum of 24 hours prior to commencement of concreting operations.
- D. Frames of subsurface structures: Coat surfaces of new and existing frames with oil to prevent bonding with concrete.
- E. Notify the testing agency a minimum of 72 hours prior to commencement of concreting operations.

3.02 FORM WORK:

- A. Form Setting:
 - 1. Place and secure forms to correct locations, dimensions and profiles.
 - 2. Assemble formwork to permit easy stripping and dismantling without damaging concrete.
 - 3. Construct forms sufficiently tight to prevent mortar leakage. Lock form section to be free from ply or movement in any direction.
 - 4. Place joint fillers vertical in position, in straight lines. Secure to formwork during concrete placement.
 - 5. Provide chamfers at all exposed concrete edges.
 - 6. Apply form release agent to form surfaces in accordance with the manufacturer's printed instructions, before placing reinforcing and embedded items.
- B. Grade and Alignment:
 - 1. Check and correct the alignment and grade elevation of the forms immediately before placing the concrete.
 - 2. When any form has been disturbed or any grade has become unstable, reset and recheck the form.

3.03 REINFORCEMENT:

- A. Ensure all reinforcing is clean, and free of rust, scale, oil, dirt or other materials which may reduce bonding.
- B. Have required bends made in the shop without heat.
- C. Place reinforcement in accordance with approved shop drawings.
- D. Interrupt reinforcement at expansion joints.
- E. Support reinforcing with precast concrete blocks, metal chairs or other method approved by the Owner's Representative. Supporting with gravel, brick or wood blocks is not permitted.

3.04 GENERAL CONCRETE PLACEMENT:

- A. Place concrete in accordance with ACI 301. When central or transit mixed concrete is used, place the mixture where it will require as little rehandling as possible.
- B. Keep forms and subgrade moist during concrete placement.
- C. Ensure reinforcement, embedded items and formed joints are not disturbed during concrete placement.
- D. Do not allow concrete to free fall more than 3 feet.
- E. Distribute and spread concrete as soon as possible. Place concrete continuously between predetermined construction joints. Do not break or interrupt successive pours such that cold joints occur.
- F. Thoroughly work concrete with suitable tools to remove coarse aggregate from the surface and to place mortar against the form. Work concrete to produce a smooth finish, free of air pockets, water pockets and honeycombs.
- G. Consolidate concrete against and along the faces of all forms and along the full length and on both sides of all joint assemblies with a suitable mechanical vibrator. Do not permit the vibrator to come in contact with forms, joint assemblies or subgrade. Do not over vibrate concrete or use the vibrator to transport or flow concrete.
- H. Ensure positive drainage to all drains and away from all window sills and door openings, unless specifically noted otherwise.

3.05 WALKS:

- A. Construct to general grade. Wavy walks or walks that pond water are not acceptable.
- B. Place short vertical curves where necessary and where change in grade exceeds 2%. Do not exceed 1/2 inch/ft. slope within 2 feet of top and bottom steps. Crown 1/4 inch/ft. or cross slope to maintain drainage.

C. Joints:

1. Install 1/2 inch premolded joint filler at no more than 25 feet o.c., at walk junctions and intersections, at top and bottom of steps, and where walks abut curbs, building, slabs or other fixed objects. Extend to within 1/4 inch of the surface.
2. Install expansion joints in irregular walk sections at right angles to the walk centerline to create panels not exceeding 250 sq ft. Extend the full depth of the slab.
3. Score joints at minimum spacing of 5 ft. o.c. with a suitable edging tool.

D. Finishing:

1. Slopes exceeding 6%: Finish with a bolted or heavy broom texture.
2. Other surfaces: Finish with a light broom texture unless otherwise noted on the Landscape or Civil Plans.
3. Round edges, including each side of joints and grooves, to a 1/4 inch radius.
4. Finish walks to be 1/4 inch above curb, and with a neat bevel at termination with curbs.

E. Curing: Uniformly apply curing compound over the entire surface after finishing, initial set and removal of side forms, in accordance with the manufacturer's printed instructions for the application.

F. Protection: Do not remove forms until at least 24 hours after paving. Protect walks from pedestrian traffic and applied loads for at least three days after paving.

3.06 PROTECTION:

A. Protect installed items under provisions of Division 1 of the Specifications. In addition to specific protection measures specified above.

1. Immediately after placement, protect pavement from premature drying, excessive temperatures and from mechanical injury. Maintain environmental and barrier protection for seven days after placement.
2. Maintain concrete with a minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.
3. Protect concrete form paint and stains.

3.07 FIELD QUALITY CONTROL:

A. Field inspection and testing will be performed in accordance with practices specified elsewhere in the specifications.

B. Maintain records of placed concrete items. Record:

1. Date.
2. Location of pour.
3. Quantity.
4. Air temperature.
5. Test samples taken.

END OF SECTION