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SECTION 15010 – MECHANICAL GENERAL PROVISIONS

A. CODES AND STANDARDS

1. The following codes and standards requirements shall be identified in the project specifications:
 - i. Mechanical Work shall meet requirements of the National Fire Protection Association, the Pennsylvania Uniform Construction Code, and all other federal, state, and municipal authority's laws, rules, and regulations applicable to the Work.
 - ii. Boilers, hot water heater(s), heating equipment and pressure vessels shall be constructed and tested in accordance with recommendations of the National Fire Protection Association, Pennsylvania Department of Labor and Industry - Boiler Inspection Division, and ASME Code. Boilers, hot water heaters and unfired pressure vessels shall be stamped with the ASME symbol and National Board number and shall be inspected during construction by an inspector who has been commissioned by the Pennsylvania Department of Labor and Industry to perform such service. Boilers, hot water heaters and unfired pressure vessels shall be prepared for initial inspection in accordance with Pennsylvania Department of Labor and Industry regulations.
 - iii. Plumbing Work shall be approved as Project progresses by the local plumbing inspector having jurisdiction. Contractor shall certify domestic water systems for compliance with Pennsylvania Plumbing System Lead Ban & Notification Act (No. 33-1989). Nothing in the Specifications shall be construed to permit deviation from requirements of governing code(s).
 - iv. Installation of all gas piping and gas burning equipment shall conform to recommendations of the American Gas Association, HMC's Insurance Underwriter and the local utility.
 - v. The handling and use of CFC and HCFC refrigerants, whether leaking, venting, recovering, etc., shall be in accordance with US Environmental Protection Agency regulations CFR 58 FR 28660, ASHRAE 15 Safety Code for Mechanical Refrigeration, and ANSI/ASHRAE 34 Number Designation and Safety Classification of Refrigerants.
 - vi. Electrical Work shall meet requirements of the National Electrical Code and all federal, state, and municipal authority's laws, rules and regulations applicable to the Work.

- vii. Where applicable, materials and equipment shall bear the label of approval of Underwriters Laboratories, Inc.
 - viii. Comply with Pennsylvania Underground Utility Line Protection Act (No. 172-1986) before commencing any excavation work. Telephone number for Pennsylvania One-Call Systems, Inc. is 1-800-242-1776.
 - ix. A drill stop shall be used on all core drilling.
2. Except where a requirement in this specification is more stringent, the mechanical work shall be designed and installed to meet the following codes, standards, and guidelines:

Pennsylvania State University's Office of Physical Plant (OPP) Standards included as an appendix to these standards and available at the following link. HMC reserves the right to modify OPP standards as necessary to meet specific project needs.

<http://www.opp.psu.edu>

AIA Guidelines for Design and Construction of Hospital and Health Care Facilities (2001 Edition)

Pennsylvania Uniform Construction Code, including:

- International Building Code 2006
- ICC Electrical Code 2006 (references National Electric Code NFPA 70-05)
- International Energy Conservation Code 2006
- International Existing Building Code 2006
- International Fire Code 2006
- International Fuel Gas Code 2006
- International Mechanical Code 2006
- International Plumbing code 2006

B. COORDINATION

- 1. Equipment not related to the support of Telecommunication Rooms such as piping, ductwork, and distribution of building power must not be located in, or pass through, the Telecommunication room.
- 2. Any equipment requiring periodic or emergency maintenance shall be located in the corridor outside of patient and critical use rooms unless approved by HMC.
- 3. Roof mounted equipment curbs shall be installed in accordance with HMC's standard curb detail.

C. PAINTING

1. Equipment furnished under this Division that is pre-painted or pre-finished by manufacturer shall have all rust spots cleaned, primed, and refinished prior to final acceptance by HMC.
2. Rooftop equipment shall be painted Duron 5431W, "Silver Wing".

D. RECORD DOCUMENTS

1. The Contractor shall be required to maintain a set of Contract Documents, i.e., Specifications, Drawings, Addenda, Modifications and approved submittals at the site, in good order and annotated to show all changes made during construction process. At the time of substantial completion of the Work, deliver to the Engineer the complete set of as-built drawings. The Engineer will, within 30 days after receipt from the Contractor, transpose all changes recorded by the Contractor onto a full set of reproducible drawings, and CADD electronic media, compatible with the HMC's CADD system, which shall become the record drawings for the Project, and shall forward same to the HMC. These record documents shall be delivered to HMC in both print (1 set) and electronic form (1 copy). Electronic format for printed documents shall be Adobe Acrobat PDF. Electronic format for drawings shall be AutoCAD. In each case, provide the software version required by HMC.

E. OPERATION AND MAINTENANCE INSTRUCTIONS

1. The Contractor shall be required to furnish an instructor/operator at completion of system(s) installation, who shall operate all systems and provide documentation. The instructor/ operator(s) shall provide instruction to thoroughly train HMC personnel in the operation and maintenance of all equipment. The amount of time required for training shall be determined by HMC for each project.
2. The Contractor shall be required to provide a minimum of 2 printed sets and 1 electronic set of instructions covering operation and maintenance of each item of equipment and valve charts shall be submitted to HMC during this operating period. Required instructions from manufacturer's representatives shall be submitted at this time. Instructions and charts shall be submitted in print and electronic form. Electronic format shall be Adobe Acrobat PDF.

F. TEMPORARY UTILITIES

1. Shall be provided as required by the HMC Project Manager.

G. MATERIALS

1. Materials shall be new, without imperfections or blemishes, and shall be protected from the elements prior to installation.

H. VIBRATION ANALYSIS

1. A vibration analysis shall be performed prior to the start of warranty for all fans and pumps rated 15HP and above.
2. The vibration levels at frequencies associated with the major machine components (i.e. motor and fan shafts, bearings, belts, and impeller) shall be measured and compared to applicable vibration severity levels.
3. A report identifying findings shall be provided to HMC and included in the operation and maintenance manuals.

I. MECHANICAL ROOM CONSTRUCTION

1. Coordinate with the HMC Project Manager and Project Architect mechanical room wall construction rating to accommodate storage within the room as required by the project program.

END OF SECTION

SECTION 15050 - PLUMBING BASIC MATERIALS

- A. Furnish and install access panels in ceilings and walls for service and repair access to concealed equipment. Minimum size shall be 18 inches by 18 inches. Where restrictions will not permit minimum size, verify access panel size with HMC. Access panel construction shall be compatible with ceiling and wall materials and fire rating.
- B. Furnish and install fire stop sealing system for piping and conduits passing through walls and floors with smoke or fire rating in accordance with HMC's Penetrations Policies and Procedures.
- C. Complete and submit HMC's Equipment Data Acquisition form for central plumbing equipment. Also, furnish and install nameplates. Nameplates for non-powered equipment and equipment connected to normal power circuits shall be laminated phenolic, two outer layers of black phenolic and an inner layer of white with engraving depth to the inner layer. Nameplates for equipment connected to normal-emergency power circuits shall have an outer layer of red. Nameplates shall include the following information:

Unit #
Area Served
Date unit put in service
Contractor
Manufacturer
Model #
Serial #
Archibus #
HMC/COM Project #

Coordinate equipment designations with HMC and submit a complete itemized listing of nameplate equipment designations for approval.

END OF SECTION

SECTION 15055 - PLUMBING PIPE AND PIPE FITTINGS

- A. Interior domestic water piping shall be Type L copper type.
- B. Sanitary vent piping shall be service weight cast iron soil pipe.
- C. Interior sanitary piping shall be service weight cast iron soil pipe. Exterior sanitary piping shall be service weight cast iron soil pipe. Piping serving acid waste systems shall be Schedule 40, Type II acid resistant polypropylene compound or Schedule 40, fire retardant, acid resistant proxylene.
- D. All storm piping shall be service weight cast iron soil pipe.
- E. Piping located within MRI room shielding shall be non-ferrous.
- F. Interior and above grade gas piping shall be Schedule 40 black steel.
- G. Underground gas piping shall be polyethylene plastic with trace line meeting local utility's requirements.
- H. Dead legs in piping distribution systems shall not be permitted. All branch piping shall be removed to mains and capped.

END OF SECTION

SECTION 15060 - PLUMBING VALVES

- A. All branch lines on both cold and hot water systems shall be furnished with shut-off valves.
- B. Ball valves shall be used on all domestic water piping 4 inches and smaller. Ball valves shall be full port, one-piece style for piping 2 inches and smaller and full port, three-piece style on larger piping. Manufactured: Watts or Apollo, no substitutions.
- C. Three-piece ball valves shall be used on all medical gas piping and rated for the application.
- D. Butterfly valves shall not be permitted.

END OF SECTION

SECTION 15065 - PLUMBING PIPE SPECIALTIES

- A. Furnish and install dielectric fittings whenever dissimilar metals are used in a piping system. Fittings shall be Victaulic Clearflow Dielectric Waterways. Dielectric unions will not be permitted.
- B. Furnish and install valve tags for all shutoff valves. Coordinate with HMC for number sequencing. Valve tags for valves to be replaced shall be removed and re-installed on the new valves. Valve tags for valves to be removed shall be turned over to HMC.
- C. All piping shall be identified by legend and flow arrows. Identification system shall conform to ANSI A-13.1, Scheme For Identification of Piping Systems, using standard background colors. Air and vacuum piping serving laboratories shall be labeled "LAB AIR" and "LAB VACUUM".

END OF SECTION

SECTION 15070 - PLUMBING SUPPORTS AND ANCHORS

- A. The requirements of the applicable sections of ANSI B31, pressure piping shall be considered as minimum requirements governing fabrication, installation and support of piping systems.

END OF SECTION

SECTION 15080 - PLUMBING PUMPS

- A. Furnish and install a fractional horsepower inline circulator pump for the domestic hot water circulation system. Pump shall be bronze and shall be rated for use in potable hot water systems. The circulator pump shall be furnished with isolation valves, pressure gage(s) (indicating inlet and outlet pressure) and thermometer. The pump shall be manufactured by Bell & Gossett. No substitutions.

END OF SECTION

SECTION 15090 - PLUMBING INSULATION

- A. Domestic cold water piping, valves, and appropriate piping system specialties shall be insulated with fiberglass or foamed plastic insulation. Insulation shall be minimum 1/2 inch thick for all pipe sizes.
- B. Domestic hot water piping, valves, and appropriate piping system specialties shall be insulated with fiberglass or foamed plastic insulation. For water temperature less than 170 degrees F, insulation shall be minimum 1 inch thick for pipe sizes up to 2 inches and 1-1/2 inch thick for pipe sizes 2-1/2 inches and larger.
- C. Vertical drop from roof drains and horizontal rain water conductors shall be insulated. Insulation shall be fiberglass or foamed plastic, 1/2 inch thick.

END OF SECTION

SECTION 15200 - PLUMBING SPECIALTIES

- A. Water supply shall be extended from the local municipal water system and distributed to all fixtures and equipment requiring same. Water service shall be protected by a double check valve backflow preventer with isolation valves and valved bypass where permitted by the local water authority. Water meter shall be installed in accordance with local municipality requirements.

- B. Wall hydrants with locking covers shall be provided on the exterior building walls in quantities and locations as directed by HMC.

END OF SECTION

SECTION 15250 - WATER HEATERS

- A. Where plant steam is available, furnish and install instantaneous-type water heaters. The water heaters shall be manufactured by Patterson-Kelly.
- B. For stand-alone buildings, furnish and install two gas-fired storage water heaters and associated vent piping. Each water heater shall be sized for 2/3 of the building demand. Vent terminations shall be as required by equipment manufacturer. The water heaters shall be manufactured by PVI, Bradford White or A.O. Smith.
- C. Hot water shall be generated at 140 degrees F and distributed through a temperature limiting device (thermostatic mixing valve) that limits the tempered water to a maximum 110 degrees F to lavatories. Hot water used for culinary purposes, cleansing, or building maintenance purposes shall be limited to 120 degrees F.
- D. A domestic water circulation system shall be designed to return to the water heaters at a temperature loss of 5 to 10 degrees Fahrenheit. Provide balancing valves with isolation valves as required. Circulation pumps shall be of bronze construction be manufactured by Bell & Gossett, no substitutions.

END OF SECTION

SECTION 15300 - SANITARY DRAINAGE

- A. Sanitary drainage shall be collected from all fixtures and equipment requiring same and connected to the municipal sewer system.
- B. Sanitary and vent piping below floors, above ceilings and inside walls shall be minimum 2 inch ID, no-hub.
- C. Furnish and install floor drains (minimum 2 inch) in each public toilet room, patient toilet room with a shower, and mechanical room and where required by code for equipment drains. Floor drains shall be furnished with integral trap guards to prevent trap evaporation and sewer gas emissions. Trap guards shall be manufactured by Proset (Trap Guard) or as approved.
- D. Traps for grease, barium or plaster shall be constructed of cast iron or stainless steel. Porcelain covered carbon steel will not be permitted.
- E. Active sanitary piping shall not be left open during construction. Piping shall be plugged with approved temporary plugs at the end of each work day.
- F. Abandoned sanitary piping shall be removed. All piping to be removed shall be removed back to the remaining active stack or branch and capped. If abandoned sanitary piping is not accessible, backfilling with cement slurry is acceptable.
- G. Connections to existing sanitary piping shall be achieved by cutting the pipe and installing a fitting. Drain tappings shall not be permitted. Field verify locations and sizes of existing sanitary and vent piping. Abandoned inverted sanitary wyes on vertical stacks shall be capped or plugged with a close thread nipple with a cap or a no-hub coupling with a no-hub cap.
- H. Roof openings from vents through roofs to be removed shall be properly patched.

END OF SECTION

SECTION 15350 - STORM DRAINAGE

- A. Storm drainage shall be collected within the building via roof drains and on the site via catch basins and extended to the municipal storm drainage system.

END OF SECTION

SECTION 15400 - PLUMBING FIXTURES

- A. Furnish and install plumbing fixtures in locations and arrangements required by building program. Fixtures shall meet ADA requirements where required and be installed with stop valves and all associated trim and piping. In general, plumbing fixtures shall meet the following characteristics:
1. Water Closets: Flush valve, wall hung with a 500 lb. minimum load rated heavy-duty carrier, white vitreous china elongated bowl and open toilet seat. Tank type will not be permitted. Provide with bedpan lugs and bedpan washing wand on flush valves in patient toilet rooms. Water closets shall be manufactured by American Standard or Kohler.
 2. Bariatric Water Closets: Floor mounted flush valves with rear discharge for installation against finished walls, siphon jet action, ADA compliant with hinged seat. 14 gage, type 304 stainless steel, seamless welded to withstand loads up to 2,000 pounds with no measurable deflections and up to 5,000 pounds with no permanent damage. Side access panels to facilitate installation and servicing.
 3. Urinals: Wall hung vitreous china, without strainers. Urinals shall be manufactured by American Standard or Kohler.
 4. Flush valves for water closets and urinals in public and staff areas shall be hard-wired automatic style manufactured by Sloan or Toto, no substitutions. Power shall be provided from a normal-emergency circuit. Flush valves in patient areas shall be manual manufactured by Sloan or Toto, no substitutions.
 5. Lavatories: Wall hung fixtures shall be vitreous china material, manufactured by American Standard or Kohler. In public and patient care areas with countertop sinks, the sinks shall be integral molded bowls as part of the solid surface material countertop.
 6. Sinks: Stainless steel, self-rimming. Compartment quantity and size as required for function. Sinks shall be manufactured by Elkay or Just.
 7. Faucets for lavatories and sinks in staff and patient care areas shall be swivel-base gooseneck style with wrist blade handles on 8 inch centers manufactured by Chicago or T&S.
 8. Faucets for lavatories in public toilet areas shall be hard-wired automatic style manufactured by Sloan or Toto, no substitutions. Power shall be provided from a normal-emergency circuit.

9. Faucets for sinks in laboratories shall be furnished with vacuum breakers, manufactured by T & S Brass, no substitutions. Coordinate spout configuration with size of sink.
 10. Showers: One-piece acrylic with, fold-up seat, top and dome light. ADA shower stalls shall be provided with threshold strips to contain water. Showers shall be manufactured by Acryline or Aquaglass. Hand-held shower heads are not permitted in showers unless required by code or functional program. Shower valves shall be pressure-balancing type with check stops manufactured by Powers.
 11. Mop Receptors: One piece precast terrazzo with faucet. Mop receptors shall be manufactured by Fiat, or equal. Acrovyn surrounds at mop receptors shall be coordinated with the project architect.
 12. Electric Water Coolers: Wall mounted, ADA compliant with hand-operated (valve-type) bubblers. Touch pads with solenoid valves will not be permitted. Electric water coolers shall be manufactured by Oasis, Elkay or Halsey Taylor.
 13. Emergency Eyewash: Drench hose type for installation on countertop with 8 feet long hose, squeeze handle operation and ABS plastic eye/face wash head with integral flip top dust cover. Provide with thermostatic mixing valve with high temperature limit valve and built-in shutoff in the event of hot or cold water supply failure. Eyewash and thermostatic mixing valve shall be manufactured by Guardian (Models G5022 and G3600) or Haws, no substitutions.
- B. Ball valves shall be provided for each group of plumbing fixtures and remote plumbing fixtures above the ceiling in addition to square-keyed shut-offs (loose key) below the fixture.
- C. Exposed piping below plumbing fixtures shall be chrome plated. ADA compliant accessible fixtures shall be installed with appropriate (offset) P-traps and insulated jacket.
- D. Hot and cold water piping to shower valves shall be installed with spring-loaded check valves and stop & waste valves. An access panel to permit maintenance of the valves shall be provided behind the shower. Copper sweat unions shall be installed downstream of the stop & waste valves to facilitate maintenance.

END OF SECTION

SECTION 15430 – MEDICAL GAS AND VACUUM SYSTEMS

- A. Medical gas and vacuum systems shall be designed, installed and tested in accordance with NFPA 99 and manufacturer's recommendations. Coordinate outlet locations and quantities with HMC.
- B. The current loading and capacity of existing medical gas and vacuum systems shall be reviewed when extending or adding to existing systems. Any capacity or operational deficiencies or upgrade requirements shall be identified to HMC.
- C. Oxygen piping shall be extended from the existing central system or oxygen cylinders and manifold supply and distributed to patient outlets and equipment requiring same.
- D. Medical air piping shall be extended from the existing central system or medical air cylinders and manifold supply and distributed to patient outlets and equipment requiring same.
- E. Medical vacuum piping shall be extended from the existing central system or vacuum pumps and receiver system and distributed to patient outlets and equipment requiring same.
- F. Medical gas/vacuum piping service valves, patient outlets, zone valve box assemblies, alarm systems, line pressure monitoring gages shall be manufactured by Allied Healthcare (Chemetron), no substitutions.
- G. Medical gas supply manifolds shall be manufactured by Allied Healthcare, Amico, or Beacon Medical Products.
- H. Vacuum pump assembly shall be liquid ring style with cooling water recirculating system. Vacuum pump shall be manufactured by Beacon Medical Products (Nash).
- I. Medical air compressors shall be oil-less scroll type. Air compressors shall be manufactured by Beacon Medical Products.
- J. Source equipment shall be furnished with transducers or contacts as required to permit remote monitoring of alarm points by the Building Management System in addition to monitoring required by NFPA 99.
- K. Brazed fittings shall be used on all medical gas fittings. All medical gas piping when installed shall be purged each time a joint is brazed. Piping shall be purged with nitrogen to prevent carbonizing.
- L. Any compound that has an oil base shall not be used on medical gas system installations.

- M. Medical gas and vacuum systems, including all source equipment, valving, alarms and use point outlets shall be evaluated and certified for mechanical and therapeutic function as defined in the NFPA 99. Testing shall be performed by an agency independent of the facility, installer or suppliers. Testing agency shall specialize in medical facilities and shall be able to demonstrate experience and expertise in medical gas installations. Medical gas verification shall be performed by one of the following companies:

Sherman Engineering Company (610-340-5300)

Medical Engineering Services, Inc. (703-779-8442)

Patient Instrumentation Corporation (610-799-4436)

MedGAS, Inc. (570-759-9319)

Medpipe Maintenance, Inc. (724-745-1854)

END OF SECTION

SECTION 15450 - FIRE PROTECTION

- A. The entire fire protection system shall conform to the latest requirements of the National Fire Protection Association (NFPA 13), state and local authorities, and HMC's Fire Insurance Underwriters (FM Global).
- B. All areas of the building shall be fully sprinklered by a wet pipe sprinkler system. The sprinkler systems shall be zoned as approved by HMC.
- C. Canopies, attics and freeze-potential areas shall be protected by a dry-pipe system.
- D. The wet pipe sprinkler system shall be hydraulically designed and shall be based upon 0.10 GPM per sq. ft. over the most remote 1500 sq. ft. area with sprinkler heads spaced at a maximum of 225 sq. ft. per head.
- E. Sprinkler contractor shall furnish and install all required flow switches and OS&Y valve supervisory switches. Electrical contractor shall furnish and install all conduit and wiring from all flow switches and supervisory switches to fire alarm panel. Electrical contractor shall make final connections at the switches and at the panels. All sprinkler control valves except drain valves shall be electronically supervised and equipped with supervisory switches.
- F. Unless noted otherwise, sprinkler heads in finished ceilings shall be 1/2 inch, quick response application, adjustable, fully concealed with white cover plate, with a temperature rating of 165 degrees F. All sprinkler heads installed in finished ceilings shall be centered in the ceiling tiles. Fully concealed sprinkler heads shall be Viking VK462 Horizon Mirage with Model B-2 sprinkler spray pattern with an FM stamp, no substitutions.
- G. For areas where ceilings are not installed, sprinkler heads shall be 1/2 inch, quick response application, brass, and of appropriate orientation (upright, pendent, or sidewall) with a temperature rating of 165 degrees F. Exposed sprinkler heads shall be chrome plated. Sidewall heads shall be installed with recessed escutcheons. Exposed sprinkler heads shall be manufactured by Viking with an FM stamp, no substitutions.
- H. Sprinkler heads in psychiatric and seclusion rooms shall be tamper resistant.
- I. Sprinkler heads installed in cold boxes shall be 1/2 inch, Reliable G3FR Dry Pendent with a 15 degree F temperature rating.
- J. Sprinkler heads in steam reduction rooms shall have a 286 degree F temperature rating.
- K. Prior to design of the fire protection system, a water flow test shall be performed to

determine the actual water supply available at the building's fire system inlet. All elevation differences during water flow shall be considered.

- L. Plastic pipe shall not be permitted.
- M. Adjustable drop nipples (maintenance eliminator) will be permitted for flush fit adjustment of the sprinkler head assembly.
- N. Each sprinkler system zone shall be provided with a combination drain/inspector's test station and piped to grade.
- O. Fire hydrants shall be furnished with two (2) – 2-1/2 inch National Standard Thread side outlets and a 5 inch Storz steamer connection.
- P. Final fire protection system design and layout shall be coordinated with all building trades and shown on drawings generated by the fire protection system designer/engineer.
- Q. Coordinate sprinkler piping, equipment, heads, appurtenances, etc. with that of other trades so that sprinkler work will be installed in the most direct manner and so that interference between piping, ducts, equipment, and architectural or structural features will be avoided. Sprinkler piping, equipment, heads, appurtenances, etc. installed in an arbitrary manner without regard for work of other trades will be rejected in any situation where an undesirable condition or an unfair hardship for other trades, or HMC, results.
- R. Submit insurance company and fire marshal's letters of approval and any additional review comments with drawings and calculations to architect. Fire protection shop drawings will not be reviewed unless submitted with approval letters and associated comments from insurance company and fire marshal. Submit drawings and calculations to the local fire marshal and HMC's Insurance Underwriter.

SECTION 15500 - HVAC SYSTEM DESIGN CRITERIA

A. The design criteria for determining the heating and cooling loads for the building shall be based on the following:

1. Summer Outdoor Conditions: 95 degrees F DB, 78 degrees F WB
2. Winter Outdoor Conditions: 0 degrees F DB
3. Summer Indoor Conditions: 72 degrees F DB, 45-55 percent RH
4. Winter Indoor Conditions 75 degrees F DB, minimum RH as required by Guidelines or medical or computer equipment manufacturers.
5. Procedure and Equipment Rooms As required by staff and equipment manufacturers

Heating and cooling load calculations using the TETD methodology shall be submitted to HMC for review.

- B. Ventilation systems shall be designed in accordance with latest ASHRAE Ventilation for Acceptable Indoor Air Quality Standard 62 and the AIA Guidelines for Design and Construction of Hospital and Health Care Facilities (2001 Edition).
- C. Airborne Infectious Isolation (AII) Rooms shall be designed in accordance with Centers for Disease Control and Prevention (CDC) Guideline for Environmental Infection Control in Healthcare Facilities and Barton Associates' newsletter on the subject at the end of this section.
- D. Design of air systems shall be coordinated with the existing HMC smoke control systems.

END OF SECTION

SECTION 15550 - HVAC BASIC MATERIALS

- A. Furnish and install access panels in ceilings and walls for service and repair access to concealed equipment. Minimum size shall be 18 inches by 18 inches. Where restrictions will not permit minimum size, verify access panel size with HMC. Access panel construction shall be compatible with ceiling and wall materials and fire rating.
- B. Furnish and install fire stop sealing system for piping and conduits passing through walls and floors with smoke or fire rating in accordance with HMC's Penetrations Policies and Procedures.
- C. Complete and submit HMC's Equipment Data Acquisition form for all installed central HVAC system equipment, including, but not limited to, boilers, chillers, pumps, air handling units, fans and building automation system panels. Also, furnish and install nameplates. Nameplates for non-powered equipment and equipment connected to normal power circuits shall be laminated phenolic, two outer layers of black phenolic and an inner layer of white with engraving depth to the inner layer. Nameplates for equipment connected to normal-emergency power circuits shall have an outer layer of red. Nameplates shall include the following information:

- Unit #
- Area Served
- Date unit put in service
- Contractor
- Manufacturer
- Model #
- Serial #
- Archibus #
- HMC/COM Project #

Coordinate equipment designations with HMC and submit a complete itemized listing of nameplate equipment designations for approval.

- D. Full perimeter roof curbs with sheet metal caps shall be used for installing equipment on roof. Individual equipment supports (roof rails) will not be permitted.
- E. Walkway pads or pavers shall be provided on a path to and around roof mounted equipment. Coordinate type of pad/paver with roofing system.
- F. Access catwalks and protective railings shall be installed for all equipment installed on steel dunnage.

END OF SECTION

SECTION 15555 - HVAC PIPE AND PIPE FITTINGS

- A. Low, medium and high pressure steam and condensate piping shall be Schedule 80 black steel with threaded (up to 1-1/2 inch) or welded fittings.
- B. The hot water heating system piping shall be Type L hard drawn seamless copper tube with solder joints or standard weight (Schedule 40) black steel with threaded joints. Victaulic fittings will not be permitted on hot water piping.
- C. The chilled water system piping shall be Type L hard drawn seamless copper tube with solder joints, standard weight (Schedule 40) black steel with threaded joints, or Victaulic piping and fittings.
- D. Refrigerant piping shall be Type L hard drawn seamless copper tube with brazed joints.
- E. Cryogen vent piping for MRI magnet venting shall be constructed of non-ferrous materials and installed and insulated in accordance with MRI manufacturer's requirements.
- F. Hydronic piping shall be sized with a maximum friction loss of 3.5 feet of head per 100 feet of pipe.

END OF SECTION

SECTION 15560 - HVAC VALVES

- A. Shut-off valves shall be installed to permit isolation of each piece of equipment and its associated appurtenances (balancing valves, control valves, etc.).
- B. Ball valves shall be used on all piping 4 inches and smaller. Ball valves shall be full port, three-piece style manufactured by Watts or Apollo, no substitutions.
- C. Gate valves shall be used on all hydronic piping larger than 4 inch. Butterfly valves will not be permitted.
- D. High performance butterfly valves shall be used on low, medium and high pressure steam piping at the pressure reducing stations. Manufacturer shall be Adams, no substitutions.
- E. Ball valves shall be installed on each side of steam traps, balancing valves and heating coil assemblies for isolation.

END OF SECTION

SECTION 15565 - HVAC PIPING SPECIALTIES

- A. Furnish and install dielectric fittings whenever dissimilar metals are used in a piping system. Fittings shall be Victaulic Clearflow Dielectric Waterways. Dielectric unions will not be permitted.
- B. Furnish and install valve tags for all shutoff valves. Coordinate with HMC for number sequencing. Valve tags for valves to be replaced shall be removed and re-installed on the new valves. Valve tags for valves to be removed shall be turned over to HMC.
- C. All piping shall be identified by legend and flow arrows. Identification system shall conform to ANSI A-13.1, Scheme For Identification of Piping Systems, using standard background colors.

END OF SECTION

SECTION 15570 - HVAC SUPPORTS AND ANCHORS

- A. The requirements of the applicable sections of ANSI B31, Pressure Piping shall be considered as minimum requirements governing fabrication, installation and support of piping systems.

END OF SECTION

SECTION 15575 - HVAC VIBRATION ISOLATION

- A. Furnish and install concrete inertia bases with free-standing isolators for base mounted pumps.
- B. Furnish and install spring hangers for suspended air handling units and fans.
- C. Furnish and install restraining spring isolators for packaged air-cooled chiller and process chillers located on the roof.
- D. Furnish and install neoprene or fiberglass isolation pads for boilers, condenser-compressor units and air-cooled condensers.

END OF SECTION

SECTION 15580 - HVAC PUMPS

A. GENERAL

1. For free-standing hot water heating systems, furnish and install two constant or variable volume, base-mounted pumps. One pump shall serve as a lead pump and the other shall serve as a lag pump.
 2. For free-standing chilled water systems, furnish and install two variable volume, base-mounted pumps. One pump shall serve as a lead pump and the other shall serve as a lag pump.
- B.** Base-mounted pumps shall be furnished with high efficiency motors, suction diffusers, isolation valves, gages and balancing devices (triple duty valve). Pumps shall be manufactured by Bell & Gossett or Taco.
- C.** Inline pumps for small heating systems shall be furnished with isolation valves, gages and balancing devices (circuit setter). Pumps shall be manufactured by Bell & Gossett or Taco.

END OF SECTION

SECTION 15590 - HVAC INSULATION

- A. Hot water heating piping, valves, and appropriate piping system specialties shall be insulated with fiberglass or foamed plastic insulation. Insulation shall be 1 inch thick for branch runout piping and mains up to 2 inches, 1-1/2 inch thick for piping mains to 2 inches and 2 inch thick for piping mains larger than 2 inches.
- B. Chilled water piping, valves, and appropriate piping system specialties shall be insulated with fiberglass or foamed plastic insulation. Insulation shall be minimum 1 inch thick for branch runout piping up to 2 inches, 1 inch thick for piping mains to 1-1/2 inches and 1-1/2 inch thick for piping mains 2 inches and larger.
- C. Steam and condensate return piping, valves, and appropriate piping system specialties shall be insulated with fiberglass insulation. Insulation thickness shall be as listed below:

Temp Range	Runouts to 2"	Mains to 1"	Mains to 2"	Mains to 4"	Mains 5" & Larger
>306	1-1/2	2-1/2	3	3	3-1/2
<305	1-1/2	2	3	3	3

- D. Refrigerant suction piping and appropriate piping system specialties shall be insulated with fiberglass or foamed plastic insulation. Insulation shall be minimum 1 inch thick for branch runout piping and mains up to 1 inch and 1-1/2 inch thick for piping mains larger than 1 inch.
- E. Condensate drainage piping shall be insulated with 1/2 inch thick fiberglass or foamed plastic insulation.
- F. Cryogen vent piping for MRI magnet venting shall be insulated with fiberglass insulation. Insulation shall be 5 inches thick or as recommended by MRI manufacturer.
- G. For outdoor installations, piping insulation jacket shall be 20 mil PVC.
- H. Supply and return air ductwork shall be externally insulated with 1-1/2 inch thick fiberglass duct insulation. Interior duct insulation will not be permitted.
- I. Exposed supply and return ductwork in laboratories shall be double wall construction with minimum of 1 inch insulation in between walls.
- J. Exposed supply and return ductwork in mechanical rooms shall be externally insulated with 1 inch thick rigid fiberglass insulation with aluminum foil finish. Insulation mounting pins shall be mechanically attached to ductwork.

- K. Backs of lay-in style ceiling diffusers shall be insulated to prevent condensation.
- L. Access doors for servicing equipment shall be double wall insulated. Doors shall be sized large enough to facilitate service and inspections (i.e. fire damper links).

END OF SECTION

SECTION 15600 – CENTRAL HEATING EQUIPMENT

A. GENERAL

1. For hot water heating systems in free-standing buildings, furnish and install two hot water boilers located in a mechanical room to provide hot water for heating equipment used in the various areas of the building. Each boiler shall be sized for 2/3 of the connected building heating load.
- B.** The boilers shall be gas-fired, low pressure, cast-iron sectional type with forced draft venting. Boilers shall be constructed in accordance with the provisions of Section IV of the ASME Boiler and Pressure Vessel Code and shall be stamped with the ASME symbol. Furnish and install all required controls and appurtenances. Boilers shall be manufactured by Weil McLain No. 88, Burnham Corp. or Peerless.
- C.** Furnish and install a primary circulating pump at each boiler as recommended by the manufacturer.
- D.** Boiler flue pipe shall be air insulated, double-wall constructed of stainless steel inner pipe and aluminized steel outer pipe. Flue pipe shall be UL approved and comply with NFPA Standards 37 and 211. Furnish and install required sections and fittings for a complete installation.

END OF SECTION

SECTION 15650 –CENTRAL COOLING EQUIPMENT

A. GENERAL

1. For free-standing chilled water systems, furnish and install an air-cooled packaged chiller located where directed by HMC to provide chilled water for the cooling equipment used in various areas of the building.
- B. The chiller shall be completely assembled on a fabricated steel base with all interconnecting refrigerant piping and internal power and control wiring. Unit mounted control panel shall include a interface to permit remote chilled water setpoint adjustment and demand limiting by accepting a 4-20mA or 10-20Vdc analog signal. Unit shall be provided with manufacturer's sound attenuation package to reduce compressor and condenser fan noise and 5 year compressor warranty. Chiller shall be manufactured by York International or Carrier.
- C. Provide a refrigerant leak detection system for each indoor chiller installation. System shall alarm locally and be connected to the Building Management System for remote monitoring.

END OF SECTION

SECTION 15660 - VARIABLE FREQUENCY DRIVES

- A. Furnish and install variable frequency drives on each air handling unit to serve as starter, circuit breaker, motor overload protection, indicator panel, remote signal output and power-factor correction. Drives shall be provided with digital readout monitors and the following protection systems: frequency stall, current limit, overcurrent, short circuit, overvoltage, undervoltage, component burnout. The drive shall also be provided with auto restart, incoming motor circuit protector and thermal overload, AC line reactor and manual bypass switch and contactors for interfacing with the Building Automation System. Drives shall be manufactured by ABB, Cutler Hammer, or Allen Bradley.

END OF SECTION

SECTION 15700 - HEAT TRANSFER

- A. Furnish and install all hydronic specialties necessary for a complete system including, but not limited to air purgers, air vents, expansion tanks, relief valves, backflow preventers, pressure reducing valves and test plugs. Furnish and install a ball valve for isolation of each air vent.
- B. Furnish and install calibrated balancing valves on all terminal hot and chilled water equipment. Provide a portable master meter kit for use during testing and balancing and deliver meter kit to HMC at completion of Work. Calibrated balancing valves shall be manufactured by Tour and Anderson, no substitutions.
- C. Furnish and install a complete water treatment program. Feeding, control equipment, and chemicals on the hot water and chilled water loops shall include one 4 quart, one shot feeder and one year's supply of chemicals for each system. Chemicals, service and equipment shall be provided by HMC's current water treatment vendor.
- D. Furnish and install electric heating cable on all hot and chilled water piping installed outdoors. The cable shall be controlled and monitored by the Building Automation System.
- E. Steam pressure reducing valves shall be configured for 1/3, 2/3 capacity arrangement with a valved bypass. Steam pressure reducing stations serving building additions shall be located in dedicated, ventilated rooms. Pressure reducing valves and steam traps shall be manufactured by Spirax Sarco or Armstrong.
- F. Condensate return pumps shall be electrically powered. Steam powered condensate pumps will not be permitted. Condensate pumps shall be manufactured by Weil Pump Company, Pacific Pumping Company, or Roth.
- G. Steam to hot water heat exchangers shall be U-tube design manufactured by Spirax Sarco, or approved equal. A valved bypass shall be provided around temperature control valves.
- H. 3-way control valves shall be used on constant volume systems. 2-way shall be used on variable volume systems.
- I. All control valves shall be installed with isolation valves and unions to permit replacement.

END OF SECTION

SECTION 15705 – HUMIDITY CONTROL EQUIPMENT

- A. Humidifiers shall be provided for each procedure and equipment room as required to maintain space conditions specified by the AIA Guidelines and medical equipment manufacturer's requirements. Humidifiers shall be installed downstream of supply fans.
- B. Where plant steam is not available, humidifier shall be steam generating humidifier with electric steam generator and stainless steel duct dispersing manifold or space distribution unit containing a fan. Unit shall be provided with disconnect switch, microprocessor control and remote humidistat. Provide condensate separator where required in steam line between duct dispersing manifold and unit and water filter in make-up water line.
- C. Where plant steam is available, steam humidifiers shall be dispersing manifold type with stainless steel, perforated steam jacket, stainless steel condensate receiver and electrically operated control and jacket valves. Humidifier shall be manufactured by Carel, no substitutions.
- D. Coordinate ductwork material and configuration requirements for duct dispersion tube installation with equipment manufacturer's recommendations.
- E. High limit controls shall be provided for each humidifier.

END OF SECTION

SECTION 15710 - TERMINAL HEATING UNITS

A. GENERAL

1. Cabinet unit heaters shall be provided at each exterior entrance or vestibule.
2. Horizontal unit heaters shall be provided in each mechanical, electrical and service space not served by the central air handling system.
3. Wall heaters shall be provided in any toilet with an exterior wall.

- B.** Cabinet unit heaters, horizontal unit heaters and wall heaters shall be controlled by line voltage room thermostats with heat-off-fan settings. Thermostat shall cycle the fan. If the unit heaters are served by the same hot water loop serving the variable air volume boxes, provide a 2-way control on each unit heater to allow water flow only on a call for heat.

END OF SECTION

SECTION 15720 - UNITARY EQUIPMENT

A. GENERAL

1. Furnish and install dedicated computer room style units for each MRI procedure, equipment and control room. Floor-mounted configuration is preferred. Ceiling-recessed or ceiling-concealed configuration is least desirable. If ceiling installation is approved by the HMC Project Manager, provide adequate access around units for servicing.
2. Furnish and install a remote air-cooled condenser or compressor-condenser unit for each computer room air conditioner. Location of unit shall be approved by HMC.
3. Install an HMC-furnished closed-loop process fluid chiller for each MRI, CT Scanner and linear accelerator.
4. Furnish and install a dedicated ductless split system for each Telecommunication room.

B. Computer room air conditioners shall be air cooled. Units shall be provided with an electric steam-generating humidifier, electric heating coil and microprocessor control system. Associated air-cooled condensers or compressor-condenser units shall be arranged for vertical airflow and furnished with low ambient temperature controls. Computer room air conditioners shall be manufactured by Liebert or Data-Air. Provide equipment nameplates with location served information as specified in Section 15550.

C. Ductless split systems shall be provided with low ambient controls and manufactured by Sanyo or Mitsubishi.

END OF SECTION

SECTION 15800 - AIR HANDLING EQUIPMENT

A. GENERAL

1. Furnish and install air handling units for each building or area of work. Air handling units shall be installed inside mechanical equipment rooms or penthouses whenever possible. Number of units and zoning shall be approved by HMC. Air handling units shall be sized for the total airflow required by the summation of the terminal units. "Block load sizing" will not be permitted.
2. Furnish and install centrifugal roof fans to provide general exhaust for miscellaneous areas.
3. Furnish and install dedicated centrifugal roof fans for Red Bag Room exhaust.
4. Furnish and install high plume style exhaust fans for laboratory hood exhaust systems. Redundant fans serving a common exhaust plenum shall be provided. Fans shall be on normal emergency power and controlled/monitored by the Building Management System.

B. Air handling units shall be double wall construction. Rooftop units shall be designed and built specifically for outdoor installation. The air handling units shall be manufactured by York International/Pace or Carrier. The units shall be configured for economizer operation and building pressure relief. The units shall be furnished with hinged access doors and shall generally consist of the following sections:

1. Discharge section.
2. Sound attenuator section.
3. Bag filter section.
4. Diffuser plate/access section.
5. Supply fan section with high efficiency motor compatible with VFD, fixed sheaves and airflow monitor.
6. Chilled water coil section (maximum 550 fpm face velocity) with 304 stainless steel casing, tracks, coil supports, drain plugs and drain pan.
7. Access section with UV lighting.
8. Hot water coil section (maximum 700 fpm face velocity) or minimum 2-row steam coil section. Integral face and bypass steam (Wing) coils will not be permitted.
9. Air blender section.

- 10. Filter/mixing box section.
- 11. Return fan section with high efficiency motor compatible with VFD, fixed sheaves and airflow monitor.
- C. Coil headers shall be copper or cast iron with red brass connections. Steel pipe headers will are not acceptable.
- D. A valved bypass shall be installed around all large chilled water control valves and preheat coil valves.
- E. Steam heating coil control valves serving air handling units shall be arranged for 1/3-2/3 capacity control with a valved bypass.
- F. Concrete housekeeping pads or steel rails for support of floor-mounted air handling units shall be of sufficient height for proper condensate drain and steam coil condensate trapping installation.
- G. Air handling units shall be installed at least 3 feet from any wall.
- H. Access shall be provided to permit air handling unit coil removal, fan motor, and bearing replacement.
- I. Centrifugal roof fans shall be provided with motorized dampers, bird screen, automatic spring loaded belt tightener and insulated roof curb. Roof fans shall be manufactured by Greenheck, Cook, or Penn Ventilator.
- J. Laboratory hood exhaust fans shall be high-plume discharge type manufactured by Strobic Air, or Greenheck Vector. Redundant fans shall be provided as directed by HMC.

END OF SECTION

SECTION 15840 - AIR FILTRATION

- A. 35% efficient (MERV 8) pre-filter and 95% efficient (MERV 14) final filters for installation in the air handling units shall be manufactured by American Air Filter or CamFarr. Final filters shall be cartridge or bag type.
- B. HEPA filter used for contaminated exhaust shall be 99.99% efficiency (MERV 18) installed in a bag-in, bag-out type stainless steel filter housing with isolation dampers. Filter frame shall be manufactured from particle board (steel frames shall not be permitted). Application and BAS monitoring of filter pressure drop shall be as directed by HMC.
- C. Bag-in, bag-out filter housings shall not be installed above ceilings.
- D. Service platforms shall be installed for stacked housings.

END OF SECTION

SECTION 15850 - AIR DISTRIBUTION

- A. The supply, return and exhaust systems for the building shall be fully ducted using rigid metal ductwork fabricated from galvanized sheet steel or aluminum, constructed in accordance with SMACNA, HVAC Duct Construction Standards and the latest publication of the ASHRAE Equipment Handbook. Round and oval metal ductwork shall be fabricated with spiral lockseam construction. All duct joints shall be sealed to prevent leakage.
- B. Ductwork within each MRI procedure room shall be fabricated from non-ferrous material.
- C. Ductwork shall be sized with a maximum friction loss of 0.1 inch per 100 feet of ductwork with velocities in duct mains not exceeding 2200 fpm.
- D. The duct systems shall be arranged to minimize cross-talk and sound transmission between rooms by use of fittings or sound attenuators.
- E. Joints in ductwork installed outdoors shall be sealed with calk.
- F. Ductwork installed outdoors, including exhaust ductwork, shall be insulated.
- G. Ductwork installed on roofs shall be installed high enough above the roof to permit re-roofing with the ductwork in place.
- H. Laboratory hood exhaust ductwork shall be labeled "CONTAMINATED". Label shall identify the room or area served.
- I. Take-off fittings for connecting flexible duct shall be pre-fabricated, galvanized steel with dampers. Acoustical flexible ductwork shall be limited to 10 feet in length and manufactured by Flexmaster, Type 8M.
- J. Opposed blade volume dampers shall be provided at each branch duct connection and as required for balancing.
- K. Turning vanes shall be installed in all mitered elbows.
- L. Duct access doors shall be installed in ductwork within working distance of all volume dampers, motor-operated dampers, fire dampers and smoke dampers to permit inspections and adjustments. Access doors shall be minimum 24 inches by 24 inches or full width of duct less 2 inches. Closure method shall be double cam latch to allow complete removal.
- M. Ceiling return and exhaust registers shall be perforated face lay-in style and provided with opposed blade volume dampers and baked white enamel finish, manufactured by Tuttle & Bailey, Titus, or Carnes.

- N. Sidewall exhaust and return registers shall be surface mounted with fixed position horizontal bars at 35 to 45 degree deflection and spaced 3/4 inches on center and provided with opposed blade volume dampers and baked white enamel finish. Registers shall be manufactured by Tuttle & Bailey, Titus, or Carnes.
- O. Sidewall supply registers shall be surface mounted with double deflection air foil shaped bars with adjustable horizontal front bars spaced 3/4 inches on center and provided with opposed blade volume dampers and baked white enamel finish. Registers shall be manufactured by Tuttle & Bailey, Titus, Carnes or equal.
- P. Registers shall be selected and branch ductwork to terminals shall be configured to minimize noise.

- Q. Ceiling supply diffusers shall be high performance style for variable air volume applications. Diffusers shall be 24 x 24 full face and panel mounted lay-in type frames with removable inner core, adjustable volume damper and baked white enamel finish. Diffusers shall be manufactured by Tuttle & Bailey, Titus, Carnes or equal.
- R. Supply, return and exhaust terminals shall be selected with a maximum noise rating of NC-25.
- S. Louvers shall be 6 inch deep extruded aluminum construction with drainable stormproof blades, birdscreen and Kynar 500 finish in color selected by Architect. Louvers shall be manufactured by Louvers and Dampers, American Warming and Ventilating, Ruskin or equal.
- T. Fire dampers shall be dynamic rated with blades stacking out of airstream, constructed and installed in accordance with UL 555 and NFPA 90A.
- U. During construction, open ends of ductwork, either stored or installed, shall be protected with plastic covering.

END OF SECTION

SECTION 15870 - VARIABLE AIR VOLUME SYSTEMS

- A. Variable air volume boxes shall be control reheat style. Casing shall be provided with access door and constructed of galvanized steel and lined with minimum 1-1/2 pound density thermal/acoustical foil-faced fiberglass insulation meeting UL 181 and NFPA 90 requirements or double wall construction. The calibrated air damper assembly shall be factory set and field adjustable for minimum and maximum airflows. Unit shall be provided with hot water heating coil, internal regulator to maintain constant airflow independent of inlet static pressure and factory mounted electric actuator for interface with the Building Automation System. The heating coil shall be selected to provide a minimum 35 degree F air temperature rise at 50 percent of design cooling airflow. Variable air volume boxes shall be manufactured by Johnson Controls/York International, Carrier, or Enviro-Tec.
- B. A temperature zoning plan shall be submitted to HMC for review and approval prior to preparation of heating-cooling load calculations and ductwork design. No more than 3 rooms of similar function and exposure shall be grouped on a single VAV box.

END OF SECTION

SECTION 15900 - BUILDING AUTOMATION SYSTEM

- A. Furnish and install a complete direct digital control (DDC) BAS/ATC system as manufactured by Johnson Controls. System shall be complete in all respects including all labor, materials, equipment and services necessary, and shall be installed by personnel regularly employed by system manufacturer. Refer to the Division 17 for additional requirements.
- B. For remote buildings, an operator (computer) workstation interface shall be provided for local access and to communicate remotely with the Main Campus' BAS/ATC systems via a dial-up modem or web-based (Internet) access. Capabilities for future communication via a fiber optic data network shall be provided.
- C. Sequences of Operation
 - 1. Sequences of operation for mechanical equipment shall be reviewed and approved by HMC and Johnson Controls prior to completion of design. Typical sequences of operation are listed below.

Air Handling Units

General

The BAS/ATC unit controller shall dictate the unit operating mode.

Off Mode

During times or when the unit is de-energized, the unit's hot water coil valve shall be fully open, the unit's chilled water cooling coil valve shall be fully closed, the unit's supply and return fans shall not run, the outdoor air damper shall be in the fully closed position and the return air damper shall be in the fully opened position. If the outside air temperature is below 40 degrees F, the chilled water cooling coil valve shall open to a minimum flow position to prevent freezing.

The unit's associated VAV boxes shall be indexed to 100% open. The VAV boxes' hydronic heating valves shall also be indexed to 100% open.

Unoccupied Mode

During Unoccupied Mode of operation, the unit supply and return fans shall run and the unit shall produce 105 degree (adjustable) supply air via its hot water heating coil. The heating coil valve shall modulate open (in response to depressed supply air temperatures) and close (in response to elevated supply air temperatures) in order to maintain discharge air temperature set point. The unit's outdoor air damper shall be closed and the unit's return air damper shall be fully

open.

As the room temperatures begin to rise, the PID loop associated with the room's respective VAV box(s) shall begin to close the VAV box in order to optimally arrive at the space's setback heating set point. The VAV boxes associated with each room shall be allowed to modulate completely shut during this mode.

When the average room temperatures during the Unoccupied Mode are within 1 degree of the average of the setback set points, the Air Handling Unit system shall index to the Off Mode.

Warm Up Mode

During Warm Up Mode of operation, the unit supply and return fans shall run and the unit shall produce 105 degree (adjustable) supply air via its hot water heating coil. The heating coil valve shall modulate open (in response to depressed supply air temperatures) and close (in response to elevated supply air temperatures) in order to maintain discharge air temperature set point. The unit's outdoor air damper shall be closed and the unit's return air damper shall be fully open.

As the room temperatures begin to rise, the PID loop associated with the room's respective VAV box(s) shall begin to close the VAV box in order to optimally arrive at the space's adjustable heating set point. The VAV boxes associated with each room shall be allowed to modulate completely shut during warm up operations. If at any time during the Warm Up Mode the supply fan VFD's output falls below 30 percent (adjustable), the system shall index it's associated VAV boxes to their respective minimum heating positions and the system supply air temperature shall be reset to 70 degrees (adjustable).

The room temperatures associated with a given Air Handling Unit's VAV boxes shall be averaged and the average temperature value shall be used to initiate the occupied mode of operation. When the average room temperatures during the Warm Up Mode are within 1 degree of the average of the occupied set points, the Air Handling Unit system shall index to the Occupied Mode.

Cool Down Mode

During Cool Down Mode of operation, the unit supply and return fans shall run and the unit shall produce 55 degree (adjustable) supply air by utilizing its economizer and/or modulating the chilled water cooling coil control valve. .

As the room temperatures begin to fall, the PID loop associated with the room's respective VAV box(s) shall begin to close the VAV box in order to optimally

arrive at the space's adjustable cooling set point. The VAV boxes associated with each room shall be allowed to modulate completely shut during cool down operations. If at any time during the Cool Down Mode the supply fan VFD's output falls below 30 percent (adjustable), the system shall index it's associated VAV boxes to their respective minimum cooling positions and the system supply air temperature shall be reset to Occupied Mode temperature required by the Cooling Mode Reset Schedule.

The room temperatures associated with a given Air Handling Unit's VAV boxes shall be averaged and the average temperature value shall be used to initiate the occupied mode of operation. When the average room temperatures during the Cool Down Mode are within 1 degree of the average of the occupied set points, the Air Handling Unit's system shall index to the Occupied Mode.

Occupied Mode

In the occupied mode of operation, the Air Handling Unit shall deliver supply air based on the following reset schedules for Heating and Cooling modes of operation:

Heating Mode Reset Schedule

<u>O.A. Temp.</u>	<u>Supply Air Temp.</u>
0	85
60	65

Cooling Mode Reset Schedule

<u>O.A. Temp.</u>	<u>Supply Air Temp.</u>
60	60
80	55

The change over from the Heating Mode to the Cooling Mode shall occur at 55 degrees (adjustable) outdoor air temperature.

During the Heating Mode, the Air Handling Unit's outside air damper shall open to its minimum airflow position. The system's VAV boxes shall prevent overheating of their spaces by modulating their respective hot water heating coil

valves shut and then modulate their air valves to their Heating Minimums. On a drop in space temperature the reverse shall occur.

During the Cooling Mode, the Air Handling Unit's outside air damper shall be allowed to modulate with the unit's return air damper to provide the required supply air temperature in accordance with the Cooling Mode Supply Air Temperature Reset Schedule as long as the outdoor air temperature is 2 degrees or more below the average space temperature of the system's rooms and the return air humidity is below 60 percent (adjustable) relative humidity as sensed by the Air Handling Unit's return air humidity sensor. The Air Handling Unit's outdoor air damper shall be closed to its minimum airflow position and its return air damper opened and the chilled water cooling coil control valve shall modulate to maintain the supply air temperature in accordance with the Cooling Mode Reset Schedule. If the return air humidity, as sensed by the Air Handling Unit's return air humidity sensor, rises above 60 percent (adjustable) relative humidity, the unit shall be indexed to the Dehumidification Mode of operation. When the return air humidity, as sensed by the Air Handling Unit's return air humidity sensor, drops five percentage points below the adjustable high humidity set point, the unit shall return to its Cooling Mode of operation. The system's VAV boxes shall prevent overcooling of their spaces by first modulating their air valves to their Cooling Minimums and on a continued fall in space temperature their respective hydronic heating coil valves shall modulate open. On a rise in space temperature the reverse shall occur.

During the Dehumidification Mode, the Air Handling Unit's supply air temperature shall be set to 53 degrees (adjustable). In the event that the space temperature of any of the rooms served by the VAV Packaged Unit's system falls below its heating set point, the hot water heating coil control valve shall modulate to warm the supply air stream to within 5 degrees (adjustable) of the average space temperature of the system's rooms while the unit's chilled water coil control valve continues to dehumidify the air stream to five percentage points below the adjustable high humidity set point.

Variable Frequency Drive (VFD) Control

The Air Handling Unit's associated supply fan VFD shall be controlled by a static pressure sensor located two thirds of the way down the system's supply duct main. The VAV system balancer shall determine the required minimum system static pressure necessary for the most remote VAV box to deliver its maximum scheduled cooling air volume. The minimum system static pressure necessary for the most remote VAV box to deliver its maximum scheduled cooling air volume shall be input to the system's the Cooling Mode Reset Schedule's supply static pressure set point (adjustable). The VAV system balancer shall determine the

required minimum system static pressure necessary for the most remote VAV box to deliver its minimum scheduled heating air volume. The minimum system static pressure necessary for the most remote VAV box to deliver its minimum scheduled heating air volume shall be input to the system as the Heating Mode Reset Schedule's supply static pressure set point (adjustable). The system's static pressure shall change as the system changes back and forth from the Heating Mode Reset Schedule to the Cooling Mode Reset Schedule.

The Air Handling Unit's associated return fan VFD shall be controlled to maintain the constant minimum outside airflow indicated on the Drawings as measured at the outside air intake. The minimum outside air volume shall remain constant regardless of system turndown. The unit controller shall modulate the relief air damper to maintain a positive building pressure of 0.10 inches wc (adjustable).

Safeties

The Air Handling Unit's supply and return fans shall turn off, its chilled water cooling control valve stroked 100 percent closed, and its hot water heating coil valve stroked 100 percent open upon activation of the fire alarm system or if the supply air temperature, as sensed by the system's discharge air temperature sensor, drops below 40 degrees (adjustable). The Air Handling Unit's return air damper shall fully open, its outdoor air damper shall be fully closed and an alarm shall be sounded at the operator interface.

The VFD output algorithm shall prevent the system static pressure from exceeding the Heating or Cooling static pressure set point by more than 25 percent. If the system static pressure exceeds the Heating or Cooling static pressure set point by more than 25 percent for more than 10 seconds, the Air Handling Unit's fan shall turn off, its chilled water cooling control valve stroked 100 percent closed, and its hot water heating coil valve stroked 100 percent open. Its return air damper shall fully open, its outdoor air damper shall be fully closed and an alarm shall be sounded at the operator interface.

Computer Room Air Conditioners and Air-Cooled Condensers

Manufacturer supplied controller shall maintain room temperature setpoint of 72 degrees F, 50 percent relative humidity (adjustable). BAS/ATC system shall monitor space temperature and humidity and alarm on abnormal condition or a trouble signal from the manufacturer controls.

Closed Loop Process Chiller

Unit mounted manufacturer's controller shall maintain discharge glycol temperature setpoint. BAS/ATC shall monitor glycol supply and return temperatures and alarm on abnormal supply temperature condition or a trouble signal from the manufacturer controls.

Cabinet, Unit and Wall Heaters

A line voltage thermostat shall energize the unit fan on a fall in space temperature below 72 degrees F (adjustable) if hot water is proven by an aquastat located on the hot water return branch. On a rise in temperature above setpoint, the unit fan shall be de-energized.

Fans

Ventilation fans shall be energized and associated motor operated damper shall be opened by the BAS/ATC system to operate continuously during occupied hours. The BAS/ATC system shall monitor fan status via a current sensing switch and signal an alarm upon failure.

Thermal relief fans shall be energized upon a rise in space temperature above 85 degrees F (adjustable) as sensed by a space thermostat and the associated motor operated dampers shall open. Fan shall de-energized and associated motor operated damper shall close upon a drop in space temperature below 85 degrees F (adjustable).

Air-Cooled Chiller

The chiller shall be enabled by the BAS/ATC system during occupied hours and anytime the outdoor air temperature is above 50 degrees F (adjustable). The chiller shall maintain its supply temperature at 45 degrees F (adjustable) via its internal controls.

Boilers

The boilers shall be enabled by the BAS/ATC system during occupied hours and anytime the outdoor air temperature is below 55 degrees F (adjustable). The hot water scheduling valve shall mix return hot water and water off of the boiler in order to reset the hot water supply temperature from 180 degrees to 150 degrees with respective outdoor air temperatures of 20 degrees to 80 degrees. The reset function shall be linear. The boiler shall maintain its temperature at 180 degrees F (adjustable) via its internal controls.

Hot Water/Chilled Water Pumps

The BAS/ATC unit controller shall energize pumps in a lead-lag sequence. On a loss in flow as sensed by a differential pressure sensor, the unit controller shall energize the standby pump and signal an alarm. The BAS/ATC system shall automatically reverse the lead and standby positions of the pumps every 30 days.

Electric Heat Trace

The unit controller shall energize the electric heat trace whenever the outside air temperature drops below 38 degrees F (adjustable) and de-energize the electric heat trace when the outside air temperature rises above 41 degrees F (adjustable). The BAS/ATC system shall monitor the status of each electric heating cable via a current switch and signal an alarm upon failure.

Medical Gas Source Equipment

All NFPA required monitoring and alarm points shall be tied-in to the BAS/ATC system.

Freezers

Medical freezers with alarms shall be tied-in to the BAS/ATC system.

- D. BAS/ATC system input and output points shall be furnished in accordance with the attached Input/Output Summary.
- E. BAS/ATC system input and output points shall be reviewed and approved by HMC and Johnson Controls prior to completion of design. Typical input and output points are listed on the attached Input/Output Summary.

END OF SECTION

SECTION 15950 - TESTING AND BALANCING OF MECHANICAL SYSTEMS

- A. Testing, adjusting, and balancing shall be performed by a fully certified independent agency in complete accordance with standards as published by the Associated Air Balance Council or the National Environmental Balancing Bureau.
- B. Copies of complete test and balance reports shall be submitted for approval in accordance with specified submittal procedures at substantial completion of the project. Test and balance reports shall include a table of contents, air system(s) schematic(s) including terminal numbers and traverse locations, and hydronic system(s) schematic(s) including flow station locations.
- C. Filters in air handling equipment shall be replaced immediately prior to testing and balancing of the air systems.

END OF SECTION

Input/Output Points List																																																								
EQUIPMENT	INPUTS										OUTPUTS								PROGRAMS							NOTES																														
	ANALOG					BINARY					DIGITAL				ANALOG				ALARMS			PROGRAMS																																		
	MEASURED				CALC.	BINARY					DIGITAL				ANALOG				ALARMS			PROGRAMS																																		
	TEMPERATURE	PRESSURE	RH	AIRFLOW		KWH	ENTHALPY	RUN TIME			STATUS	FILTER	SMOKE	FREEZE	AIRFLOW			OFF-ON	OFF-AUTO	OFF-HI	OPEN-CLOSE		DMPR. POS	VALVE POS.	SETPOINT ADJ.		VAR. SPEED DRIVE		HI ANALOG	LOW ANALOG	HI BINARY	LOW BINARY	PROOF	TIME SCHEDULING	DEMAND	START/STOP OPT.	ECONOMIZE	SMOKE CNT.	TREND	SETBACK-SET-UP																
Boilers	X									X																																														
HWS	X																						X																																	
HWR	X																																																							
Reset Valve																							X																																	
HW Pumps							X			X							X																																							
Electric Heat Tape										X							X																																							
Dom HW Pump										X							X																																							
Dom Water Htrs										X																																														
HW	X																											X																												
Med Ga/Vac Equip																																																								
Freezers																																																								
NOTES																																																								

Making Buildings Work - Topic of the Month:
AIRBORNE INFECTIOUS ISOLATION ROOMS

Airborne infectious isolation (AII) rooms, more commonly known as negative pressure rooms, are used in the healthcare setting to minimize the spread of tuberculosis and other infectious agents usually spread from person to person by coughing and inhalation. Isolation is accomplished by containing the infectious agents within a room and controlling the flow of air from clean to dirty (contaminated) areas and then preventing recirculation of contaminated air.

The 2001 Edition of the Guidelines for Design and Construction of Hospital and Health Care Facilities published by The American Institute of Architects Academy of Architecture for Health presents minimum requirements for the application and construction of these rooms. The AIA Guidelines are used as a reference or standard by authorities in most states, the Joint Commission for the Accreditation of Healthcare Organizations and several federal agencies when reviewing, approving and licensing healthcare facilities.

The AIA Guidelines require at least one AII room in each of the following areas:

Medical and Surgical Units	Newborn Intensive Care Units
Critical Care Units	Pediatric and Adolescent Units
Emergency Department	Pediatric Critical Care Units
Decontamination room	Cough-inducing Procedure Rooms
Examination room	(i.e. bronchoscopy)

In addition to the areas identified above, an Infection Control Risk Assessment (ICRA) performed by the facility may identify other areas for additional AII rooms. Although not required to meet the requirements of AII room construction, The AIA Guidelines require that ER Waiting Rooms, Triage and Radiology Waiting Rooms have all of their air exhausted directly to the outdoors or passed through a HEPA filter before being recirculated to other areas.

AII rooms are not permitted to be dual function – serving as an AII and a protective isolation room where airflow is reversed. Also, it is not recommended that any operating rooms be convertible to AII rooms due to compromising the sterile environment. Typically, patients are intubated for surgical procedures, greatly reducing the chance for coughing and spreading agents.

ROOM CONSTRUCTION RECOMMENDATIONS

Chapter 7.2.C of the AIA Guidelines covers AII room requirements for functional components and envelope construction. Most important with respect to the negative air pressure control is that all walls, ceilings, floors and all penetrations through them (i.e. piping, wall outlets, light fixtures, etc) are tightly sealed. Patient room windows are no longer required to be operable and can also be sealed.

Since acoustical tile ceilings cannot be effectively sealed, monolithic ceilings with surface-mounted light fixtures are highly recommended to control air leakage. Also recommended are self-closing doors, without door gasketing to allow control of make-up air into room.

Anterooms, or vestibules, are no longer required by the AIA Guidelines. If an anteroom is desired by the facility, a separate, direct access to the corridor for movement of patient beds is recommended. This door should be gasketed, again, to control the flow of air through the anteroom.

MECHANICAL VENTILATION REQUIREMENTS

Mechanical ventilation requirements are described in Table 7.2 of the AIA Guidelines. A minimum of 12 air changes per hour (ACH) is required with all of the room air being exhausted directly to the outdoors. To ensure that the direction of airflow is always from clean to dirty, a minimum differential pressure of 0.01" wg must be maintained between the AII room and adjacent areas. This minimum differential pressure is 10 times higher than that required in previous editions of the Guidelines and is achievable by having less than 0.5 sq ft of leakage for the room and greater than a 125 cfm differential between the supply and exhaust airflows (approximately 400 fpm air flow velocity across all room openings).

Non-turbulent airflow patterns in the room are recommended, though laminar flow diffusers are not necessary. Supply diffusers in the ceiling at the foot of the bed and a low exhaust inlet near the head of the bed are preferred to allow clean air to wash across the patient – protecting the healthcare worker. The bathroom exhaust must also be connected to the AII room exhaust system and be factored into the entire room air balance.

The discharge for the exhaust fan serving the AII room and adjacent bathroom must be located a minimum of 25' away from ventilation air intakes, including operable windows. If this separation is not possible, the exhaust air must be filtered through a HEPA filter. Barton Associates recommends monitoring of the exhaust fan operation through the building management system to signal an alarm on loss of airflow. Although it is

permitted to exhaust through a HEPA filter in the branch duct to a general building exhaust system as a last resort, it is not recommended because of the potential for leakage around the filter and increased maintenance and monitoring requirements.

NEGATIVE PRESSURE MONITORING REQUIREMENTS

Visible daily monitoring by staff of airflow direction is now required by the AIA Guidelines. A number of devices are available to meet this requirement. Barton Associates typically specifies digital differential pressure monitoring devices that can be set to neutral or negative mode and remotely control the exhaust fan and other control devices through the building management system. Another advantage of connecting the monitoring device to the building management system is that it can provide a means for data-logging information for documentation.

The design of effective AII rooms is a challenge, depending on the location of the AII room and the available existing mechanical systems serving the space. Barton Associates has successfully completed designs for numerous new and converted AII rooms.

If you would like more information or have any questions, please contact Robert A. Sells, P.E. at 717-845-7654 or email at ras@ba-inc.com.

Barton Associates, Inc. has served the mechanical, electrical, and plumbing construction industry for over 30 years. Beyond our varied general services, we excel in the Healthcare, Institutional, Commercial/Retail, and Industrial Markets. How can we help you with your next project?

SECTION 16010 – ELECTRICAL GENERAL PROVISIONS

A. CODES AND STANDARDS

1. Electrical Work shall meet requirements of NFPA 70 - National Electrical Code, the Pennsylvania Uniform Construction Code and all other federal, state, and municipal authority's laws, rules and regulations applicable to the Work.
2. Where applicable, materials and equipment shall bear the label of approval of Underwriters Laboratories, Inc.
3. Except where a requirement in these standards is more stringent, the electrical work shall be designed and installed to meet the following codes, standards, and guidelines:

Pennsylvania State University's Office of Physical Plant Standards included as an appendix to these standards and available at the following link. HMC reserves the right to modify OPP standards as necessary to meet specific project needs.

<http://www.opp.psu.edu>

AIA Guidelines for Design and Construction of Hospital and Health Care Facilities (2001 Edition)

NFPA 13 - Standard for the Installation of Sprinkler Systems

NFPA 72 - National Fire Alarm Code

NFPA 99 - Standard for Health Care Facilities

NFPA 101 - Life Safety Code

NFPA 110 - Standard for Emergency and Standby Power Systems

NFPA 111 - Standard on Stored Electrical Energy Emergency and Standby Power Systems

Pennsylvania Uniform Construction Code, including:

International Building Code 2006

ICC Electrical Code 2006 (references National Electric Code NFPA 70-05)

International Energy Conservation Code 2006

International Existing Building Code 2006

International Fire Code 2006

International Fuel Gas Code 2006

International Mechanical Code 2006

International Plumbing Code 2006

B. EXCAVATION AND BACKFILL

1. Perform excavation and backfill required for Work of this Division, inside and outside building. Work shall include cutting and patching of curbs, walks, concrete, repaving, and reseeded of all areas disturbed by excavation.
2. Banks and excavations shall be retained by means of shoring and braces to avoid cave-ins. Shoring shall be in accordance with Pennsylvania Department of Labor and Industry requirements. Shoring shall be maintained until installation, tests and inspections are complete.
3. Pumping equipment shall be provided and maintained to pump water from excavations.
4. Comply with Pennsylvania Underground Utility Line Protection Act (No. 172-1986) before commencing any excavation work. Telephone number for Pennsylvania One-Call Systems, Inc. is 1-800-242-1776.
5. All underground conduit runs shall be marked with metal-embossed utility marking tape to be run above the duct bank along its full length. Locate marking tape 12 inches minimum above the top of the duct bank.
6. Underground conduits installed horizontally using augers shall also have metal-embossed utility marking tape installed within the conduits.

C. PAINTING

1. Equipment furnished under this Division that is pre-painted or pre-finished by manufacturer shall have all rust spots cleaned, primed, and refinished prior to final acceptance by the Hershey Medical Center (HMC).
2. Junction box covers shall be painted in specific colors, by systems, as follows:

Emergency: Red
Fire alarm: Orange

D. RECORD DOCUMENTS

1. The Contractor shall be required to maintain a set of Contract Documents, i.e., Specifications, Drawings, Addenda, Modifications and approved submittals at the site, in good order and annotated to show all changes made during construction process. At the time of substantial completion of the Work, deliver to the Engineer the complete set of as-built drawings. The Engineer will, within 30 days after receipt from the Contractor, transpose all changes recorded by the Contractor onto a full set of reproducible drawings, and CADD electronic media, compatible with the HMC's CADD system, which shall become the record drawings for the Project, and shall forward same to the HMC. These record documents shall be delivered to HMC in both print (1 set) and electronic form (1 copy) within 30 days of substantial completion. Electronic format for printed documents shall be Adobe Acrobat PDF Microsoft Word. Electronic format for drawings shall be AutoCAD. In each case, provide the software version required by HMC.

E. OPERATION AND MAINTENANCE INSTRUCTIONS

1. The Contractor shall be required to furnish an instructor/operator at completion of system(s) installation, who shall operate all systems and provide documentation. The instructor/ operator(s) shall provide instruction to thoroughly train HMC personnel in the operation and maintenance of all equipment. The amount of time required for training shall be determined by HMC for each project.
2. The Contractor shall be required to provide a minimum of 2 printed sets and 1 electronic set of instructions covering operation and maintenance of each item of equipment and valve charts shall be submitted to HMC during this operating period. Required instructions from manufacturer's representatives shall be submitted at this time. Instructions and charts shall be submitted in print and electronic form. Electronic format shall be Adobe Acrobat PDF.

F. TEMPORARY UTILITIES

1. Temporary utilities, (lighting and power) shall be provided as required by the HMC Project Manager. The source of power shall be as approved by HMC.

G. MATERIALS

1. Materials shall be new, without imperfections or blemishes, and shall be protected from the elements prior to installation.

H. EQUIPMENT DESIGNATIONS

1. Contact HMC for the designations of all electrical equipment provided as part of the scope of work. Reference Section 16050 for nameplate requirements.

END OF SECTION

SECTION 16050 - BASIC MATERIALS AND METHODS

- A. All materials and equipment shall be new and shall be UL listed, where applicable.
- B. Furnish and install access panels in ceilings and walls for service and repair access to concealed equipment. Minimum size shall be 18 inches by 18 inches. Where restrictions will not permit minimum size, verify access panel size with Architect. Access panel construction shall be compatible with ceiling and wall materials and fire rating.
- C. Hangers and supports shall be suitable for their intended purpose and shall have a galvanized finish, or otherwise protected against corrosion. Hangers and supports for all electrical equipment shall only be secured to and supported from structural steel, or concrete deck.
- D. Where backboards are required the Contractor shall furnish and install a 4' x 8' sheet of 3/4 inches fire-treated plywood backboards from finished floor to finished ceiling at each location shown on the drawings. Backboards shall be painted white with a fire retardant paint.
- E. Furnish and install fire stop sealing system for conduits passing through walls and floors with smoke or fire rating in accordance with HMC's Penetrations Policies and Procedures.
- F. Complete and submit HMC's Equipment Data Acquisition form for all installed all transformers disconnect switches, motor starters, panelboards, substations, and similar equipment. Also, furnish and install nameplates. Nameplates for "normal" equipment shall be laminated phenolic having an outer layers of black phenolic and an inner layer of white with engraving depth to the inner layer. Nameplates for "emergency" equipment shall have an outer layer of red phenolic and an inner layer of white phenolic. Nameplates shall include the following information:

Unit #
Area Served
Date unit put in service
Contractor
Manufacturer
Model #
Serial #
Archibus #
HMC/Com Project #

Coordinate equipment designations with HMC and submit a complete itemized listing of nameplate equipment designations for approval.

G. Electrical System Overcurrent Protective Device Coordination Study

1. Provide for review 2 copies of a detailed over-current protective device coordination study, and short circuit analysis. Analysis shall begin at and include nearest upstream protective device from the electrical equipment items furnished and installed under this contract as indicated on the Drawings. Ground fault shall be included. Study shall end with either main breaker or largest branch breaker in lighting and appliance panelboards. Study will be used to determine settings of protective devices for selective coordination. Equipment will be provided with ampere interrupting current rating and bus bracings equal to or greater than values indicated on Drawings. Where the Drawings indicate short circuit ratings larger than required by the short circuit analysis, the ratings shown on the Drawings shall not be decreased as a result of short circuit study.
2. All breakers shall be fully rated for short circuit interrupting, series connected ratings will not be approved.
3. The over-current protective device coordination and short circuit analysis shall be submitted prior to submission of power distribution equipment shop drawings.

H. ARC – Flash Study

1. Provide for review 2 copies of a detailed arc-flash study.
2. An arc-flash study and analysis shall be performed on the electrical system beginning at and include the nearest upstream transformer. System to include both existing electrical equipment items and electrical equipment items furnished and installed under this contract indicated on the Drawings.
3. The Arc-Flash Hazard Analysis shall be performed with the aid of computer software intended for this purpose in order to calculate ARC Flash incident Energy (AFIE) levels and flash protection boundary distances.
4. The Arc-Flash Hazard Analysis shall be performed in conjunction with the Over-current Protective Device Coordination Study and Short Circuit Analysis.
5. Results of the analysis shall be submitted in tabular form, and shall include, device or, bus name, bolted fault and arcing fault current levels, flash protection boundary distances, personal-protective equipment classes and AFIE levels.

6. The analysis shall be performed under worst-case ac-flash conditions, and the final report shall be describe, when applicable, how these conditions differ from worst-case bolted fault conditions.
 7. The Arc-Flash Hazard Analysis shall be performed by a professional engineer registered in the state where the work is to be performed.
 8. The Arc-Flash Hazard Analysis shall be performed in compliance with IEEE standard 15842002, IEEE Guide for Performing Arc-Flash Calculations.
 9. The Arc-Flash Hazard Analysis shall include recommendations for reducing AFIE levels and enhancing worker safety.
 10. The proposed vendor shall demonstrate experience with Arc-Flash Hazard Analysis by submitting names of at least ten actual Arc-Flash Hazard Analysis it has performed in the past year.
 11. The proposed vendor shall demonstrative capabilities in providing equipment, services, and training to reduce Arc-Flash exposure and train workers in accordance with NFPA 70E and other applicable standards.
 12. The proposed vendor shall demonstrate experience in providing equipment labels in compliance with NEC-2002 section 110 and ANSI Z535.4 to identify AFIE and appropriate Personal Protective Equipment (PPE) classes.
 13. Appropriate “Danger Labels”, as specified in Section 16050, Basic Materials, shall be placed on all items of electrical equipment. Included in the study. “Danger Label” shall, at a minimum, indicate the word message as specified in Section 16050, for “Danger Labels” and the following:
 - (a.) Maximum voltage of the equipment.
 - (b.) Arc-flash Boundary
 - (c.) Required PPE.
 14. Information and data on existing electrical system components and equipment required for completion of the Over-current Protective Device Coordination Study and Short Circuit Analysis and Arc-Flash Analysis shall be collected by the contractor in the field.
- I. Danger labels shall be furnished and installed on each item of electrical equipment specified to receive the label. Word message on label shall be: “ARC FLASH AND SHOCK HAZARD. DE-ENERGIZE BEFORE SERVICING”.

END OF SECTION

SECTION 16110 - RACEWAYS AND FITTINGS

- A. Raceways in the building shall be either rigid metal conduit (RMC) or electrical metal tubing (EMT). Flexible metal conduits shall be used for final connections to light fixtures, motors and other items that would require a flexible dry connection. Liquid-tight flexible metal conduits shall be used for final connections to light fixtures, motors and other items that would require a flexible wet-location connection. Conduits under concrete slabs shall be PVC schedule 40. The minimum acceptable size shall be 3/4 inch.
- B. All EMT shall utilize compression fittings.
- C. All underground conduits for both power and communications systems shall be concrete encased. Telephone, data cabling shall be run in cable tray to be located above finished ceilings. Cable tray shall be aluminum ladder types, minimum 12 inches wide and shall have a usable depth of 5 inches. Sides shall be “flanged out.” Furnish and install all support hardware.

END OF SECTION

SECTION 16120 - WIRE AND CABLE 600 VOLTS AND BELOW

- A. All wire and cable shall be copper, with heat and moisture resistant thermoplastic insulation, type THHN/THWN, and shall be installed in metallic raceways. Aluminum conductors will not be permitted. Conductors #10AWG and below shall be solid. Conductors #8 and above shall be stranded.
- B. Minimum size for power wiring shall be #12 AWG.
- C. Minimum size for control wiring shall be #14 AWG, except 24 volt and below. All control wiring shall be stranded.
- D. Shared neutral conductors are not permitted. Each branch circuit phase conductor shall be paired with a dedicated neutral conductor along its entire length, including branch circuits for light fixtures.
- E. Aluminum conductors will not be permitted.

END OF SECTION

SECTION 16125 – WIRE AND CABLE ABOVE 600 VOLTS

- A. Conductors shall be single-stranded copper conductor, extended semiconducting screen, EPR insulation 15 KV rated 133 percent, extruded semiconducting insulation, copper tape shielding and outer jacket, Type MV-90. Each reel of cable shall be factory-tested in accordance with KEA and UL standards. A certified copy of the factory test shall be furnished to HMC. Specific approval on cable type and size must be obtained for each installation. Cables and terminations for use on 5 KV systems shall be rated for 15KV.
- B. Terminations and Connections
1. High-voltage cable shall be terminated with Elastimold nonloadbreak 650 LR Series 600 amp, KV devices where connections and taps are required. Taps may be made using nonloadbreak 200 amp, 15 KV devices where appropriate.
 2. Permanent splices shall be kept to a minimum but may be authorized for specific applications.
 3. Stress cones shall be of the premanufactured style as manufactured by Adalet, Raychem, Elastimold, or 3M. Handmade stress cones are not acceptable.
- C. Direct Burial Cable
1. Direct burial cable shall not be used.
- D. Identification
1. After installation, all high-voltage cables shall be properly identified by a durable nonmetallic tag in each manhole. Tag shall bear feeder identification number (i.e., EC-4) and be secured by plastic tie wraps.
- E. Testing
1. Reference Pennsylvania State University's Office of Physical Plant (OPP) standards for testing requirements.

END OF SECTION

SECTION 16130 - BOXES

- A. Outlet and junction boxes shall be furnished and installed with plaster rings for plaster areas and masonry boxes in masonry areas.
- B. NEMA 1 boxes shall not be exposed in public areas.

END OF SECTION

SECTION 16140 - WIRING DEVICES

A. General

1. 20 ampere receptacles shall be standard throughout the HMC.
2. Hospital grade receptacles shall be used in hospital (DOH) areas. Spec grade receptacles shall be used in all other areas (i.e. COM).
3. Standard duplex receptacles shall be provided at regular intervals as required by Code for cleaning, maintenance, and general use. Install duplex receptacles with the ground opening in the “up” position. Additional outlets over Code minimum shall be provided as required. Special outlets and power supplies shall be installed at locations designated for equipment requiring special power characteristics.
4. Minimally, at least one duplex receptacle shall be provided on each wall of each room. Additional receptacles and data outlets shall be installed for computer stations.
5. Four receptacles will be installed in each office as a minimum. A double duplex receptacle, data outlet, and phone outlet will be installed at the approximate location of the desk.
6. Ground fault interrupter (GFI) duplex receptacles shall be installed at locations required by the National Electrical Code.
7. Faceplates shall be brushed stainless steel. Receptacles faceplates shall be labeled with panelboard and branch circuit designations.

B. Hub (Data/Telecommunication) Rooms:

1. Furnish and install in each room two dedicated 3-wire 120V AC duplex transient-voltage protected electrical outlets supplied by separate branch circuits rated 20-ampere for telecommunication equipment/racks. Coordinate exact locations for the receptacles with HMC’s I.T. Department in field prior to rough-in
2. Furnish and install, in addition to the two branch circuits and receptacles above, 20-ampere, duplex 120V AC convenience outlets located on six foot centers around the rooms perimeter walls. All outlets must be on non-switched circuits
3. Furnish and install a dedicated 3 phase panelboard to serve the room in cases where IT equipment loads exceed normal branch circuit capacity. Lighting and ancillary power requirements not associated with the IT equipment should be fed from building lighting/power panelboards.
4. Furnish and install a 10 position ground bar in each room. Connect the ground bar

to each of the following using a 6 gauge conductor: main electrical service ground, electrical panel in Telecommunications room, main service entrance/telecommunication equipment room, and the non-dedicated local 120/208V panelboard serving the Telecommunications room. All equipment and cable shields shall be properly grounded.

5. Equipment not related to the support of the Telecommunications room such as piping, ductwork, and distribution of building power must not be located in, or pass through, the room.
 6. Furnish and install lockable breakers for the Telecommunications room at the main panel.
 7. Coordinate Telecommunications room electrical layout with HMC's I.T. Department.
- C. General purpose switches shall be manufactured by Hubbell, 1221 Series or Pass & Seymour.
- D. Duplex receptacles shall be manufactured by Hubbell, 5362 Series or Pass & Seymour, except in patient treatment and imaging areas, which shall be Hubbell, 8300 Series or Pass & Seymour.
- E. Ground fault circuit interrupter type receptacles shall be manufactured by Hubbell, GF5362 Series or Pass & Seymour, except in patient treatment and imaging areas, which shall be Hubbell, GF-8300 Series or Pass & Seymour.
- F. Transient voltage surge suppression (TVSS) duplex receptacles shall be manufactured by Hubbell, 5252-S Series or Pass & Seymour.
- G. Unless noted, color of all wiring devices shall be ivory, except red when connected to the emergency or essential electrical system.

END OF SECTION

SECTION 16145 - DISCONNECT SWITCHES

- A. Heavy duty, fusible or non-fusible, disconnects shall be manufactured by Square D, Cutler-Hammer, Siemens, or General Electric.
- B. NEMA 12 enclosure for indoor locations and NEMA 3R enclosure for exterior locations. Furnish 3 spare fuses for each fusible disconnect.

END OF SECTION

SECTION 16170 - OVERCURRENT PROTECTIVE DEVICES

- A. All breakers shall be fully rated for short circuit interrupting, series connected ratings will not be approved.
- B. All circuit breakers shall be the bolt-on type.

END OF SECTION

SECTION 16180 - GROUNDING SYSTEMS

- A. Grounding shall be by separate insulated grounding conductors pulled with phase conductors. Grounding system shall be electrically, and mechanically continuous from all outlet devices, power utilization equipment, and distribution equipment to system main ground point.
- B. Neutral conductors shall be continuous throughout system and shall be grounded only at service neutral.
- C. Ground wires insulated with green covers and shall be installed in all raceway runs.
- D. Furnish and install a ground bar along all of the walls in every main electrical room.

The ground bar shall be solid copper measuring 2 inches wide by 1/4 inch thick. Locate 12 inches above the finished floor using 2 inch stand-off hardware. Connect the ground bar to the building ground electrode system using #4/0 bare copper conductor.

- E. Ground electrode systems shall consist of a copper ground ring, main water service piping, concrete encased electrodes and ground rods all bonded together using #4/0 bare copper conductors. The ground electrode system shall be bonded to the ground buss of the service entrance equipment using #4/0 bare copper conductor.

END OF SECTION

SECTION 16200 - POWER GENERATION

- A. A generator shall be furnished and installed to provide emergency power for emergency egress lighting, exit lights, and selected electrical systems as indicated. The generator shall be sized for the planned connected load. Minimally the generator shall have a spare capacity of 25 percent. Fuel shall be natural gas when available or diesel.
- B. Furnish and install the generator in an approved exterior weather protected, sound attenuating enclosure, and belly tank. All openings and exhaust openings for enclosure shall be provided with sound attenuation. Overall sound performance shall be 66 dBA at 7 meters, maximum. Sound attenuating enclosure shall have hinged doors.
- C. The generator shall have a run-time meter with time intervals not less than a tenth of an hour.
- D. Emergency power electrical wiring shall be installed in non-flexible metal conduit in accordance with Article 517 - Health Care Facilities of NFPA-70 National Electrical Code.
- E. Emergency power shall be supplied to the following equipment and systems:
 - 1. Egress lighting
 - 2. Building fire alarm system
 - 3. Telephone system
 - 4. Sound/paging system
 - 5. Nurse call/code blue system(s).
- F. The emergency generator shall be manufactured by Caterpillar, Onan-Cummins, Kohler, or Olympia.

END OF SECTION

SECTION 16250 - AUTOMATIC TRANSFER SWITCHES

- A. An automatic transfer switch (ATS) shall be installed in compliance with Article 517 Health Care Facility of NFPA-70 National Electrical Code. The transfer switch shall only be used for the connection of life safety branch, critical branch, and equipment branch loads as identified in Article 517 of NFPA-70.
- B. The ATS shall have a programmable delayed transition when transferring loads to and from the emergency source so that the electromagnetic fields associated with motor loads can collapse prior to re-energizing. Each ATS shall be provided with a bypass isolation switch housed in the same enclosure as the ATS.
- C. The automatic transfer switches shall be manufactured by ASCO.
- D. Normal-to-emergency transition shall be in accordance with the National Electrical Code. Emergency-to-normal transition shall be adjustable up to 5 minutes.

END OF SECTION

SECTION 16400 - ELECTRIC SERVICE

- A. Contractor shall be responsible for requesting, coordinating, and assisting in the installation of the building's electric service. The contractor is responsible for furnishing and installing all items and accommodations required by the electric company, including the installation of electric company supplied items for installation by the contractor. The electric service shall be installed in accordance with the requirements of the electric utility company and NFPA 70.
- B. The metering facility shall be installed in accordance with the utility company requirements.
- C. Buildings located remotely from the HMC site shall be served with 277/480 volts, 3 phase, 4 wire by the utility company.
- D. Service entrance conductors shall be installed underground in conduit from a pad mounted transformer to the buildings main service disconnect location. A ground wire shall not be run in the conduits containing the service lateral conductors.
- E. Service entrance equipment of the proper capacity shall be installed adjacent to the metering facilities. Feeders rated at 277/480V, 3 phase shall be extended to power and lighting panels throughout the building. 120/208 volt, 3 phase, 4 wire power for duplex receptacles, incandescent lights, and small motors shall be derived from one or more dry type transformers.
- F. The service entrance equipment shall include a power monitoring device compatible with a Johnson Controls, Metasys Building Management System. Measured parameters shall include: phase amperes, phase-to-phase and phase-to-neutral voltage, kilowatts, kilovars, kilovolts, and power factor. Provide labor and coordination during start-up.

END OF SECTION

SECTION 16420 – SUB-STATIONS

- A. Sub-stations shall be manufactured by Square D, Siemens, Cutler-Hammer or General Electric.
- B. Construction shall be front accessible and completely self-supporting. Over –current devices shall be panel mounted, and each device shall be provided with a nameplate.
- C. Protective devices shall be as listed on Drawings.
- D. Buses
 - 1. Shall be tin or silver plated copper.
 - 2. And shall be arranged for future addition.
- E. Sub-station and all components shall be capable of withstanding the short circuit current indicated on the drawings. All circuit breakers shall be fully rated for interrupting the required short circuit current. Series rated circuit breakers shall not be provided.
- F. Secondary Side Main Over-current device shall be an electronic trip circuit breaker.
- G. Provide a panel mounted system monitoring device. System shall monitor peak and average values of current, voltage, energy, demand and power factor as a minimum.
- H. Transformer section shall be open ventilated, dry type transformers with full capacity primary taps, two 1-1/2 percent taps above voltage and two 2-1/2 percent below rated voltage. Windings shall be copper. Maximum temperature rise shall be 55 degrees C above a 40 degrees C ambient. Insulation: UL 220 degrees C system in accordance with NEMA standards. High voltage leads and connections shall have insulation equal to the voltage class of the winding and shall be properly supported. Basic Impulse Level: 95 KV for 15 KV Class.
- I. Provide ground fault protection system as required by the National Electrical Code – NFPA 70.

END OF SECTION

SECTION 16430 - PANELBOARDS

- A. Panelboards shall be 3 phase and shall be manufactured by Square D, Siemens, Cutler-Hammer or General Electric.
- B. Transient voltage surge suppression (TVSS) with indicating lights shall be provided for all switchboards and distribution panelboards.
- C. Transient voltage surge suppression (TVSS) shall be provided for all branch circuit panelboards dedicated to supplying computer loads.

END OF SECTION

SECTION 16440 - DRY TYPE TRANSFORMERS

- A. Dry-type transformers shall be manufactured by Square D, Siemens, Cutler-Hammer or General Electric.
- B. Transformer cores shall be constructed of high grade, non-aging silicon steel with high magnetic permeability and low eddy current and hysteresis losses. All conductors shall be copper.
- C. Insulating materials shall be per NEMA ST20 standards for 220 degrees C UL recognized insulation system.
- D. Transformers below 15KVA shall be rated for 150 degrees C temperature rise over 40 degrees C ambient. Transformers 15KVA and larger shall be rated for 80 degrees C temperature rise over 40 degrees C ambient.
- E. Transformers 25KVA and larger shall be a minimum of four, 2-1/2 percent full capacity taps on the primary windings.
- F. Sound levels shall not exceed the following:

15 to 50KVA	45dB
51 to 150KVA	50dB
151 to 300KVA	55dB
301 to 500KVA	60dB
501 to 700KVA	62dB
701 to 1000KVA	64dB
- G. Transformer enclosures shall be ventilated and fabricated of heavy gauge sheet steel. Finish with powder coating that is electro-statically applied. Color shall be ANSI 49 gray, or similar. Enclosure shall be rated for NEMA 1 indoor use.
- H. All transformers shall be UL listed.

END OF SECTION

SECTION 16445 - LIQUID FILLED TRANSFORMERS

- A. Liquid filled transformers shall be manufactured by Square D, Siemens, Cutler-Hammer or General Electric.
- B. Core and coil assemblies shall be designed to minimize operating losses and provide adequate mechanical strength during fault conditions. Core and coil assemblies shall be of the 5-legged design utilizing wound cores. Provide two, 2-1/2 percent above normal taps and two 2-1/2 percent below normal taps on the primary windings. All conductors shall be copper.
- C. Temperature rise shall be 55 degrees C over 40 degrees C ambient when the transformer is being operated at rated KVA output.
- D. The transformer shall be of sealed tank construction of sufficient strength to withstand a pressure of 7 psi without permanent distortion. The cover shall be welded and tamperproof. Provide with lifting lugs. Enclosure shall be rated for outdoor use.
- E. Coolant and insulating fluid shall be inhibited mineral oil.
- F. High and low voltage compartments shall be located side-by-side and separated with a steel barrier. The low voltage compartment shall be on the right when facing the front of the transformer. The high voltage terminations and equipment shall be dead front, and the high voltage compartment shall include current limiting fuses and distribution class lightning arrestors. The low voltage terminations shall be spade terminals having NEMA standard hole spacings arranged for vertical take-off of connecting cables. The low voltage neutral shall be an insulating bushing, grounded to the tank by a removable strap.
- G. Transformers rated 75 – 500KVA shall be provided with fluid drain plugs. Transformers rated above 500KVA shall be provided with fluid drain valves having a sampling device.
- H. Transformers shall be tested in accordance with the applicable portions of ANSI C57.12.
- I. Provide with options and accessories as required by project specific design documents.

END OF SECTION

SECTION 16500 - LIGHTING

- A. Where applicable, the latest recommended IES levels of illumination shall be used as a guideline for the lighting design. The quantity and location of all light fixtures shall be coordinated with casework and furniture layouts.
- B. Emergency lighting shall be provided in locations required by the International Building Code and NFPA 101 - Life Safety Code. Switching schemes for each area shall be in accordance with the International Energy Code. Where used, occupancy sensors shall utilize infra-red / ultrasonic, dual technologies for detecting motion.
- C. Egress paths shall be furnished and installed with internally illuminated exit lights with directional arrows where required. Exit signs shall be LED illuminated and consume less than 1.5 watts. Where emergency power is provided using an emergency generator, exit signs shall not have integral batteries.
- D. Lighting fixtures throughout the building shall be illuminated primarily with fluorescent lamps utilizing electronic ballasts.
- E. Fluorescent lamps shall have a correlated color temperature of 3500K with a color rendering index of 82. Electronic ballasts shall operate at an input frequency of 60 Hz rated for 108-132 volts (120V circuit) or 249-305 volts (277V circuit). Electronic ballasts shall operate the lamps at a frequency of 20 to 35 KHz and have no detectable flicker. All ballasts shall be of the high power factor type of 90 percent or higher, sound rated A, or better, contain no PCBs and be listed by UL. Electronic ballasts shall comply with FCC and NEMA limits as to EMI or RFI and to minimize interference with the operation of other normal electrical equipment.
- F. Fluorescent fixtures with energy saving T8 low mercury, environmental lamps and multi-volt, instant-start or programmed rapid-start electronic ballasts shall be utilized in all rooms. 2' x 2' or 2' x 4', 2, 3, or 4-lamp fluorescent prismatic lensed fixtures shall be installed in all finished rooms unless noted otherwise; utilitarian spaces without finished ceilings shall be provided with industrial style fixtures. Incandescent lighting shall be used for special applications only as directed by Architect or Engineer.
- G. Lamps shall be selected from the following list. Any other lamp or ballast types must be approved by HMC prior to specification.
 - 1. 48 inches, T8 fluorescent, SP35, 32 watt, low mercury.
 - 2. 24 inches, T8 fluorescent, SP35, 17 watt, low mercury.
 - 3. 24 inches, CF40 fluorescent, SP35, 40 watt, low mercury.
 - 4. Low mercury compact fluorescent lamps:

- a. 26 watt quad
 - b. 32 watt triple
 - c. 28 watt quad, cold start
 - d. 13 watt, cold start
- H. Conference/education rooms, office and work rooms/areas likely to have computers or audio/visual equipment shall be provided with parabolic light fixtures. Large cell parabolic fixtures shall not contain louvers less than 3-inches deep. 2' x 4' fixtures with three lamps shall have 18 cells, and 2' x 2' fixtures shall have 9 cells.
- I. Research laboratories shall not be provided with night lights, and all fixtures shall be controlled using occupancy sensors.
- J. The switching scheme in all rooms and areas shall conform to the 2006 International Building Code. Multi-level/dual-switched light fixtures shall consist of inside and outside lamp/lamp pairs controlled by separate light switches. Fixtures in public areas shall be controlled by occupancy sensors.
- K. If generator power is not provided, furnish and install emergency battery units to provide adequate egress lighting levels, and to provide power to exit signs in the immediate and adjoining areas. Exit signs shall not be provided with integral batteries. On the exterior of egress doors and where fluorescent fixtures are not installed in an area, remote emergency light fixtures shall be furnished and installed. The remote emergency light fixtures shall be supplied by an emergency battery unit located nearby.
- L. Furnish and install a complete exterior lighting system for all parking areas, walkways, and flags. Pole heights shall conform to Derry Township height limitations and fixture types shall conform to Derry Township light pollution requirements. Fixtures shall have vertical, pulse start, super metal-halide lamps.
- M. Provide 4 branch circuits for fixtures in parking areas. Parking area fixtures shall be connected to branch circuits to form an alternating "checkerboard" pattern. Provide 2 branch circuits for building mounted lights, and 1 branch circuit for walkway lights. Provide 5 lighting contactors for control of exterior lights via the building management system. All contactors shall have 120 VAC coils. Each pole shall be fused independently.

END OF SECTION

SECTION 16715 - TELECOMMUNICATION (TELEPHONE AND DATA) SYSTEM

- A. Telecommunications system shall conform to HMC Information Technology's "Minimum Standards for Telecommunications Facilities and Cabling" and the requirements of the Pennsylvania State University's "Minimum Standards for Telecommunications Facilities" available at <http://www.tns.its.psu.edu/projects/mintelecomstandards.pdf>
- B. Contractor shall coordinate the installation of telephone service to the facility with the local telephone company/access provider. As a minimum the contractor shall furnish and install four 4 inches PVC conduits, concrete-encased from building to the local telephone company/access provider point of presence onto the property. Coordinate and confirm the actual location with the local telephone company/access provider and HMC prior to installation.
- C. HMC will provide, under separate contract, all data and communication equipment to be located in the telecommunications room. Contractor shall coordinate installation schedule with HMC Information Technology Department.
- D. The contractor shall furnish and install all conduit and cabling for telephone and data networking. Conduits shall be installed from telecommunication outlet box locations to above an accessible ceiling. Additionally, conduit path shall be installed above inaccessible ceilings for HMC furnished and installed telecommunication cabling. From each outlet furnish and install 4 runs of category 5E cable back to the nearest telecommunications room. All cable shall be plenum rated.
- E. The contractor shall furnish and install a pull cord rated for 200 pound tension in each telecommunication conduit.
- F. All walls within telecommunications closets shall be furnished with plywood backboards. Refer to Section 16050.
- G. Telecommunication outlets shall be installed in the following locations and quantities.
 - 1. Each telecommunication outlet shall consist of a double gang outlet box with a single gang faceplate cover, and a 3/4 inch minimum conduit riser in the wall and stubbed out of the wall to above an accessible ceiling. In patient, exam, and treatment rooms etc., extend 3/4 inch conduit from each outlet to above the accessible ceiling in the adjoining corridor. Use 3/4 inch flexible conduit in rooms where inaccessible ceilings exist and new telecommunications outlets are required. Non-terminated telecommunication conduit ends shall be provided with a plastic bushing. Coordinate exact telecommunication outlet locations in field with HMC prior to rough-in.

2. Each office or other room likely to have a desk and/or computer shall be provided with at least two telecommunication outlet locations. Desk/computer locations other than locations in individual offices shall be provided with one telecommunication outlet location.
 3. Each exam or treatment room shall be provided with a wall telephone outlet location and a telecommunication outlet location.
 4. Each nurse's station shall be provided with two telecommunication outlet locations.
 5. Each work, file, and copy room shall be provided with two telecommunication outlet locations. Other similar type areas shall be provided with one telecommunication outlet location.
- H. Furnish and install a minimum 1inch conduit sleeve through the corridor wall of any room with walls extending to the underside of the ceiling deck. The conduit sleeves shall be extended in each direction to above accessible ceiling areas.
- I. Telephone and data outlets shall be installed in all offices, conference rooms, and other areas where use of a telephone or computer will be required.
- J. Where provided, all telephone and data cable shall be routed within cable tray.

END OF SECTION

SECTION 16720 - FIRE ALARM SYSTEM

(Reference Fire Alarm System Requirements in Division 17)

- A. The fire alarm system shall be an addressable type, zone annunciated. The fire alarm system shall be listed as required by the International Building Code (IBC) and shall be designed in accordance with IBC regulations.
- B. Pull stations and horns shall be semi-flush mounted.
- C. The fire alarm control panel shall be flush mounted if installed in a finished area.
- D. A remote annunciator panel shall be installed in a main entrance into the building at a location approved by the local fire marshal.
- E. Visual indicating devices shall be installed per ADA requirements and in accordance with NFPA 72 , National Fire Code
- F. Smoke/heat detectors shall be installed as required by the IBC. Where fire alarm devices are installed, the devices shall be installed in accordance with NFPA 72, National Fire Alarm Code
- G. Fire alarm system shall include necessary facilities to tie-in to an off site central monitoring system.
- H. Include all electronics, hardware, wiring, and conduit to tie the fire alarm system with the elevator recall panel.
- I. The fire alarm system shall manufactured by Notifier, no substitutions. The existing site fire alarm system is operated from a Noti-Fire Network and site control is via a Notifier Network Control Station at the Building Operations Center.

END OF SECTION

SECTION 16725 – AREA OF REFUGE COMMUNICATION SYSTEM

- A. System shall be a complete vandal-resistant ADA rescue assistance communications system.
- B. Master control panel and area stations shall not protrude from the wall more than 4 inches as per ADA code.
- C. Construction of all area stations and main control panel is to be heavy-duty stainless steel with tamper-proof mounting screws. Materials and accessible control elements are to be heavy duty and vandal-resistant.
- D. In case of power failure during operation of system, alarms shall not be reset by temporary interruption of power or transfer to battery backup.
- E. Area station shall be engraved operating instructions in a type size and style conforming to ADA requirements for legibility and accompanied with grade 2 Braille. Heavy duty, 15 gage stainless steel cover plate enclosure. Unit shall be powered from the master with separate power sources for the amplifier.
- F. Each area station is to have instructional signage for its use in a stainless steel frame. Text is to conform with ADA requirements for text size and style.
- G. Each area station is to have high-brightness LED indicators and a pulsing audible signal. One red LED for Help Requested and one red LED for Help Coming.

END OF SECTION

SECTION 16750 – SOUND/PAGING SYSTEM

- A. Equipment shall include flush ceiling speakers, back boxes, volume controls, channel selector switches, wall plates, mixer(s), amplifier(s), and program source equipment all housed in a free standing sound system rack.
- B. Contractor shall furnish and install a two-gang outlet box for each combination volume control/selector switch shown on the drawing.
- C. Furnish and install interface with building telephone equipment to allow pages from telephone handset. Paging zones shall be provided as specified by HMC.
- D. Contractor shall furnish and install sound system cable. Size, quantity, and type of cable to be directed by sound system equipment supplier.

END OF SECTION

SECTION 16765 - NURSE CALL SYSTEM, AUDIBLE-VISUAL-TONE

- A. Furnish and install audible-visual-tone type nurse call systems where required by the AIA Guidelines for Design and Construction of Hospital and Health Care Facilities.
- B. New nurse call systems shall be Rauland, "Responder", no substitutions. Minor modifications to the existing Executone EZ Care system shall be reviewed with the HMC Project Manager. System model shall be verified/approved by HMC Facilities and HMC Clinical Engineering.

END OF SECTION

SECTION 16790 – CABLE TV SYSTEM

- A. Electrical Contractor shall furnish and install a complete, fully functional, CATV system that includes all distribution amplifiers, power supplies, splitters, couplers, taps, cable, jacks and all other required components including the following:
 - 1. Underground conduit for CATV service and conduit and conduit accessories at pole, as directed by CATV Company.
 - 2. All service, backbone and horizontal pathways, surface raceways, conduits, cable tray, backboards, outlet boxes, and grounding.
- B. RG-6U type coaxial cable for all drop cables. RG-11/U type coaxial cable for trunkline cables. Plenum rated - CATVP markings. Acceptable Manufacturers are West Penn, Belden, and Commscope.
- C. HMC will pay all costs directly to the CATV company for work and services performed by cable company.
- D. Install CATV system in accordance with system manufacturer's instructions. Provide all equipment necessary for a complete and operable system. Final connections between equipment and the wiring system, testing and placing system in operation, shall be completed under direct supervision of a representative of the manufacturer. Submit manufacturer's printed installation instructions with operation and maintenance data at completion of Work.

END OF SECTION

SECTION 16800 - SECURITY/ACCESS CONTROL SYSTEM

- A. Furnish and install outlet boxes, conduit, and wiring for door/window contacts being installed at all grade level windows and exterior doors.
- B. Furnish and install outlet boxes, conduit, and wiring for card readers, cameras, and electric strikes. Card readers shall be by Lenel.
- C. Coordinate exact location and sizes of security and access control items with the security/access control contractor in field prior to rough-in.
- D. Include provisions for security system monitoring by the HMC Security Dispatcher from the Emergency Department Command Post.

END OF SECTION

SECTION 16900 - CONTROLS AND INSTRUMENTATION

- A. Starters, disconnect switches and wiring shall be provided for mechanical equipment and equipment requiring power that is furnished under the general portions of the contract.
- B. Controls and instrumentation equipment shall be manufactured by Square D, Siemens, Cutler-Hammer, or General Electric.

END OF SECTION

SECTION 17100 - BUILDING AUTOMATION SYSTEM

GENERAL

- A. Furnish and install a complete direct digital control (DDC) Building Automation system as an extension of the existing facility Building Automation System as noted below.
- a. Mega-Structure – Basic Science, Clinical Science, Hospital, Clinical Science Addition, Cancer Research, South Addition, East Addition, OR/ED, BMR, UPC-1, UPC-2 shall be Johnson Controls.
 - b. Out Buildings – ARF, 30 Hope Drive, 35 Hope Drive, Long Lane, Hangar, UCC (Sipe Avenue), Eastmoor, NMRI, Academic Support Building (ASB) shall be Johnson Controls.
 - c. Cancer Institute shall be Automated Logic.
- B. All work shall be performed by the factory representative office for the respective control system.
- C. The Division 17 Contractor shall contract directly with the General Contractor or as designated by PSHMC.
- D. Any project expanding or modifying the control system shall integrate (via Bacnet) all control points back to the Johnson Controls Metasys Extended Architecture User Interface in the PSHMC Building Operations Center (BOC). This integration shall be completed in a cooperative pro-active manner by all parties involved. This includes graphical user interface within the Metasys Extended Architecture System.
- E. Upon adding any additional control points, or modifying existing control points, the BOC must be notified and given proper instruction on the changes. This notification shall be provided prior to activating any points or alarming on the system in order to provide review by BOC.
- F. The addition of any alarms shall be reviewed by the respective PSHMC Project Manager to allow for the addition of alarm messages as required. This alarm addition will be part of the respective project, and shall have naming conventions consistent with the remainder of the network.
- G. Controls shall be installed in a manner which permits easy maintenance accessibility. If possible controls shall be installed in mechanical rooms, or in public spaces or corridors, and be consolidated rather than in ceilings above critical hospital activities.

STANDARDS - AHU

- A. AHU Equipment numbering scheme shall be confirmed and validated with the PSHMC project manager prior to completion of design documents to avoid duplicate equipment numbers on the PSHMC campus.
- B. Wiring in mechanical rooms shall be in conduit, unless authorized by PSHMC.
- C. Wiring in concealed areas, not in conduit, shall be plenum cable and in accordance with the NEC.
- D. Economizer control shall be enabled via the common PSHMC network temperature and humidity sensor enthalpy control. Economizer control shall not be on a per unit basis with individual outdoor air temperature.
- E. Valves shall be electronic proportional control (0-10V / 4-20mA). Incremental pulse type actuation is not permitted.
- F. Valves shall be spring return to normal failsafe.
- G. Sequences of Operation.
 - 1. Sequences of operation for mechanical equipment shall be reviewed and approved by PSHMC and Johnson Controls prior to completion of design.
 - 2. Sample AHU sequence controlling to 55 degree discharge.

SUPPLY FAN CONTROL: THE VARIABLE SPEED SUPPLY FAN WILL BE STARTED BASED ON OCCUPANCY SCHEDULE. WHEN THE SUPPLY FAN STATUS INDICATES THE FAN STARTED, THE CONTROL SEQUENCE WILL BE ENABLED. THE SUPPLY FAN WILL MODULATE TO MAINTAIN THE DISCHARGE STATIC PRESSURE AT SETPOINT. UPON A LOSS OF AIRFLOW, THE SYSTEM WILL AUTOMATICALLY RESTART.

RETURN FAN CONTROL: AFTER THE SUPPLY FAN HAS BEEN STARTED, THE VARIABLE SPEED RETURN FAN WILL BE STARTED. THE RETURN FAN WILL MODULATE IN CONJUNCTION WITH THE SUPPLY FAN. THE RETURN FAN WILL LAG THE SUPPLY FAN BY A PERCENTAGE DIFFERENTIAL.

ECONOMIZER CONTROL: WHEN ENABLED VIA THE NETWORK COMMAND, THE ECONOMIZER WILL ACT AS THE INITIAL STAGE OF COOLING, WORKING IN SEQUENCE WITH THE COOLING COIL.

MINIMUM OA CONTROL: THE FRESH AIR INTAKE OF THE UNIT WILL BE LIMITED TO PREVENT THE PREHEAT TEMPERATURE FROM FALLING BELOW THE LOW LIMIT SETPOINT.

TEMPERATURE CONTROL: THE UNIT WILL CONTROL TO MAINTAIN A CONSTANT DISCHARGE AIR TEMPERATURE.

OCCUPIED MODE: THE OCCUPANCY MODE WILL BE CONTROLLED VIA A NETWORK INPUT. THE OCCUPANCY MODE CAN ALSO BE OVERRIDDEN BY A NETWORK INPUT.

UNOCCUPIED MODE: THE UNIT WILL REMAIN OFF DURING UNOCCUPIED PERIODS.

PREHEAT COIL: THE PREHEAT COIL WILL MODULATE TO MAINTAIN THE TEMPERATURE SETPOINT. WHEN THE UNIT IS SHUTDOWN, THE PREHEAT COIL WILL BE COMMANDED TO A PRESET POSITION SHOULD THE OUTDOOR AIR TEMPERATURE FALL BELOW THE LOW OUTDOOR AIR TEMPERATURE SETPOINT. UPON A LOSS OF AIRFLOW, THE PREHEAT COIL WILL BE COMMANDED TO A PRESET POSITION SHOULD THE OUTDOOR AIR TEMPERATURE FALL BELOW THE LOW OUTDOOR AIR TEMPERATURE SETPOINT.

COOLING COIL: THE COOLING COIL WILL MODULATE TO MAINTAIN THE TEMPERATURE SETPOINT. WHEN THE UNIT IS SHUTDOWN, THE COOLING COIL WILL BE COMMANDED TO A PRESET POSITION SHOULD THE OUTDOOR AIR TEMPERATURE FALL BELOW THE LOW OUTDOOR AIR TEMPERATURE SETPOINT. UPON A LOSS OF AIRFLOW, THE COOLING COIL WILL BE OFF.

REHEAT COIL: THE REHEAT COIL WILL MODULATE TO MAINTAIN THE TEMPERATURE SETPOINT. WHEN THE UNIT IS SHUTDOWN, THE REHEAT COIL WILL BE COMMANDED TO A PRESET POSITION SHOULD THE OUTDOOR AIR TEMPERATURE FALL BELOW THE LOW OUTDOOR AIR TEMPERATURE SETPOINT. UPON A LOSS OF AIRFLOW, THE REHEAT COIL WILL REMAIN IN CONTROL.

HUMIDIFICATION: THE HUMIDIFIER VALVE WILL MODULATE TO MAINTAIN THE RETURN AIR RELATIVE HUMIDITY SETPOINT AS SENSED BY THE RETURN AIR RELATIVE HUMIDITY SENSOR. THE HUMIDITY HIGH LIMIT WILL OVERRIDE THE OUTPUT IF NECESSARY TO PREVENT THE DISCHARGE AIR HUMIDITY FROM EXCEEDING DISCHARGE HUMIDITY HIGH LIMIT SETPOINT.

UNIT ENABLE: A NETWORK UNIT ENABLE SIGNAL WILL CONTROL THE MODE OF THE UNIT.

ADDITIONAL POINTS MONITORED BY THE FMS:

- MINIMUM OUTDOOR AIR VELOCITY PRESSURE (MOA-VP)
- MIXED AIR TEMPERATURE (MA-T)
- DISCHARGE AIR VELOCITY PRESSURE (DA-VP)
- RETURN FAN STATUS (RF-S)
- RETURN AIR TEMPERATURE (RA-T)
- RETURN AIR VELOCITY PRESSURE (RA-VP)
- PREFILTER DIFF PRESSURE (PFILT-DP)
- FINAL FILTER DIFFERENTIAL PRESSURE (FFILT-DP)
- DISCHARGE AIR HIGH DUCT PRESSURE (DAHI-A)
- DISCHARGE AIR SMOKE ALARM (DA-SD)
- RETURN AIR LOW DUCT PRESSURE (RAPLO-A)
- RETURN AIR SMOKE ALARM (RA-SD)
- LOW TEMPERATURE ALARM (LT-A)

- H. Typical minimum point requirement as applicable to the HVAC system.
- 1.

Air Handling Units	Input Type
Discharge Air Temperature	Analog Input
Return Air Temperature	Analog Input
Mixed Air Temperature	Analog Input
Preheat Air Temperature	Analog Input
Discharge Air Static Pressure	Analog Input
Return Air Static Pressure	Analog Input
Mixed Air Static Pressure	Analog Input
Relief Air Static Pressure	Analog Input
Return Air Humidity	Analog Input
Filter Differential Pressure	Analog Input
Supply Airflow	Analog Input
Return Airflow	Analog Input
Supply Fan Speed Control	Analog Output
Return Fan Speed Control	Analog Output
Preheat Valve Control	Analog Output
Cooling Valve Control	Analog Output
Reheat Valve Control	Analog Output
Humidifier Valve Control	Analog Output
Mixed Air Damper Control	Analog Output
Exhaust Air Damper Control	Analog Output
High Return Pressure Alarm	Digital Input
High Supply Pressure Alarm	Digital Input
Low Temperature Limit Alarm	Digital Input
Supply Duct Smoke Detector Alarm	Digital Input
Return Duct Smoke Detector Alarm	Digital Input
Supply Fan Status	Digital Input
Return Fan Status	Digital Input
Supply Fan VFD Alarm	Digital Input
Return Fan VFD Alarm	Digital Input
Supply Fan Control	Digital Output
Return Fan Control	Digital Output

STANDARDS – VAV

- A. VAV Equipment numbering scheme shall be confirmed and validated with the PSHMC project manager prior to completion of design documents to avoid duplicate equipment numbers on the PSHMC campus.
- B. VAV boxes shall be supplied by the Division 17 contractor and included within the building automation contract. Boxes shall be Johnson Controls TSS or approved equal, and shall contain factory mounted Bacnet VMA controller, access in terminal casing, and ¾” closed cell foam insulation.
- C. VAV boxes shall be supplied with factory mounted controller.
- D. VAV boxes shall have a discharge air temperature.
- E. VAV boxes shall have a zone thermostat with terminal block termination.
- F. Valves shall be electronic proportional control (0-10V / 4-20mA). Incremental pulse type actuation is not permitted.
- G. Valves shall be spring return to normal failsafe.
- H. Piping shall be in accordance with piping arrangement specified in division 15 specifications.
- I. Sequences of Operation
 - 1. Sequences of operation for mechanical equipment shall be reviewed and approved by PSHMC and Johnson Controls prior to completion of design.
 - 2. Sample VAV Sequence.

OCCUPIED MODE: WHEN THE ZONE TEMPERATURE IS BETWEEN THE OCCUPIED HEATING AND COOLING SETPOINTS (INSIDE OF THE BIAS), THE PRIMARY AIR DAMPER WILL BE AT THE MINIMUM CFM AND THERE WILL BE NO MECHANICAL HEATING. ON A RISE IN ZONE TEMPERATURE ABOVE THE COOLING SETPOINT, THE PRIMARY AIR DAMPER WILL INCREASE THE CFM AND THERE WILL BE NO MECHANICAL HEATING. ON A DROP IN ZONE TEMPERATURE BELOW THE HEATING SETPOINT, THE REHEAT COIL WILL BE USED TO MAINTAIN THE ZONE TEMPERATURE, THE DAMPER IS CONTROLLED TO PROVIDE A MINIMUM CFM.

UNOCCUPIED MODE: WHEN IN THIS MODE, WHILE THE ZONE TEMPERATURE IS BETWEEN THE UNOCCUPIED HEATING AND COOLING SETPOINTS (INSIDE OF THE BIAS), THE PRIMARY AIR DAMPER WILL BE AT THE MINIMUM CFM, THERE WILL BE NO MECHANICAL HEATING. ON A RISE IN ZONE TEMPERATURE ABOVE THE UNOCCUPIED COOLING SETPOINT, THE PRIMARY AIR DAMPER WILL INCREASE THE CFM (IF AVAILABLE), AND THERE WILL BE NO MECHANICAL HEATING. ON A

DROP IN ZONE TEMPERATURE BELOW THE UNOCCUPIED HEATING SETPOINT, THE REHEAT COIL WILL BE USED TO MAINTAIN THE ZONE TEMPERATURE, THE DAMPER WILL BE AT THE MINIMUM CFM.

DISCHARGE AIR TEMP SENSOR: A DISCHARGE AIR TEMP SENSOR IS PROVIDED ON EACH BOX FOR MONITORING PURPOSES.

UNIT ENABLE: A NETWORK UNIT ENABLE SIGNAL WILL CONTROL THE MODE OF THE BOX.

J. Typical minimum point requirement as applicable to the HVAC system.

1.

<u>VAV</u>	<u>Input Type</u>
Zone Temperature	Analog Input
Discharge Air Temperature	Analog Input
VAV CFM	Analog Input
Heating Valve Control	Analog Output

Miscellaneous Systems

A. Miscellaneous Equipment numbering scheme shall be confirmed and validated with the PSHMC project manager prior to completion of design documents to avoid duplicate equipment numbers on the PSHMC campus.

B. Exhaust Fans.

1. Exhaust fans shall have control and status points programmed into the Building Automation System for control or scheduling ability.

C. Pumps.

1. Pumps shall have control and status points programmed into the Building Automation System for control or scheduling ability. With multi pump systems, pumps shall operate in a lead/lag arrangement.

D. Chilled Water System.

1. Modifications or additions to the chilled water system shall work in conjunction with the campus chilled water system and central plant. Piping, controls, and sequences of the chilled water interfaces shall be consistent with the operation of other mega-structure secondary interfaces. The following points shall be monitored at a minimum:

- A. Primary supply temperature.
 - B. Primary return temperature.
 - C. Primary supply flow.
 - D. Secondary supply temperature.
 - E. Secondary return temperature.
 - F. Secondary chilled water differential pressure.
 - G. Chilled water pump control, status, and VFD control.
2. Graphics shall be incorporated into the overall campus chilled water graphic on Metasys Extended Architecture.
- E. Variable Speed Drives.
1. VFD's shall be Johnson Controls VSS, Cutler Hammer, ABB, or approved equal.
 2. VFD harmonic filters shall be considered in the design of the HVAC VFD application.
 3. VFD's shall be furnished by the mechanical contractor.
- F. Hot Water System.
1. Modifications or additions to the hot water system shall work in conjunction with the campus hot water system and central plant.
- G. Freezer Alarms.
1. If the Omega view system is available within the project area, freezer alarms shall be connected and coordinated with the PSHMC project manager. This scope of work will not include the division 17 contractor.
 2. In the event that freezer alarms require connectivity to BOC, the freezer points shall be connected to the Building Automation System with alarm parameters programmed for BOC action upon an alarm event. Alarm messaging will be coordinated with the PSHMC project manager.
- H. Emergency Generators.
1. Emergency generator and/or transfer switches shall have points brought back to the Johnson Controls Metasys Extended Architecture User Interface. These points will be trended and scheduled in conjunction with remaining site generator and

transfer switch points. BOC shall be fully trained to be able to gather required Joint Commission / Department of Health information in trend data form.

2. Generator and/or transfer switch shall be provided with applicable network or Bacnet interface for communication to Metasys Extended Architecture.

I. Smoke Control.

1. The existing hospital HVAC system has an operational smoke control system. This system is integrated with the Johnson Controls IFC fire alarm system, the Notifier fire alarm system, and the Johnson Controls Metasys Building Automation System.
2. Upon renovations of an area with smoke control, the smoke control equipment may be eliminated along with the programming logic based on PSHMC budget and direction. Any removal of smoke control equipment and programming logic shall occur without disruption or compromising the remaining smoke control system left in place.
3. Decisions regarding smoke control design and implementation shall be determined by the Engineer, PSHMC, and Johnson Controls.

SECTION 17200 – FIRE ALARM SYSTEM

- A. Furnish and install a complete fire alarm system as an extension of the existing facility fire alarm system.
- B. The fire alarm system installed shall be an extension of the Notifier Fire Alarm Network, or an extension of the Johnson Controls IFC Fire Alarm Network. All attempts shall be made to upgrade and expand the use of the Notifier Fire Alarm Network, as determined by PSHMC.
- C. All work shall be performed by the Johnson Controls factory office for the respective fire alarm system.
- D. The Division 17 Contractor shall contract directly with the General Contractor or as determined by PSHMC.
- E. The fire alarm Notifier network shall be on the PSHMC IT network, and shall be coordinated with the PSHMC IT staff.
- F. All fire alarm power sources shall be 24VAC.
- G. Smoke dampers, or Fire/Smoke dampers shall be provided with factory end switches. End switch status shall be monitored by the Notifier fire alarm system.
- H. A Graphical interface shall be provided for Notifier fire alarm system and shall be an expansion of the existing Notifier system. New graphics shall be consistent with the existing user interface.
- I. Testing documentation of all devices and operation and maintenance manuals shall be provided at the completion of the project in accordance with standard PSHMC terms.
- J. New fire alarm panels, SLC loops, power circuits, etc... shall be provided with 20% spare capacity to allow for future expansion or modification.
- K. New installations shall be reviewed for Voice Evacuation application. Application is at the discretion of PSHMC.
- L. Programming Matrix.
 - a. See following Page.

Zone Number	Zone Name	Zone Number	Zone Name
1	Basement	50	Elevator #3 Shunt
2	Ground Floor	51	Elevator #3 Flash
3	First Floor	52	Elevator #4 Primary
4	Second Floor	53	Elevator #4 Alternate
5	Third Floor	54	Elevator #4 Shunt
6	Fourth Floor	55	Elevator #4 Flash
7	Fifth Floor	56	spare
8	Sixth Floor	57	EF-1 (Exhaust Fan)
9	Seventh Floor	58	EF-2 (Exhaust Fan)
10	Eighth Floor	59	EF-3 (Exhaust Fan)
11	Ninth Floor	60	EF-4 (Exhaust Fan)
12	Penthouse	61	spare
13	spare	62	spare
14	spare	63	spare
15	spare	64	spare
16	spare	65	spare
17	spare	66	spare
18	spare	67	spare
19	spare	68	spare
20	Heat Detector	69	Trouble Condition
21	Smoke Detector	70	General Alarm
22	Smoke Duct Det.	71	spare
23	Pull Station	72	spare
24	Tamper Valve	73	spare
25	Water Flow	74	spare
26	Low air pressure	75	spare
27	Trouble Monitor	76	spare
28	Track Supv.	77	spare
29	Speaker Circuit	78	spare
30	Horn/Strobe Ckt	79	spare
31	Pre-action Alarm	80	spare
32	Door Release	81	spare
33	HVAC Damper	82	spare
34	Non Fire	83	spare
35	Exhaust Fan	84	spare
36	spare	85	spare
37	spare	86	spare
38	spare	87	spare
39	spare	88	spare
40	Elev. #1 Primary	89	spare
41	Elev. #1 Alternate	90	spare
42	Elev #1 Shunt	91	EF Disable (exhaust fan)
43	Elev. #1 Flash	92	Speaker Disable
44	Elev. #2 Primary	93	Horn/Strobe Disable
45	Elev. #2 Alternate	94	Pre-action Disable

- b. All Smoke control Zones shall be established and identified using zone 100 and beyond. This Matrix will work for the 640 and 3030 panels. 3030 panels have zones beyond 100 and shall be used for smoke control. (The spares listed here may be used for other things or to be kept open for future).

M. Notifier Veri-Fire Tools Parameters.

- a.

Custom Label= 20 Characters max
Extended Label= 12 Characters Max

For the custom label Zone numbers 1-12 shall be used on the programming Matrix to establish the device label. This will use up 6 Characters, the other 9 will be used by keywords as follows: Corr (corridor) Stair (stair tower) Elev (elevator) RM (room with number)
This will conform to the labeling that is in place throughout the campus. An example is (1st floor Corr. 142)

For the extended label, the building name or fire panel name shall be used; a list of the names is as follows:

Clinical	
HSA	30 Hope Drive
CSA	Sipe Ave.
BMR	ARF
H.E.A	ASB
UPC-1	Longlane
UPC-2	NMRI
Sports Med	Eastmoor Building
Centerview Garage	Eastmoor Apartments

Future Names shall be determined accordingly.

The following type code and devices are compatible with the existing systems. The type code labels shall conform to the following device types.

Hardware Parameters	Type Code Labels	Notifier Part number
Detectors	Heat Fixed 135,190	FST-851
	Heat Rate of Rise	FST-851
	Smoke Detector (ION)	FSI-851
	Smoke Duct Detector	FSD-751 (PL or RPL)
Control Modules	Control	FCM-1
	Relay	FM-1
	Speaker	

	Strobe	
	Horn Ckt	
	Gen Alm	
	Gen Supv	
	Gen Trb	
Monitor Modules	Monitor Module	FMM-1 (NO MINI MODULES)
	Heat Detector	
	Power Module	
	Pull Station	
	Smoke Conventional	
	Tamper	
	Water Flow	

System Programming normal Message shall be= Building Name

ACS Programming

Point Number	Floor And Side
1 st Floor North	
1 st Floor South	
2 nd Floor North	
2 nd Floor South	
3 rd Floor North	
3 rd Floor South	
4 th Floor North	
4 th Floor South	
5 th Floor North	
5 th Floor South	
6 th Floor North	
6 th Floor South	
7 th Floor North	
7 th Floor South	
8 th Floor North	
8 th Floor South	

N. Wire Standards.

- a. For signaling line circuit (SLC) loops - 16 gauge 2 conductor solid twisted non shielded wires with a FPLP coating.
- b. For fiber optic cable - style ST connectors on a 62.5 multimode cable.
- c. For RS-485 Cable - 16 gauge 2 conductor solid shielded with a FPLP coating.

-
- d. For speaker circuits - 16 gauge 2 conductors twisted shielded solid wire with a FPLP coating.
 - e. For the NAC circuits - 14 gauge 2 conductors stranded with a THHN coating, the color coding is as follows:
 - i. NAC circuit #1 Red=Positive
#1 Black=Negative

#2 Blue=Positive
#2 Brown=Negative

#3 Yellow=Positive
#3 Orange=Negative

#4 White=Positive
#4 Purple=Negative

O. Labeling Standards.

- a. All labels for devices are ½” in height. The label shall be black letters on a red background. The information on the label shall consist of the node number, loop number, and device number.

Device Labels Location

Device Type	Label Location	Example
Smoke Detector	Detector Base	N18L01D047
Heat Detector	Detector Base	N18L03D145
Duct Detector	Front Of the detector	N18L04D097

- b. For a remote test station there shall be 2 labels placed on the test station, the top label shall indicate the room number the duct detector is located in (example HG504). The bottom label shall indicate the duct detector the remote station serves (example N18L06D094).
- c. For NAC devices a label shall be viewable from below. The label shall have the following information: the NAC panel and circuit, as well as the device number on that circuit. If the device is the last device on the circuit, it shall also contain the letters EOL. (Example 02-02-14-EOL).

Module Label Locations

With the exception of the pull station, all modules shall have 3 labels placed on them; at

the top, in the middle, and at the bottom.

Module Type	Top Label	Middle Label	Bottom Label	Example
Water flow	Monitor	Water flow	Address	N18L07M132
Valve Tamper	Monitor	Valve Tamper	Address	N16L04M012
Low Air Pressure	Monitor	Low Air	Address	N14L01M013
Air Handler Shut	Relay	AHU Shutdown	Address	N12L01M132
Elev Recall	Relay	Elev Recall Prim	Address	N12L07M111
Elev Recall	Relay	Elev Recall Alt	Address	N12L07M112
Elev Recall	Relay	Elev Recall Shunt	Address	N12L07M113
Elev Recall	Relay	Elev Recall Blink	Address	N12L07M114
Pre-Action	Relay	Pre-action system	Address	N12L04M141
NAC Control	Control	NAC ckt (01 etc)	Address	N12L05M127
Pull Station			Address	N13L01M001

P. Wire Labels.

- a. The Label type shall be Panduit Panther S050X075VAC or equal. The label shall be black letters on a white background. Hand written labels are not permitted. All labels shall be placed 1/2" from the termination point and shall include the following information:
 - b. Panel Wires: If connected to a terminal block the terminal block number, the circuit number, and the polarity shall be listed.
 - i. Example TB-4-4 Pos= Terminal block 4 circuit 4 positive.
 - c. If the wires are connected to a terminal block for a relay, the state of the relay terminal must also be listed on the label.
 - i. Example TB-4-4 N/C= Terminal block 4 Circuit 4 normally Closed.
 - d. NAC circuit wires shall have the NAC panel and circuit number on them.
 - i. Example NAC 01-02= NAC panel #1 Circuit 2.

Q. Turnover Package.

- a. Blueprints, an electronic copy of the fire alarm riser, and a device layout (as-built prints) shall be included. The device ID shall be noted on the drawings.

- b. A floor plan with the fire alarm conduit and all junction boxes shall be provided in AutoCAD format. The NAC devices and riser shall be on a separate riser and floor plan.
- c. Fiber Optic: The test documentation for the fiber optic cable shall include a point to point test from one node to the new node listing distance and decibel loss as well as the route taken via tele/data hubs.

END OF SECTION