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GENERAL SERVICES DIVISION (GSD)

MEP Building Design Standards

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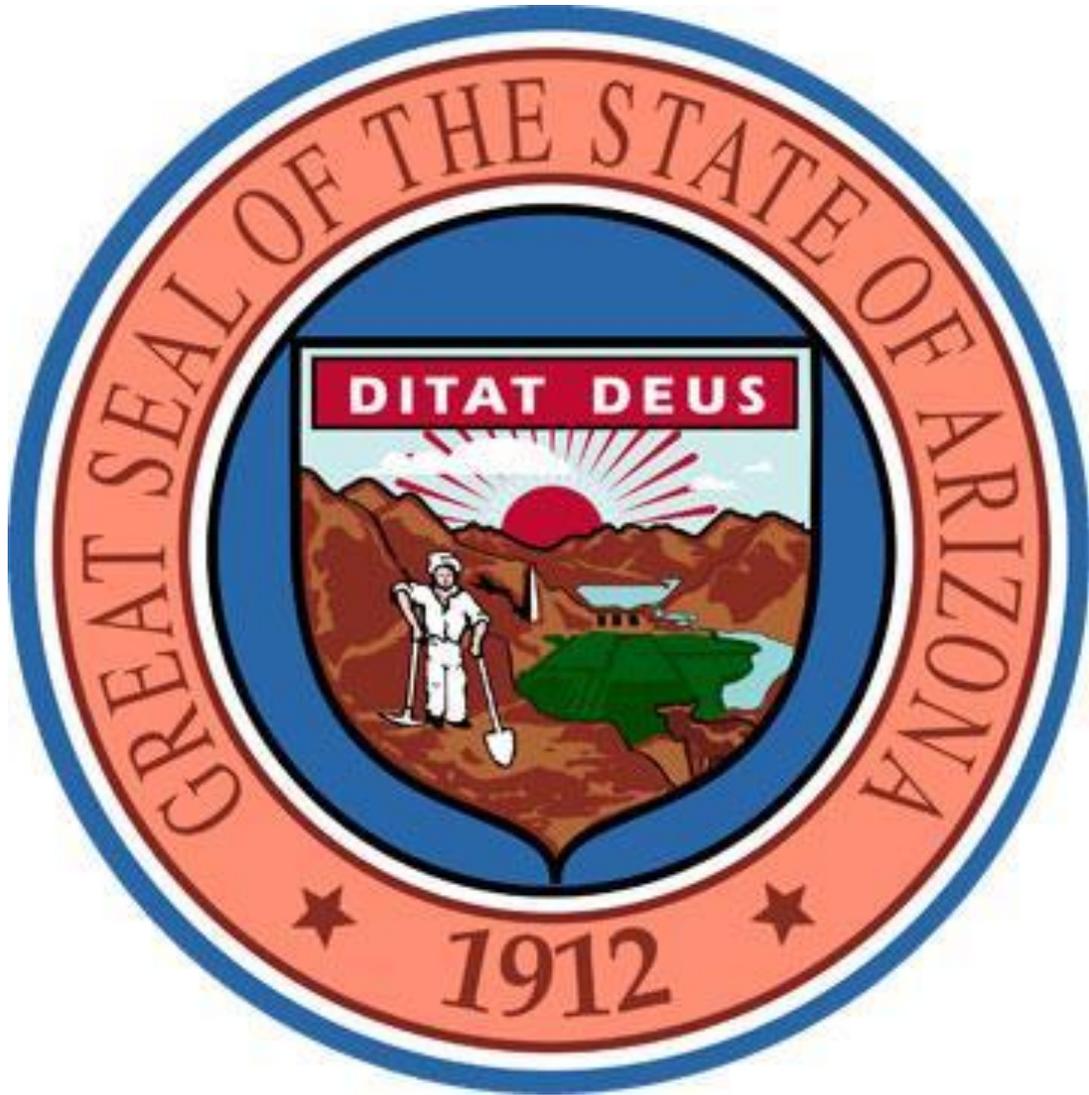


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Section 21 0500 Common Work Requirements for Fire Suppression

1. Adopted Codes listed here:
 - 2012 International Building Code
 - 2012 International Plumbing Code
 - 2012 International Mechanical Code
 - National Electrical Manufacturer's Association
 - National Electrical Code
 - Underwriters Laboratories
 - American National Standards Institute
 - American Society for Testing Materials
 - Local utility companies
 - National Fire Protection Association
 - ASME Boiler and Pressure Vessel Codes
 - Occupational Safety and Health Administration
 - American Society of Heating Refrigeration and Air Conditioning Engineers
 - Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)
 - American Society of Sanitary Engineering
2. Coordination Drawings shall be provided prior to start of construction.
3. All specified equipment shall be rated for the altitude of the project.
4. All equipment and materials shall be listed and labeled by a nationally recognized laboratory (NRTL).
5. All ground mounted equipment shall be provided with a minimum 4" high concrete housekeeping pad.
6. All motors shall be premium efficiency type, with nominal efficiencies not less than the following as per the Consortium on Energy Efficiency (CEE), and minimum power factor of 0.85.
7. VFD's shall be factory fabricated, variable voltage and frequency type for driving the specified AC motor in a typical HVAC variable torque application, listed per UL-508, and rated for installation within a return air plenum. Performance specified here is based on driving a 4-pole NEMA B induction motor. Select and size VFDs so they are compatible to drive motors with characteristics as indicated on the drawings. ABB or equivalent.

Section 21 0505 Piping Specialties for Fire Suppression

1. See Division 23, Section 23 0505, for applicable requirements.

Section 21 0523 Valves for Fire Suppression

1. All Valves shall conform with current applicable provisions of the General Conditions, Supplemental General Conditions, and General Requirements.
2. All Valves shall meet the current MSS Specifications covering Bronze & Iron Valves. MSS-SP-80, MSS-SP-70, MSS-SP71, MSS-SP-85 where applicable.
3. Valves shall be lead free.
4. All Fire Suppression system valves shall be UL Listed and FM Approved. See applicable fire suppression system specification sections for additional valve requirements, including hose threads, tamper switches, etc.

5. All Gate, Globe, Check, Ball valves shall be manufactured by Milwaukee, Nibco, Apollo, Stockham, Powell, Crane, Grinnell, or equivalent.
6. Butterfly valves shall be as manufactured by Milwaukee, W. C. Norris, Centerline, Crane, Demco, Keystone, Grinnell, Victaulic, Nibco, or Dezurik, or equivalent.

Section 21 0548 Vibration and Seismic Controls for Fire Protection

1. Seismic restraints shall be provided for equipment, materials and systems furnished and installed under Division 21 of this Specification in accordance with the requirements of the 2012 International Building Code; and NFPA No. 13 for fire protection system as adopted and interpreted by the AHJ.
2. All fire protection equipment mounted on vibration isolators shall be provided with seismic restraints securely anchored to the building structure capable of resisting horizontal forces of 100% of their weight and/or in accordance with IBC Requirements.
3. All items of fire protection equipment required for life safety including the fire pump and fire protection systems shall be provided with seismic restraints securely anchored to the building capable of resisting horizontal forces of 100% of their weight and/or in accordance with IBC Requirements.
4. All items of fire protection equipment, except as specified above, and all piping furnished and installed under Division 21 shall be provided with seismic restraints securely anchored to the building capable of resisting horizontal forces of 50% of their weight.
5. Seismic restraint/snubber manufacturer shall be responsible for the structural design of attachment hardware as required to attach seismic restraints/snubbers to both the equipment and supporting structure on vibration isolated equipment, or to directly attach equipment to the building structure for non-isolated equipment.

Section 21 1201 Fire Suppression Class I, Dry Standpipe

1. The standpipe fire protection systems shall conform to the applicable provisions of NFPA Standard No. 14 and 101 and to the requirements of the International Building Code. Unless otherwise shown on the drawings or specified, all materials and equipment used in the installation of the fire protection systems shall be listed as approved by the Underwriters' Laboratories List of Approved Equipment, Fire Protection Devices and Devices Involving Fire Hazard, and shall be the latest design of the manufacturer. All fire hoses, threads and adapters shall match the standards of the City Fire Department.
2. All materials and equipment used in the installation of the fire protection systems shall be listed as approved by the Underwriters' Laboratory and/or by Factory Mutual for intended use, unless stated otherwise in these specifications.
3. Underground piping within the building and to a point 5'0" from the building perimeter shall be AWWA Class 200 ductile iron water main pipe and fittings with mechanical joints. Interior of pipe and fittings shall be cement lined. Exterior of pipe and fittings shall be bituminous coating or equivalent. All changes in direction shall be adequately blocked or strapped to prevent separation of joints.
4. Interior building piping systems shall be black steel pipe ASTM A120, or A653 grade A or B, ERWQ or BW, Standard wall, Schedule 40. Piping installed outside or exposed to outdoor ambient conditions shall be galvanized.

5. Changes of direction shall be accomplished by the use of fittings suitable for use in fire protection systems as defined in Article 7.5 of NFPA 14.
6. Fittings and specials for ductile iron pipe shall be Class 250 to match pipe, conforming to AWWA C110, mechanical flange joint type. All ductile iron fittings shall be cement lined.
7. Fittings for steel pipe shall be cast iron screwed, welded fittings, or UL and FM approved mechanical pipe couplings and fittings as manufactured by Victaulic or equivalent in accordance with requirements specified in Section 21 0504.
8. Joints shall be provided in accordance with Section 21 0504 and the manufacturer's instructions. Threaded joints for piping shall be provided in strict accordance with NFPA requirements.
9. Unions and flanges shall be provided in accordance with Section 21 0504. Gaskets shall be as recommended by the manufacturer and suitable for service on which used.
10. See Section 21 0504 for general requirements associated with equipment and piping systems hangers and supports. Seismic supports for fire protection system shall be provided in accordance with NFPA requirements.
11. All fire protection piping shall be rigidly supported from the building structure by means of adjustable ring type hangers. Piping hangers shall be spaced as specified in Article 7.6 of NFPA 14. Piping system shall be installed in an approved manner and shall not overload the structure. Contractor shall provide additional hangers and steel support members as may be required to distribute the piping weight over several structural members where required or directed. Fire protection piping system shall be supported independent and shall not be attached or supported from hangers, trapezes, or supports provided for other piping systems or equipment.
12. See Section 21 0523 for general valve requirements. All valves for fire hose fire department connections shall have threads and adapters to match the standard of the City Fire Department. All valves shall be UL listed and FM approved. Valve sizes shall be determined by the approved hydraulic calculations. Outside screw and yoke valves shall be indicated on the approved hydraulic calculations. Tamper switches shall be provided on all valves controlling fire protection system operation, as required by NFPA. Valves shall be rated for working pressure not less than the maximum pressure to be developed at that point in the system under any operating condition.
13. Gate valves, 2" and under, shall be bronze body and trim, outside screw and yoke, wedge disc, screwed connections, 400 PSI W.O.G. Maximum working pressure.
14. Gate valves, 2-1/2" and larger, shall be Class 125 or Class 250, as required, with flanged ends, outside screw and yoke, bronze seals, wedge disc, iron body.
15. Drain valves shall be globe valve or angle body globe valve, with screwed ends, bronze body and trim, 200 PSIG W.O.G. maximum working pressure.
16. Swing check valves, 2" and smaller shall be y-pattern, horizontal swing bronze body, bronze trim, 200 PSIG W.O.G. screwed connections.
17. Swing check valves, 2-1/2" and larger, shall be Class 125 or Class 250 iron body, clearway swing check, as required with flange connections.
18. Automatic Ball Drips: Automatic ball drips shall be 1/2" or 3/4" as required normally open, which close when the flow of water through the valve exceeds 4 to 10 GPM, 175 PSIG working pressure, Underwriters' Laboratories, Inc., or Factory Mutual approved, Standard Fire West No. 5248 or equivalent.

19. Post indicator fire main control valve shall be vertical post type for underground valve control or wall type. Underwriters' Laboratories, and Factory Mutual approved pattern with approved gate valve and tamper switch. Vertical post indicator shall be Mueller Co. Model A-20804 with Mueller AWWA non-rising stem gate valve, A-2050 Series or equivalent and wall type indicator shall be Mueller A-20810 or equivalent.
20. Pressure gauges shall be designed for use with water. Gauges shall be of the Bourdon type having an enclosed phosphor-bronze type. The moving parts shall be brass or stainless steel except the hair spring, which is phosphor-bronze. The case and ring shall be brass or stainless steel, and the ring shall be either threaded or pressed over the case. Gauges shall be 4-1/2 inch size with dial marking subdivisions no finer than one percent of the maximum scale reading, and shall be accurate to two percent or less. The gauge scale, when possible, shall be at least twice the maximum working pressure. All gauges shall be FM approved and UL listed.
21. All valves which control water to the standpipe system shall be equipped with supervisory switches having one normally open contact and one normally closed contract. Valve supervisory switches shall be single pole double throw switching contacts, and shall be housed in a gasketed weathertight enclosure. The supervisory device supplied shall be specifically designed to mount on, and operate reliably with, the type of control valve being monitored. All valve position switches shall be adjusted to transmit a supervisory signal within two revolutions of the valve operating hand wheel or crank (away from its full open position).
22. For standpipe systems installed within facilities without a fire alarm system, valves may be supervised in a manner approved by NFPA No. 14, other than with tamper switches, as approved by the Fire Marshal.
23. Water flow switches shall be field adjustable vane-type with pneumatic retard and 175 PSI working pressure. Units shall be single pole double throw, normally open, suitable for 24-volt, DC service or as otherwise required to interface with Building Fire Alarm system. The flow switch shall be furnished and installed under this section of specifications and electrically connected under Division 28. Flow switches when required for zoning shall be piped and installed so that only one flow switch actuates when an alarm in that zone is present.
24. Fire Department Connections: Fire department connections shall be of the type and style shown on the drawings, cast brass body, double clappers, plugs, and attached chains. All exposed surfaces, caps and chains shall be chrome plated. Identification shall be by raised letters on the individual devices, or shall consist of attached escutcheon plates of the same material. Label shall read "STANDPIPE." The dimension from grade level to the center of the 2-1/2-inch inlets shall be 34 inches (plus or minus 2 inches), or as otherwise directed by the Fire Marshal. Make the fire department connection with UL approved swing check valve. Provide automatic ball drip between Fire Department connection and check valve to drain connection.
25. Roof Manifold: Roof manifold connections shall be of the type and style as shown on the drawings, cast brass body with 2-1/2" NPT inlet and 2-1/2" male NPT outlets, with 2-1/2", 300 PSIG rated, UL listed and FM approved angle valves with caps and chains, rough brass finish. The dimension for the roof level to the 2-1/2" hose connections shall be 34 inches, or as otherwise directed by the Fire Marshal.
26. Hose Valves (Zones exceeding 100 PSIG): Fire hose valves shall be 2-1/2" type hose valve, arrangement and style as shown on the drawings, 400 PSIG maximum operating pressure, UL listed and FM approved, combination shut-off, pressure reducing, and pressure regulating

features for installation on standpipe systems. Pressure regulation shall be non-adjustable to provide outlet pressure higher than 100 PSIG as required by NFPA No. 14, unless otherwise required by the Fire Marshal. Furnish valve complete with cap and chain. Valve and trim shall be rough brass finish. Furnish approved pressure relief valves when required to prevent excessive pressure rise due to line high pressure ranges.

27. Hose Valves (low pressure zones): Fire hose valves shall be 2-1/2" type hose valve, arrangement and style as shown on the drawings, 300 PSIG maximum working pressure, UL listed and FM approved. Furnish valve complete with cap and chain. Valve and trim shall be rough brass finish.
28. Main riser plaques shall be 7 inches by 10 inches with four mounting holes (one in each corner), and shall have white lettering on red porcelain with white blank for the "design data." Plaque shall meet all requirements of NFPA 13, Chapter 7.

Section 21 1202 Fire Suppression, Class II, Wet Standpipe

1. The standard fire protection systems shall conform to the applicable provisions of NFPA Standard No. 14 and 101 and to the requirements of the International Building Code. Unless otherwise shown on the drawings or specified, all materials and equipment used in the installation of the fire protection systems shall be listed as approved by the Underwriters' Laboratories List of Approved Equipment, Fire Protection Devices and Devices Involving Fire Hazard, and shall be the latest design of the manufacturer. All fire hoses, threads and adapters shall match the standards of the City Fire Department.
2. All material and equipment furnished shall be in accordance with the following requirements and NFPA 14. All fire protection materials and equipment shall be new and unused, shall be free of defects and specifically designed for the use intended, shall conform to the requirements of NFPA 14, and shall be UL listed and FM approved, unless otherwise noted in the specification.
3. Underground piping within the building and to a point 5'0" from the building perimeter shall be AWWA Class 200 ductile iron water main pipe and fittings with mechanical joints. Interior of pipe and fittings shall be cement lined. Exterior of pipe and fittings shall be bituminous coating or equivalent. All changes in direction shall be adequately blocked or strapped to prevent separation of joints.
4. Interior building piping systems shall be black steel pipe ASTM A120, or A653 grade A or B, ERWQ or BW, Standard wall, Schedule 40. Piping installed outside or exposed to outdoor ambient conditions shall be galvanized.
5. Changes of direction shall be accomplished by the use of fittings suitable for use in fire protection systems as defined in Article 7.5 of NFPA 14.
6. Fittings and specials for ductile iron pipe shall be Class 250 to match pipe, conforming to AWWA C110, mechanical flange joint type. All ductile iron fittings shall be cement lined.
7. Fittings for steel pipe shall be cast iron screwed, welded fittings, or UL and FM approved mechanical pipe couplings and fittings as manufactured by Victaulic or equivalent in accordance with requirements specified in Section 21 0504.
8. Joints shall be provided in accordance with Section 21 0504 and the manufacturer's instructions. Threaded joints for piping shall be provided in strict accordance with NFPA requirements.

9. Unions and flanges shall be provided in accordance with Section 21 0504. Gaskets shall be as recommended by the manufacturer and suitable for service on which used.
10. See Section 21 05 04 for general requirements associated with equipment and piping systems hangers and supports. Seismic supports for fire protection system shall be provided in accordance with NFPA requirements.
11. All fire protection piping shall be rigidly supported from the building structure by means of adjustable ring type hangers. Piping hangers shall be spaced as specified in Article 7.6 of NFPA 14. Piping system shall be installed in an approved manner and shall not overload the structure. Contractor shall provide additional hangers and steel support members as may be required to distribute the piping weight over several structural members where required or directed. Fire protection piping system shall be supported independent and shall not be attached or supported from hangers, trapezes, or supports provided for other piping systems or equipment.
12. See Section 21 0523 for general valve requirements. All valves for fire hose fire department connections shall have threads and adapters to match the standard of the City Fire Department. All valves shall be UL listed and FM approved. Valve sizes shall be determined by the approved hydraulic calculations. Outside screw and yoke valves shall be indicated on the approved hydraulic calculations. Tamper switches shall be provided on all valves controlling fire protection system operation, as required by NFPA. Valves shall be rated for working pressure not less than the maximum pressure to be developed at that point in the system under any operating condition.
13. Gate valves, 2" and under, shall be bronze body and trim, outside screw and yoke, wedge disc, screwed connections, 400 PSI W.O.G. Maximum working pressure. Lugged Butterfly valves also acceptable.
14. Gate valves, 2-1/2" and larger, shall be Class 125 or Class 250, as required, with flanged ends, outside screw and yoke, bronze seals, wedge disc, iron body. Lugged Butterfly valves also acceptable.
15. Drain valves shall be globe valve or angle body globe valve, with screwed ends, bronze body and trim, 200 PSIG W.O.G. maximum working pressure.
16. Swing check valves, 2" and smaller shall be y-pattern, horizontal swing bronze body, bronze trim, 200 PSIG W.O.G. screwed connections.
17. Swing check valves, 2-1/2" and larger, shall be Class 125 or Class 250 as required, iron body, clearway swing check, as required with flange connections.
18. Automatic Ball Drips: Automatic ball drips shall be 1/2" or 3/4" as required normally open, which close when the flow of water through the valve exceeds 4 to 10 GPM, 175 PSIG working pressure, Underwriters' Laboratories, Inc., or Factory Mutual approved, Standard Fire West No. 5248 or equivalent.
19. Post indicator fire main control valve shall be vertical post type for underground valve control or wall type provided as shown on the drawings, Underwriters' Laboratories, and Factory Mutual approved pattern with approved gate valve and tamper switch. Vertical post indicator shall be Mueller Co. Model A-20804 with Mueller AWWA non-rising stem gate valve, A-2050 Series or equivalent and Wall type indicator shall be Mueller A-20810 or equivalent.]
20. Pressure gauges shall be designed for use with water. Gauges shall be of the Bourdon type having an enclosed phosphor-bronze type. The moving parts shall be brass or stainless steel

except the hair spring, which is phosphor-bronze. The case and ring shall be brass or stainless steel, and the ring shall be either threaded or pressed over the case. Gauges shall be 4-1/2 inch size with dial marking subdivisions no finer than one percent of the maximum scale reading, and shall be accurate to two percent or less. The gauge scale, when possible, shall be at least twice the maximum working pressure. All gauges shall be FM approved and UL listed.

21. All valves which control water to the standpipe system shall be equipped with supervisory switches having one normally open contact and one normally closed contract. Valve supervisory switches shall be single pole double throw switching contacts, and shall be housed in a gasketed weathertight enclosure. The supervisory device supplied shall be specifically designed to mount on, and operate reliably with, the type of control valve being monitored. All valve position switches shall be adjusted to transmit a supervisory signal within two revolutions of the valve operating hand wheel or crank (away from its full open position).
22. Water flow switches shall be field adjustable vane-type with pneumatic retard and 175 PSI working pressure. Units shall be single pole double throw, normally open, suitable for 24-volt, DC service or as otherwise required to interface with Building Fire Alarm system. The flow switch shall be furnished and installed under this section of specifications and electrically connected under Division 28. Flow switches when required for zoning shall be piped and installed so that only one flow switch actuates when an alarm in that zone is present.
23. Fire Department Connections: Fire department connections shall be of the type and style shown on the drawings, cast brass body, double clappers, plugs, and attached chains. All exposed surfaces, caps and chains shall be chrome plated. Identification shall be by raised letters on the individual devices, or shall consist of attached escutcheon plates of the same material. Label shall read "STANDPIPE." The dimension from grade level to the center of the 2-1/2-inch inlets shall be 34 inches (plus or minus 2 inches), or as otherwise directed by the Fire Marshal. Make the fire department connection with UL approved swing check valve. Provide automatic ball drip between Fire Department connection and check valve to drain connection.
24. Fire Hose Cabinets: Fire hose cabinets and trim shall be of the type, style, and arrangement as shown on the drawings, UL listed and FM approved conforming to NFPA No. 14 requirements, surface mounted, semi-recess, or fully recessed, as required, for the specific application. Cabinets shall be steel construction with 20 gauge tubular steel door with 18 gauge steel frame and continuous hinge. Furnish steel door with break glass, unless otherwise indicated on the drawing, with keyed cylindered lock, internal door trip device, single strength glass panel with instruction decal. Cabinet shall be factory finished inside and out with white, electrostatically applied thermally fused polyester coating. Exterior field finish painting, as required, shall be provided under the "Painting" sections of this Specification. Furnish fire hose cabinet complete with all required trim including the following:
25. 1-1/2" fire hose rack assembly, including 1-1/2" angle hose valve, as specified in this section, pipe escutcheons, hose rack with rack nipple, couplings, and 100 feet of 1-1/2" lined polyflex fire hose, waterflow fog nozzle. Valves, nozzles, and trim shall be brass finish. Fire hose rack shall be red polyester coated steel.
26. Portable fire extinguisher, 10 pound, multipurpose dry chemical agent, effective and approved for Class A, B, and C fires.
27. Hose Valves (Zones exceeding 100 PSIG): Fire hose valves shall be 1-1/2" type hose valve, arrangement and style as shown on the drawings, 400 PSIG maximum operating pressure, UL

listed and FM approved, combination shut-off, pressure reducing, and pressure regulating features for installation on standpipe systems. Pressure regulation shall be non-adjustable to provide outlet pressure higher than 100 PSIG as required by NFPA No. 14, unless otherwise required by the Fire Marshal. Valve and trim shall be rough brass finish. Furnish approved pressure relief valves when required to prevent excessive pressure rise due to line high pressure surges.

28. Hose Valves (low pressure Zones): Fire hose valves shall be 1-1/2" type hose valve, arrangement and style as shown on the drawings, 300 PSIG maximum working pressure, UL listed and FM approved. Valve and trim shall be rough brass finish.
29. Plaques: Main riser plaques shall be 7 inches by 10 inches with four mounting holes (one in each corner), and shall have white lettering on red porcelain with white blank for the "design data." Plaque shall meet all requirements of NFPA 13, Chapter 7.

Section 21 1313 Fire Protection System, Automatic Wet Pipe Sprinkler

1. Conform to the applicable provisions of NFPA Standards 13 and 101 and to the requirements of the International Building Code. Unless otherwise shown on the Drawings or specified, all materials and equipment used in the installation of the fire protection systems shall be listed in the UL Fire Protection Equipment Directory, and shall be the latest design of the manufacturer. All fire hoses, threads and adapters shall match the standards of the City Fire Department.
2. All material and equipment furnished shall be in accordance with the following requirements and NFPA 13. All fire protection materials and equipment shall be new and unused, shall be free of defects and specifically designed for the use intended, shall conform to the requirements of NFPA 13, and shall be UL listed and FM approved, unless otherwise noted in the Specification.
3. Underground piping within the building and to a point 5'0" from the building perimeter shall be AWWA Class 200 ductile iron water main pipe and fittings with mechanical joints. Interior of pipe and fittings shall be cement lined. Exterior of pipe and fittings shall be bituminous coating or equivalent. All changes in direction shall be adequately blocked or strapped to prevent separation of joints.
4. Interior building piping systems shall be black steel pipe ASTM A120, or A53 Grade A or B, ERWQ or BW, Standard wall, Schedule 40. UL and FM approved thin wall (Schedule 10, minimum) ASTM A135 or A795 piping may be utilized for sprinkler system as allowed by NFPA and the Fire Marshal. Piping installed outside or exposed to outdoor ambient conditions shall be galvanized.
5. Changes of direction shall be accomplished by the use of fittings suitable for use in sprinkler systems as defined in Article 3 13 of NFPA 13. Fittings installed outside or exposed to outdoor ambient conditions shall be galvanized.
6. Fittings and specials for ductile iron pipe shall be Class 250 to match pipe, conforming to AWWA C110, mechanical flange joint type. All ductile iron fittings shall be cement lined.
7. Fittings for steel pipe shall be cast iron screwed, welded fittings, or UL and FM approved mechanical pipe couplings and fittings as manufactured by Victaulic or equivalent in accordance with requirements specified in Section 21 0504.
8. Joints shall be provided in accordance with Section 21 0504, Pipe and Pipe Fittings, and the manufacturer's instructions. Threaded joints for thin-wall (Schedule 10) piping shall be provided in strict accordance with NFPA requirements, UL and FM approvals for threadable thin-wall piping.

9. Unions and flanges shall be provided in accordance with Section 21 0504, Pipe and Pipe Fittings. Gaskets shall be as recommended by the manufacturer and suitable for service on which used.
10. See Section 21 0504, Pipe and Pipe Fittings, for general requirements associated with equipment piping systems hangers and supports. Seismic supports for fire protection system shall be provided in accordance with NFPA requirements.
11. All fire protection piping shall be rigidly supported from the building structure by means of adjustable ring type hangers. Piping hangers shall be spaced as specified in NFPA 13, Chapter 2. Piping system shall be installed in an approved manner and shall not overload the structure. The Contractor shall provide additional hangers and steel support members as may be required to distribute the piping weight over several structural members where required or directed. Fire protection piping system shall be supported independent and shall not be attached or supported from hangers, trapezes, or supports provided for other piping systems or equipment.
12. See Section 21 0523, Valves, for general valve requirements. All valves for fire hose fire department connections shall have threads and adapters to match the standard of the City Fire Department. All valves shall be UL listed and FM approved. Valve sizes shall be determined by the approved hydraulic calculations. Outside screw and yoke valves shall be indicated on the approved hydraulic calculations. Tamper switches shall be provided on all valves controlling fire protection system operation, as required by NFPA. Valves shall be rated for working pressure not less than the maximum pressure to be developed at that point in the system under any operating condition.
13. Gate valves 2" and under, shall be bronze body and trim, outside screw and yoke, wedge disc, screwed connections, 400 psi W.O.G. maximum working pressure.
14. Gate valves, 2 1/2" and larger, shall be Class 125 or Class 250, as required, with flanged ends, outside screw and yoke, bronze seals, wedge disc, iron body.
15. Drain valves shall be globe valve or angle body globe valve, with screwed ends, bronze body and trim, 200 psi W.O.G. maximum working pressure. Furnish and install as required by NFPA No. 13.
16. Swing check valves 2" and smaller shall be y pattern, horizontal swing bronze body, bronze trim, 200 psi W.O.G. screwed connections.
17. Swing check valves 2 1/2" and larger, shall be iron body, clearway swing check, Class 125 or Class 250 as required with flanged or grooved connections.
18. Automatic Ball Drips: Automatic ball drips shall be 1/2" or 3/4" as required normally open, which close when the flow of water through the valve exceeds 4 to 10 gpm, 175 psi working pressure, Underwriters' Laboratories, Inc., or Factory Mutual approved, Standard Fire West No. 5248 or equivalent.
19. Post indicator fire main control valve shall be vertical post type for underground valve control or wall type provided as shown on the Drawings, Underwriters' Laboratories, and Factory Mutual approved pattern with approved gate valve and tamper switch. Vertical post indicator shall be Mueller Co. Model A 20804 with Mueller AWWA non rising stem gate valve, A 2050 Series or equivalent and wall type indicator shall be Mueller A 20810 or equivalent.
20. Furnish complete wet pipe sprinkler system alarm check valve assembly with all accessories required for system operation, supervision and alarm. Valves shall be UL listed and FM approved, designed to automatically activate electrically and/or hydraulically operated alarms

and shall be furnished in the required size and arrangement with either flanged or grooved connections.

21. Furnish retard chamber, pressure gauges, valves, and trim including water motor gong and alarm switch with both normally open and normally closed electrical contacts.
22. Alarm check valve assembly shall be as manufactured by Tyco Fire Products or equivalent.
23. Pressure gauges shall be designed for use with water. Gauges shall be of the Bourdon type having an enclosed phosphor bronze type. The moving parts shall be brass or stainless steel except the hairspring, which is phosphor bronze. The case and ring shall be brass or stainless steel, and the ring shall be either threaded or pressed over the case. Gauges shall be 4 1/2 inch size with dial marking subdivisions no finer than one percent of the maximum scale reading, and shall be accurate to two percent or less. The gauge scale, when possible, shall be at least twice the maximum working pressure. All gauges shall be FM approved and UL listed.
24. All valves which control water to automatic sprinkler heads shall be equipped with supervisory switches having one normally open contact and one normally closed contact. Valve supervisory switches shall be single pole double throw switching contacts, and shall be housed in a gasketed weathertight enclosure. The supervisory device supplied shall be specifically designed to mount on, and operate reliably with, the type of control valve being monitored. All valve position switches shall be adjusted to transmit a supervisory signal within two revolutions of the valve operating hand wheel or crank (away from its full open position).
25. Water flow switches shall be field adjustable vane type with pneumatic retard and 175 psi working pressure. Units shall be single pole double throw, normally open, suitable for 24 volt, DC service or as otherwise required to interface with Building Fire Alarm system. Water flow switches shall be adjusted so that the device will transmit a water flow alarm within 90 seconds of opening the inspector's test valve on the sprinkler system. The flow switch shall be furnished and installed under this Section of Specifications and electrically connected under Division 26. Flow switches when required for zoning shall be piped and installed so that only one flow switch actuates when an alarm in that zone is present.
26. Sprinkler heads and accessories shall be UL listed or FM approved for the intended service, regular or quick response automatic closed type, 165 deg F rated with 1/2" orifice, except as may be otherwise required for the specific application, and subject to NFPA 13 and 101 requirements and recommendations. Sprinkler heads with higher temperature ratings shall be installed in electrical and mechanical equipment areas, in areas where occupancy may generate high ambient temperatures, where installed in the vicinity of heat producing equipment, attic spaces, where exposed to the direct rays of the sun and beneath skylights and windows, and at other such locations as required by NFPA 13.
27. Sprinkler heads installed in unfinished areas without suspended ceilings shall be upright bronze or brass. Sidewall type heads may be used in areas with low headroom as approved by the Fire Marshal.
28. Sprinkler heads in areas with suspended ceilings shall be chrome plated bronze pendant type or white painted finish. Sidewall heads in finished areas shall be horizontal, chrome plated bronze.
29. For all building areas, except as indicated above, furnish concealed sprinkler heads consisting of sprinkler head installed within brass enclosure assembly with cover plate with white finish or satin chrome.
30. Provide sprinkler head guards where required by NFPA 13 and where appropriate.

31. Approved Manufacturers: Tyco Fire Products, Viking, or equivalent.
32. Fire Department Connections: Fire department connections shall be cast brass body, double clappers, plugs, and attached chains. All exposed surfaces, caps and chains shall be chrome plated. Identification shall be by raised letters on the individual devices, or shall consist of attached escutcheon plates of the same material. Label shall read "AUTO SPKR". The dimension from grade level to the center of the 2 1/2 inch inlets shall be 34 inches (plus or minus 2 inches). Make the fire department connection above the inlet to the alarm valve.
33. Main riser plaques shall be 7 inches by 10 inches with four mounting holes (one in each corner), and shall have white lettering on red porcelain with white blank for the "design data." Plaque shall meet all requirements of NFPA 13, Chapter 7.
34. Strainers: Strainers, where required, shall be "Y" type with cast iron body, 30 mesh monel screen, flanged ends, 1 1/2 inch blow down connection discharging to outside, and shall be rated at 175 psi working pressure for cold water service.

Section 21 2200 Clean-Agent Fire Extinguishing Systems

1. The system shall be a Total Flood FM-200 Suppression System supplied by PYROCHEM or equivalent.
2. The system shall provide a FM-200 minimum design concentration of 7.2% by volume for Class A hazards and 9.0% by volume for Class B hazards, in all areas and/or protected spaces, at the minimum anticipated temperature within the protected area. System design shall not exceed 10.5% for normally occupied spaces, adjusted for maximum space temperature anticipated, with provisions for room evacuation before agent release.
3. The system(s) shall be actuated by a combination of ionization and/or photoelectric detectors installed for maximum area coverage of 250 sq. ft. (23.2 m²) per detector, in both the room, underfloor and above ceiling protected spaces. If the airflow is one air change per minute, photoelectric detectors only shall be installed for maximum area coverage of 125 sq. ft. (11.6 m²) per detector. (Ref. NFPA No. 72.)
4. Detectors shall be Cross-Zoned detection requiring two detectors to be in alarm before release.
5. The FM-200 Clean Agent System materials and equipment shall be standard products of the supplier's latest design and suitable to perform the functions intended. When one or more pieces of equipment must perform the same function(s), they shall be duplicates produced by one manufacturer.
6. All devices and equipment shall be UL Listed and/or FM approved.
7. The clean agent shall be stored in PYRO-CHEM Agent Storage Containers. Containers shall be super-pressurized with dry nitrogen to an operating pressure of 360 psi @ 70 oF (24.8 bar at 20 oC). Containers shall be of high-strength low alloy steel construction and conform to NFPA 2001.
8. Containers shall be actuated by a resettable electric actuator with mechanical override located at each agent container or connected bank of cylinders. Nonresettable or explosive devices shall not be permitted.
9. Each container shall have a pressure gauge and low pressure switch to provide visual and electrical supervision of the container pressure. The low-pressure switch shall be wired to the control panel to provide an audible and visual "Trouble" alarms in the event the container pressure drops below 247 psi (17 bar). The pressure gauge shall be color coded to provide an easy, visual indication of container pressure.

10. Each container shall have a pressure relief provision that automatically operates before the internal pressure exceeds 750 psi (51.7 bar).
11. Engineered discharge nozzles shall be provided within the manufacturer's guidelines to distribute the FM-200 agent throughout the protected spaces. The nozzles shall be designed to provide proper agent quantity and distribution.
 - a. Nozzles shall be available in 3/8 in. through 2 in. (BPS 10 mm through 50 mm) pipe sizes. Each size shall be available in 180o and 360o distribution patterns.
 - b. Ceiling plates can be used with the nozzles to conceal pipe entry holes through ceiling tiles.
12. Distribution piping, and fittings, shall be installed in accordance with the manufacturer's requirements, NFPA 2001 and approved piping standards and guidelines. All distribution piping shall be installed by qualified individuals using accepted practices and quality procedures. All piping shall be adequately supported and anchored at all directional changes and nozzle locations.
 - a. All piping shall be reamed, blown clear and swabbed with suitable solvents to remove burrs, mill varnish and cutting oils before assembly.
 - b. All pipe threads shall be sealed with Teflon tape pipe sealant applied to the male thread only.
13. The control panel shall be a PCR releasing panel supplied by PYRO-CHEM and perform all functions necessary to operate the system detection, actuation and auxiliary functions. It shall include battery standby power to support 24 hours in standby and 5 minutes in alarm, and be capable of supporting Cross Zoned Detection.
14. Ionization or Photoelectric Detectors shall be spaced and installed in accordance with the manufacturer's specifications and the guidelines of NFPA 72.
15. The electric manual release switch located at each exit shall be a dual action device which provides a means of manually discharging the Suppression System when used in conjunction with the control system.
16. The optional Abort Station shall be the "Dead Man" type and shall be located next to each manual switch.
17. Alarm audible and visual signal devices shall operate from the control panel.
18. The Alarm Bell, Alarm Horn and Horn/Strobe devices shall be PYRO-CHEM model, or equal in quality, performance and features.
19. The visual alarm unit shall be a PYRO-CHEM Strobe device, or equal in quality, performance and features.
20. A Strobe device shall be placed outside, and above, each exit door from the protected space. Provide an advisory sign at each light location.

Section 22 0500 Common Work Requirements for Plumbing

1. Adopted Codes listed here:
 - 2012 International Building Code
 - 2012 International Plumbing Code
 - 2012 International Mechanical Code
 - National Electrical Manufacturer's Association
 - National Electrical Code
 - Underwriters Laboratories

- American National Standards Institute
 - American Society for Testing Materials
 - Local utility companies
 - National Fire Protection Association
 - ASME Boiler and Pressure Vessel Codes
 - Occupational Safety and Health Administration
 - American Society of Heating Refrigeration and Air Conditioning Engineers
 - Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)
 - American Society of Sanitary Engineering
2. Coordination Drawings shall be provided prior to start of construction.
 3. All specified equipment shall be rated for the altitude of the project.
 4. All equipment and materials shall be listed and labeled by a nationally recognized laboratory (NRTL).
 5. All ground mounted equipment shall be provided with a minimum 4" high concrete housekeeping pad. Pad to be designed by Engineer of Record.
 6. All motors shall be premium efficiency type, with nominal efficiencies not less than the following as per the Consortium on Energy Efficiency (CEE), and minimum power factor of 0.85.
 7. VFD's shall be factory fabricated, variable voltage and frequency type for driving the specified AC motor in a typical HVAC variable torque application, listed per UL-508, and rated for installation within a return air plenum. Performance specified here is based on driving a 4-pole NEMA B induction motor. Select and size VFDs so they are compatible to drive motors with characteristics as indicated on the drawings. ABB or equivalent.
 21. Provide an advisory sign at each light location.

Section 22 0504 Pipe and Pipe Fittings for Plumbing

1. Lead Ban: All systems and system components, pipe, fittings, and fixtures delivering water for human consumption shall be lead free.
2. See Division 23, Section 23 0504 – Pipe and Pipe Fittings, for applicable requirements.

Section 22 0505 Piping Specialties or Plumbing

1. Lead Ban: All systems and system components, pipe, fittings, and fixtures delivering water for human consumption shall be lead free.
2. See Division 23, Section 23 0505, Piping Specialties.

Section 22 0523 Valves or Plumbing

1. All Valves shall meet the current MSS Specifications covering Bronze & Iron Valves. MSS-SP-80, MSS-SP-70, MSS-SP71, MSS-SP-85 where applicable.
2. Lead Ban: All systems and system components, pipe, fittings, and fixtures delivering water for human consumption shall be lead free.
3. All Gate, Globe, Check, Ball valves shall be manufactured by Milwaukee, Nibco, Apollo, Stockham, Powell, Crane, Grinnell, or equivalent.
4. All lubricated plug valves shall be as manufactured by Rockwell, Walworth, Homestead, or equivalent.
5. Ball valves shall be utilized in lieu of gate valves and globe valves for all plumbing systems for sizes 2" and smaller.
6. Provide gate and globe valves with packing that can be replaced with the valve under full working

pressure.

7. See Division 23, Section 23 0523 - Valves, for applicable requirements.

Section 22 0700 Plumbing Insulation

1. All fittings except as otherwise specified, shall be insulated with the same material and thickness as specified for the pipe.
2. Unions, flanges and valves on hot water, will not require insulation.
3. Insulation shall be as manufactured by Owens-Corning Fiberglas, Knauf, CertainTeed, Johns Manville, or Armstrong, or equivalent, and shall be equal to that specified below. Insulation and all materials on the interior and exterior surfaces of ducts, pipes, and equipment shall have a composite fire and smoke hazard rating not exceeding: Flame spread - 25; fuel contribution - 50; smoke developed - 50, as determined in accordance with ASTM Standard E-84. All insulation materials used for valves and fittings shall have the same ratings as the pipe insulation. Information must be submitted by means of manufacturer's literature showing that the proposed materials conform to above specification without exception.
4. Fiberglass pipe insulation shall be rigid molded and non-combustible with 'K' factor of 0.23 at 75oF. Jacket shall be all service (ASJ) vapor barrier jacket with white kraft paper reinforced with glass fiber yarn and bonded to aluminum foil, secured with self sealing longitudinal laps and butt strips. Johns Manville 'Micro-Lok' or equivalent.
5. Hydros Calcium Silicate insulation shall be rigid molded, non-combustible per ASTM E 136, conforming to ASTM 533, asbestos-free with 'K' factor of 0.40 at 300oF., maximum service temperature 1200oF., compression strength (block) minimum of 200 PSI to produce 5% compression at 1-1/2" thickness. Johns Manville 'Thermo-12 Gold' or equivalent.
6. Fiberglass rigid board insulation for equipment shall conform to ASTM C612 with 'K' factor of 0.23 at 75oF, R=8.0 minimum, 3.0 pound per cubic foot density. Provide vapor barrier jacket (FSK) with aluminum foil reinforced with fiberglass yarn and laminated to fire-resistant kraft, secured with UL listed pressure sensitive tape and outward clinched expanded staples and vapor barrier mastic. Johns Manville 'Spin-Glas' or equivalent.
7. Elastomeric foam insulation for piping and equipment shall be flexible, cellular, molded or sheet, conforming to ASTM C534, with 'K' factor of 0.28 at 75oF., maximum service temperature of 220oF., maximum flame spread rating of 25 and maximum smoke development rating of 50 (3/4" thickness and less). Connections shall be made using manufacturer's approved waterproof vapor barrier retarder adhesive. Provide outdoor U.V. protective coating on all insulation exposed to ambient conditions.
8. Valves and fittings, where required to be insulated, shall be covered with the same insulation material and thickness as specified for the pipe insulation and finished with PVC covers.
9. Valves and fittings with systems specified to be covered with metal or canvas, or polyvinyl chloride (PVC) jacket shall be covered with material to match piping system jacketing.
10. Polyvinyl chloride (PVC) preformed fitting covers with fiberglass inserts shall be used on valves and fittings, except where metal or canvas jacket is required for piping system. PVC fitting covers shall be Zeston 2000 or equivalent, gloss white and shall have a composite fire and smoke hazard rating not exceeding; flame spread - 25; smoke development - 50. Connections shall be made using tacks and pressure sensitive color matching vinyl tape. Seams shall be on the bottom side of pipe and fittings.

11. Metal jacket shall be 0.016-inch smooth aluminum. Provide moisture barrier lining for service temperatures 60oF and less except where applied over insulation with All Service Jacket (ASJ) vapor barrier jacket.
12. PVC jacketing shall be Zeston 2000 or equivalent, gloss white, 0.020 inch thickness, minimum, and shall have a composite fire and smoke hazard rating not exceeding; flame spread -25; smoke development -50. Connection shall be made using tacks and pressure sensitive color matching vinyl tape. Seams shall be on the bottom side of pipe and fittings.
13. See Specification Section 22 0504 for requirements associated with hangers and supports for piping systems.
14. All insulated piping systems shall be provided with individual hangers sized to encircle the insulation. Hangers for domestic cold water and roof drains may be installed under the insulation, provided that the vapor barrier system for cold piping and the hanger rods are protected from the formation of condensation by application of a heavy coating of vapor barrier mastic material.
15. Insulated piping supported by means of trapeze hangers or roller type hangers shall not rest directly on the hanger or support.
16. The insulation at hangers, trapezes and supports shall be protected by means of galvanized steel insulation half diameter support shields. Provide insulation insert between support shield and piping for piping size 1-1/2" and larger. Insulation inserts shall be heavy density calcium silicate molded insulation. Insulation inserts shall be the following minimum lengths.
17. Pipe sleeves shall be provided at penetrations through concrete and masonry construction and at fire rated and smoke rated walls and penetrations when required to comply with UL approved penetration assembly. Insulated piping passing through fire walls and smoke walls shall be provided with UL approved fire safing insulation to match the required insulation thickness and the space between the piping penetration and the adjacent wall construction shall be sealed air tight with UL approved fireproof caulking material. Pipe penetration arrangement and installation requirements shall match the applicable UL approved penetration assembly details.
18. Domestic hot water piping with operating temperatures of 140oF and less, shall be insulated with 1-inch thick fiberglass preformed pipe insulation with All Service Jacket (ASJ). Fittings shall be finished with PVC fitting covers.
19. Insulation thickness for domestic and service water systems operating in excess of 140oF, shall be 1-inch thick fiberglass preformed pipe insulation with All Service Jacket (ASJ) for piping 3/4" through 3" size and 1-1/2" thick for piping 4" and larger. Fittings shall be finished with PVC fitting covers.
20. Domestic cold water shall be insulated with 1-inch thick fiberglass preformed pipe insulation with All Services Jacket (ASJ). Fittings shall be finished with PVC fitting covers. Cold water piping installed within interior partitions, not less than 10 feet from an exterior wall, and where no return air is present, need not be insulated.
21. Domestic hot and cold water piping and P-traps exposed below handicapped lavatories and sinks shall be insulated with HANDI LAV-GUARD insulation kits which satisfy ANSI A117.1 requirements. Insulation shall have a flexible vinyl finish which protects against burning and cushions impact.
22. Plastic piping systems, including but not limited to polypropylene/CPVC, RO/DI piping, acid waste, vent piping and PVC piping, installed within building return air plenums shall be insulated with 1/2" thick fiberglass preformed pipe insulation with All Service Jacket (ASJ). Fittings shall be

insulated with preformed insulation fittings or, where preformed fittings are unavailable, neatly insulated with fiberglass duct wrap with white vinyl jacket.

Section 22 1100 Domestic Water Piping

1. Lead Ban: All systems and system components, pipe, fittings, and fixtures delivering water for human consumption shall be lead free.
2. Any product designed for dispensing potable water shall meet both the NSF 61 and NSF 372 test standards via third-party testing and certification.
3. Domestic water piping below grade or slab-on-grade shall be Type L soft copper, ASTM B88. Copper piping 2" and smaller shall be soft tubing and 2-1/2" thru 4" shall be either soft tubing or hard pipe. Domestic water piping 6" and larger below grade within the building and to a point approximately 5'-0" from the building shall be ductile iron pressure pipe, minimum 150 PSIG working pressure with mechanical joints. Wrap all underground copper pipe and fittings with minimum 20 mil polyethylene with minimum 50% overlay, provide for taping.
4. Domestic water piping above grade within the building 4" and smaller shall be Type L hard drawn copper, ASTM B88. Domestic water larger than 4" shall be copper as specified.
5. Proper insulating fittings, as specified in Section 22 0504, shall be installed to prevent electrolytic action between steel and copper piping connections.
6. Fittings for copper piping shall be wrought copper or cast brass conforming to ANSI B16.22 and B16.23, with 95-5 solder joints, as specified in Section 22 0504.
7. Flanges for copper piping systems shall be Class 150 wrought copper or cast brass conforming to ANSI B16.24.
8. Joints in copper piping system shall be made using approved "lead-free" solder and flux as described herein and approved by all applicable codes and regulations. Surfaces to be soldered shall be cleaned bright by manual or mechanical means. All joints shall be properly fluxed with a non-corrosive "lead-free" type flux manufactured to approved standards, Federal Specification QQ-S-517. Joints for copper piping systems for cold water 3" and smaller and hot water 2" and smaller shall be made using composition 95-5 tin-antimony solder. Composition 15% silver solder shall be used for all other piping sizes and for all underground joints.
9. Factory sealed shock absorbers conforming to Federal Specification WW-P-541 shall be provided at locations as outlined by Plumbing Drainage Institute Standard WH-201. Josam, Precision, Jay R. Smith, Wade, Watts, Zurn or equivalent.
10. Provide approved expansion tank on cold water make-up supply to hot water generating equipment as recommended by manufacturer or as shown on the drawings and specified in the plumbing equipment and fixture schedule on the drawings, Amtrol, Wilkins, or approved equal.
11. Valves other than automatic control valves are specified in Section 22 0523, Valves.
12. Domestic water pumps shall be as manufactured by Armstrong, Bell & Gossett, Taco, Thrush, or equivalent. All pumps for potable water applications shall have bronze or stainless steel body and trim.
13. All cross-contamination control shall be provided to ensure that no installation of the potable water supply piping system shall be made in a manner that will allow used, unclean, polluted, or contaminated water or substances to enter the domestic potable water system.
14. All backflow devices and assemblies shall be approved by the applicable Administration Authorities and shall be installed according to all applicable codes, regulations, and

manufacturer's instructions. Installation shall allow for required access and clearance for required testing, maintenance, and repair.

15. Reduced pressure backflow preventer assembly shall be furnished and installed by the Contractor. Backflow preventer size and arrangement shall be as indicated on the drawings, and shall be as manufactured by Febco, Hersey, Beeco, Watts, Wilkins, or equivalent.
16. Each water service main, branch main and branch to a group of two or more fixtures shall be valved. Stop valves shall be as specified under fixtures.
17. All plumbing fixtures, faucets with hose connections, and all other equipment having plumbing connections shall have their water supplies protected against back-siphonage.
18. The use of dielectric unions required when dissimilar metals occur.

Section 22 1123 Facility Natural Gas System

1. Above ground pipe used for the installation, extension, alteration, and/or repair of any gas piping system shall be black steel pipe ASTM A53 Grade A or B, ERW or BW, standard wall, Schedule 40.
2. All underground gas piping shall be steel or polyethylene plastic piping. All underground steel piping and fittings shall be protected from corrosion by approved coatings or wrapping materials.
3. Fittings for steel piping 2" and smaller shall be either screwed or welded. Screwed fittings shall be Class 150 standard black malleable iron conforming to ANSI B16.3. Weld fittings shall be either standard weight steel butt-weld fittings conforming to ANSI B16.9, or forged steel socket-weld fittings with a 2000 pound rating. Fittings must be Schedule 40.
4. Fittings for steel piping 2-1/2" and larger shall be standard weight steel butt-weld fittings conforming to ANSI B16.9.
5. Flanges for steel piping system shall be forged steel, weld neck, or slip-on, 1/16" raised face Class 150 flanges conforming to ANSI B16.5.
6. Flange connections for valves and equipment shall match the rating and drilling of the valves and equipment furnished.
7. Where specifically required by the application, black cast iron Class 125 standard threaded plain face companion flanges may be utilized for flanged connections in threaded piping systems.
8. Flange bolting shall be carbon steel machine bolts or studs and hex nuts, ASTM A307, Grade B.
9. Valves shall be as specified in Section 22 0523, Valves for Plumbing and shall be approved for the required service.
10. Gas meter shall be the type and capacity required for the application and shall be located in accordance with utility company requirements and applicable codes and ordinances.
11. All natural gas meters shall be preceded by a main gas supply shut-off valve serviceable and accessible outside the building.
12. Natural gas regulator shall be provided with the gas meter by the utility company, set for the required gas leaving pressure shown on the drawings.
13. Natural gas appliance and equipment regulators for all gas fired equipment shall be furnished by the equipment manufacturer or supplier and sized for the system inlet pressure and the required appliance operating pressure.
14. Natural gas piping installed on the building roof shall be supported by means of piping supports, especially designed to absorb thermal expansion and contraction of piping installed on built up and single ply membrane roofs. Wood blocks are not acceptable. Four inch and smaller gas piping shall be mounted on Erico Pyramid pipe supports or equivalent, pipe supports with a total weight not to exceed 100 pounds per pipe stand. Larger piping, and all piping requiring roller bearing action for pipe expansion, shall be mounted on Erico Pyramid RPS-H or equivalent, with a total weight not to exceed 1500 pounds per pipe collar support. Pipe support spacing shall be as

- recommended by manufacturer and as required by Code.
15. Piping hangers and supports shall be in accordance with Section 22 0504, Pipe and Pipe Fittings for Plumbing.
 16. All natural gas piping installed outside the building exposed to the weather and/or exposed to view shall be field painted.
 17. No gas piping shall be installed in or on the ground under any building or structure, and all exposed gas piping shall be at least 6-inches above grade. Ferrous gas piping installed underground in exterior locations shall be protected for corrosion as specified herein and in Section 22 0504, Pipe and Pipe Fittings for Plumbing.
 18. Gas piping supplying the building or facility shall be provided with a shut-off valve located outside the building and readily accessible. Where gas piping supplies multiple buildings or facilities, each building shall be provided with a shut-off valve as described herein.
 19. All gas fired equipment and appliances shall be connected to the gas piping system in an approved manner and shall be furnished with a shut-off valve installed ahead of the unit. Connections shall in no case be less than the unit inlet connection size and shall be rigidly connected, except as otherwise shown on the drawings and allowed by codes and regulations.
 20. Accessible capped drip pockets shall be furnished at low points in piping system, connections to appliances and equipment, and other locations where condensation may tend to collect.
 21. All gas regulators and other required devices installed within the building shall be vented to the outside of the building in accordance with manufacturer's requirements, codes, and regulations.

Section 22 1316 Sanitary Waste and Vent Piping

1. Soil, waste, and vent piping below slab on grade shall be service weight cast iron no hub [or bell and plain end] pipe, coated inside and outside, conforming to ASTM A-74 and 87 Standards, or polyvinyl chloride (PVC) sewer pipe, Schedule 40, conforming to ASTM D3034. Cast iron pipe and fittings shall be used on all waste piping subject to waste water temperatures that exceed 120 degrees F.
2. Soil, waste, and vent piping above grade shall be either service weight cast iron no hub pipe, coated inside and outside, conforming to ASTM A-74 and 87 standards. Vent piping 2" and smaller above grade may be Schedule 40 galvanized steel.
3. Acid resistant waste and vent piping shall be either Pyrex or Kimex glass piping system Schedule 40 polypropylene fire retardant piping system with heat fusion below slab or mechanical joints above slab, as manufactured by Enfield, GSR-FUS-SEAL or Orion, or acid resistant, close grain cast iron pipe containing not less than 14.25 percent silicon. Fittings for acid waste and vent piping systems shall be drainage pattern to match the required piping system.
4. Piping for pumped soil and waste systems from the discharge of the sump or sewage ejector pumps to the connection to the gravity flow drainage system shall be schedule 40 galvanized steel or Type L hard drawn copper pipe for above ground installation. When underground piping is required within the building and to point approximately 5'-0" from the building perimeter, the underground piping shall be coated cast iron or ductile iron pressure pipe and fittings with joints blocked, braced, and/or strapped in an approved manner to prevent joint separation under pressure.
5. Fittings for cast iron sanitary soil, waste and vent piping system shall be service weight or no-hub cast iron drainage pattern conforming to ASTM C564. Fittings shall be provided to match the required piping system.

6. Fittings for galvanized steel vent system shall be galvanized malleable iron conforming to ANSI B16.4. Fittings for galvanized steel soil and waste piping shall be galvanized drainage pattern.
7. Fittings for PVC piping system shall be Schedule 40 drainage pattern, solvent cement type conforming to ASTM B 2855 or elastomeric seal type conforming to ASTM D 3212.
8. Joints for cast iron pipe and fittings shall be suitable to match the required piping system and be double seal compression type molded neoprene gaskets conforming to ASTM C-564 Standards, and suitable for the class of pipe being jointed, with adhesive type joint lubricant, Tyler "LUBRI/FAST" or equivalent. No hub coupling shall be minimum four (4) band type with neoprene gasket material conforming to ASTM C-564, and 0.008-inch minimum, Type 304 stainless steel shear ring. Couplings shall be Tyler "Wide Body", Huskey Series 4000, Clamp-All, Mission Heavy Weight, Ideal, or equivalent.
9. Joints for acid resistant piping systems shall match the required piping system and shall be mechanical joint.
10. Joints for PVC piping system shall be either solvent cement type conforming to ASTM D 2855 or elastomeric seal type conforming to ASTM D 3212, except all joints above grade shall be solvent cement.
11. Equipment drain lines shall be either Schedule 40 galvanized steel pipe with galvanized malleable iron fittings or Type M copper tubing with wrought solder fittings. Equipment drain lines from pure and ultra pure applications shall be Schedule 40 PVC pipe and fittings. Provide a dielectric union at all connections between ferrous to copper materials.
12. Floor drains, floor sinks, and interceptors shall be Josam, Rockford, Jay R. Smith, Wade, Watts, Zurn, Mifab, or equivalent, as specified on the drawings, and compatible with the required piping systems.
13. Non water-based trap seal maintenance devices by SureSeal, and TrapGuard are approved.
14. Traps shall be copper-alloy adjustable tube type with slip joint inlet and swivel, not less than 20 gauge and without cleanout. Inlets shall have rubber washer and copper alloy nuts for slip joints above the discharge level and swivel joints below the discharge level, metal to metal or metal to plastic type as required for the application. Outlet shall be threaded or socket for solder joint connection as required by the application. Tailpiece shall be copper-alloy to match P-trap. Furnish cast brass wall escutcheon at waste penetration through walls. P-traps, tailpieces, escutcheon, and all piping for above floor exposed installations, including installation within cabinets and casework shall be chrome plated. Underground P-traps shall be coated cast iron or plastic as required by the application.
15. Grease interceptors of the sizes indicated shall be of reinforced concrete, or precast concrete construction with removable three-section, 3/8-inch checker-plate cover, and shall be installed outside the building. Interceptors shall be tested and rated in accordance with Plumbing and Drainage Institute PDI-G101. Concrete shall have 3,000 PSI minimum compressive strength at 28 days.
16. Acid neutralization and dilution sumps shall be constructed of high density polyethylene or other approved corrosion resistant materials conforming to ASTM D1248 suitable for operating temperatures to 180oF continuous service. Tanks shall be furnished with liquid and gas tight bolted flange top and with capacity, inlet, outlet, and vent connection of the size and arrangement in accordance with the details on the drawings. Sump shall be installed in a concrete pit with removable cover. Concrete shall have compressive strength of 3000 PSI minimum and shall be

furnished and installed in accordance with the applicable requirements contained in Division 3 of this specification. Sump and sump pit shall be installed [outside] in accessible locations, as indicated on the drawings. Furnish and install limestone chips of one inch to three inch diameter range and which have a calcium carbonate content in excess of 90%.

17. Sump and Sewage ejector pumping systems shall be submersible or vertical centrifugal type, electric driven, complete with all required safety and operating control systems, including magnetic starters, disconnects, hand-off-auto control switches, pilot lights, control transformers, relays, and interlocks installed within a NEMA approved system control panel. Furnish pump water level control float type switches, field adjusted to start and stop pumps at required operating water levels, and high limit water level alarm switch for connection to remote alarm indication. For duplex pumping system arrangement, furnish automatic alternator to sequence lead/lag pumps and to start second pump if flow exceeds the capacity of the first pump. Pumps for sewage service shall be capable of passing not less than a two (2) inch diameter sphere, and discharge piping shall not be less than 2 inch size. Pump discharge piping for each pump shall be installed above the floor for service and maintenance, and the discharge piping shall be provided with a union or flange connection, a non-clog check valve, and service shut-off valve located accessibly near the pumps. Sumps shall be fiberglass or coated steel encased in concrete with the capacity and arrangement shown on the drawings. Furnish bolted and gasketed gas tight cover with inlet, outlet, vent, and access manhole connections sized and arranged as indicated on the drawings. Aurora, Flygt, Hydro-Matic, Liberty, Weil or equivalent.
18. Cleanouts shall be as manufactured by Zurn, Jay R. Smith, Watts, Wade, or Josam, and shall be of the same size as the pipe, except that cleanout plugs larger than 4 inches will not be required. Cleanouts installed in connection with cast iron soil pipe shall consist of a long sweep, quarter bend or one or two eighth bends extended to an easily accessible place, or as indicated on the drawings. A standard cleanout fitting, Zurn No. ZN-1400-ZB, with polished bronze top shall be caulked into the hub of the fitting and finished flush with the floor. Heavy duty cleanouts shall be Zurn Z-1474, with integral anchor flanges. Where cleanouts in connection with threaded pipe are shown and are accessible, they shall be cast iron drainage T pattern, 90 degree branch fittings with square head brass screw plugs of the same size as the pipe up to and including 4 inches. Wall cleanouts in finished areas shall be Zurn No. Z 1460 8 with polished stainless steel or chrome plated metal cover.

Section 22 1400 Facility Roof and Area Drainage

1. Pipe, fittings and couplings below grade or slab on grade shall be service weight cast iron no hub pipe, coated inside and outside, conforming to ASTM A-74 and 87 Standards, or polyvinyl chloride (PVC) sewer pipe Schedule 40, conforming to ASTM D3034.
2. Pipe, fittings and couplings above slab on grade shall be either service weight cast iron no hub [or bell and plain end] pipe, coated inside and outside, conforming to ASTM A-74 and 87 Standards.
3. Piping for pumped roof and area drainage systems from the discharge of the sump pumps to the connection to the gravity flow drainage system shall be schedule 40 galvanized steel or Type L hard drawn copper pipe for above ground installation. When underground piping is required within the building and to a point approximately 5'-0" from the building perimeter, the underground piping shall be coated cast iron or ductile iron pressure pipe and fittings or PVC pipe

as specified in this section with joints blocked, braced, and/or strapped in an approved manner to prevent joint separation under pressure.

4. Fittings for cast iron pipe shall be service weight or no-hub cast iron drainage pattern, conforming to ASTM C564, coated for underground installation.
5. Fittings for PVC piping system shall be Schedule 40 drainage pattern, solvent cement type conforming to ASTM B 2855 or elastomeric seal type conforming to ASTM D 3212.
6. Joints for cast iron pipe and fittings shall be suitable to match the required piping system and shall be either lead and oakum, or double seal compression type molded neoprene gaskets conforming to ASTM C-564 Standards, and suitable for the class of pipe being jointed, with adhesive type joint lubricant, Tyler "LUBRI/FAST" or equivalent. No-hub couplings shall be minimum four (4) band type with neoprene gasket material, conforming to ASTM 564, and 0.008-inch minimum, Type 304 stainless steel shear ring. Couplings shall be Tyler "Wide Body," Husky Series 4000, Clamp-All, Mission Heavy Weight, Ideal, or equivalent.
7. Joints for PVC piping system shall be either solvent cement type conforming to ASTM D 2855 or elastomeric seal type conforming to ASTM D 3212, except all joints above grade shall be solvent cement.
8. Roof drains, overflow roof drains, and area drains shall be Froet, J. R. Smith, Josam, Mifab, Sioux Chief, Wade, Watts, Zurn, or equivalent as specified on the drawings and compatible with the required piping system. Drains shall be suitable for the required building construction system and shall be furnished complete with all extensions, receptors, flashings, and accessories required for the complete water proof installation.
9. Sump pumping systems shall be submersible or vertical centrifugal type, electric driven, complete with all required safety and operating control systems, including magnetic starters, disconnects, hand-off-auto control switches, pilot lights, control transformers, relays, and interlocks installed within a NEMA approved system control panel. Furnish pump water level control float type switches, field adjusted to start and stop pumps at required operating water levels, and high limit water level alarm switch for connection to remote alarm indication. For duplex pumping system arrangement, furnish automatic alternator to sequence lead/lag pumps and to start second pump if flow exceeds the capacity of the first pump. Pumps shall be capable of passing not less than a two (2) inch diameter sphere, and discharge piping shall not be less than 2 inch size. Pump discharge piping for each pump shall be installed above the floor for service and maintenance, and the discharge piping shall be provided with a union or flange connection, a non-clog check valve, and service shut-off valve located accessibly near the pumps. Sumps shall be fiberglass or coated steel encased in concrete with the capacity and arrangement shown on the drawings. Furnish bolted and gasketed gas tight cover with inlet, outlet, vent, and access manhole connections sized and arranged as indicated on the drawings. Aurora, Hydro-Matic, Peerless, Weil or equivalent.
10. Cleanouts shall be as manufactured by Froet, J. R. Smith, Josam, Mifab, Sioux Chief, Wade, Watts, Zurn, or equivalent, and shall be of the same size as the pipe, except that cleanout plugs larger than 4 inches will not be required. Cleanouts installed in connection with cast iron soil pipe shall consist of a long sweep, quarter bend or one or two eighth bends extended to an easily accessible place, or as indicated on the drawings. A standard cleanout fitting, Zurn No. ZN-1400-ZB, with polished bronze top shall be caulked into the hub of the fitting and finished flush with the floor. Heavy duty cleanouts shall be Zurn Z-1474, with integral anchor flanges. Where cleanouts in

connection with threaded pipe are shown and are accessible, they shall be cast iron drainage T pattern, 90 degree branch fittings with square head brass screw plugs of the same size as the pipe up to and including 4 inches. Wall cleanouts in finished areas shall be Zurn No. Z 1460 8 with polished stainless steel or chrome plated metal cover.

Section 22 1500 Compressed-Air Systems

1. Conform to ASME B31.9, Building Services Piping for systems operating at pressure of 150 psig or less and at temperature of 200°F or less. For systems beyond above pressure and temperature limitations, conform to ASME B31.1, Power Piping unless supplying process air; then use B31.3. The design codes and pressure(s) for this installation are as follows: B31.3; 150 psig.
2. COPPER TUBING AND FITTINGS (up to 2 inches)
 - a. Tubing: Copper, hard drawn or annealed, ASTM B88, Type L
 - b. Fittings: Wrought copper, ASME B16.22
 - c. Joints: Solder, ASTM B32, Alloy Sb5 tin-antimony
3. STEEL PIPE AND FITTINGS (over 2 inches)
 - a. Pipe: Black steel, ASTM A53, Schedule 40 Grade B
 - b. Fittings: Steel, ASTM A234, Grade WPB, Schedule 40, butt-welding type, ASME B16.9
 - c. Joints: Welded
4. Gate Valves: MSS SP-80 Class 150, bronze body, bronze trim, rising stem, handwheel, inside screw, solid wedge disc, solder ends to suit piping.
5. Ball Valves: MSS SP-110 Class 150, bronze, chrome-plated brass ball, full port, teflon seats and stuffing box ring, lever handle, solder or threaded ends to suit piping.
6. Globe Valve: MSS SP-80 Class 150, bronze body, bronze trim, solder or threaded ends to suit piping.
7. Swing Check Valve: MSS SP-80 Class 150, bronze body and cap, bronze swing disc with rubber seat, solder or threaded ends to suit piping.
8. "Y" type, Class 150, 20 mesh stainless steel perforated screen, bronze] cast iron body, with blowoff gate valve and plug, solder or threaded ends to suit piping.
9. Unions
 1. Ferrous Pipe: ASME B16.39, Class 150, malleable iron, threaded unions.
 2. Copper Tube and Pipe: ASME B16.22, Class 150, bronze unions with soldered joints.
10. Braided bronze or stainless steel flexible connector with corrugated metal hose, minimum working pressure 200 psi at 70 degree F, minimum temperature rating 400 degree F, with solder or threaded ends to suit piping. Manufacturer: Flex-Hose, Pumpsaver Connectors.
11. High-efficiency coalescing filter efficiency 99.99 percent at 0.6 microns, maximum oil carryover 0.008 ppm by weight, maximum inlet temperature 125 degrees F, maximum clean dry pressure drop 1.50 psid. Housing maximum working pressure 250 psig at 225 degrees F, furnish with optional two-sided color-coded pressure differential indicator, and without internal float drain. Pneumatics Products, Housing Series P2001, Filter Grade SU or equivalent
12. High-efficiency particulate filter efficiency 99.99 percent at 0.9 microns, maximum inlet temperature 150 degrees F, maximum clean dry pressure drop 1.50 psid. Housing maximum working pressure 250 psig at 225 degrees F, furnish with optional two-sided color-coded pressure differential indicator, and without internal float drain. Pneumatics Products, Housing Series P2001, Filter Grade AF or equivalent.

13. Automatic drain solenoid valve, brass body, NEMA 4 enclosure, rated at 300 psig, open time 1 to 60 seconds cycle time 1-60 minutes, 6 foot power cord with plug, maximum fluid temperature 210 degrees F, ambient temperature range 32 150 degrees F. Van Air, Model EDV-2002 or equivalent
14. Zero air loss drain valve, 1/2 inch NPT connections, pressure range 0-230 psi, temperature range 36 - 120 degree F, NEMA 4 enclosure, and Y-strainer. Operation, 50 volume checks/second. Zeks, Model NCC1701-D or equivalent.
15. Heatless, regenerative dryer, minus 40 degrees F pressure dew point, solid state controller, twin towers, with adsorbent desiccant, purge exhaust valve and muffler, drain connection and cycle saver control option that adjusts dryer purge to actual moisture load condition and includes failure to switch (FTS) alarm. Pneumatic Products, DHA Series or equivalent.
16. Refrigerated air dryer, air cooled condenser, 35 38 degrees F pressure dew point, indoor installation (ambient temperature 40 100 degrees F), automatic drain valve, and charged with R134a or R22 refrigerants. Hankison, Model HPR or equivalent.
17. Pressure Gauge ASME B40.100, Grade 1A, minimum 2 1/2 inch dial, 1/4 inch NPT brass bottom connection, maximum plus or minus 1 percent full scale accuracy, stainless steel case, phosphor bronze bourdon tube, and isolation valve. Manufacturer: Ashcroft, Type 1009 or equivalent.
18. Reduced pressure regulating valve, diaphragm operated, relieving spring adjustment mechanism, rated at 300 psig maximum, temperature range 40 120 degrees F. Watts, No. R119 Series or equivalent.
19. Air Receiver, carbon steel tank built and tested to ASME Section VIII, Division 1 Pressure Vessel Code, "U" stamped. Hanson Tank or equivalent.
20. Safety valve for air service, side outlet, full nozzle design, bronze body, brass and bronze trim, pressure range 15-250 psig, temperature range minus 60 to 406 degrees F, NPT ends, built and tested to ASME Section VIII, Division 1 Pressure Code, "UV" stamped. Kunkle Model 6010 or equivalent.

Section 22 4000 Plumbing Fixtures and Trim

1. Lead Ban: All systems and system components, pipe, fittings, and fixtures delivering water for human consumption shall be lead free.
2. Any product designed for dispensing potable water shall meet both the NSF 61 and NSF 372 test standards via third-party testing and certification.
3. Vitreous china and enameled cast iron fixtures by Sloan or approved equal as listed and described in the plumbing fixture schedule on the drawings. All vitreous china and enameled cast iron fixtures shall be white, unless otherwise indicated on the drawings. The material used for plumbing fixtures shall be of non absorptive, acid resistant vitreous china, enameled cast iron or stainless steel, and free from all imperfections. Lavatories and sinks required in patient care areas shall have the water spout mounted so that the discharge point is a minimum distance of 5" above the rim of the fixture. All fixtures used by medical and nursing staff and all lavatories used by patients shall be trimmed with valves which can be operated without the use of hands. Where blade handles are used for this purpose, they shall not exceed 4 1/2" in length except that handles on scrub sinks and clinical sinks shall be not less than 6" long. Clinical sinks shall have an integral trap in which the upper portion of a visible trap seal provides a water surface. Each water service main, branch main, riser and branch to a group of fixtures shall be valved or as otherwise shown

on the drawings to provide more stringent requirements. Stop valves shall be provided at each fixture. One piece chrome plated escutcheons shall be installed on all water piping and trap connections at walls or base cabinets. All exposed connecting piping and material shall be chrome plated.

4. Handicap accessible lavatories and counter mounted sinks shall have exposed supply and waste services insulated with rigid, molded insulation kits as manufactured by T.C.I. "Skal-Gard", Brocar "Trap Wrap", True-Bro "Handi Lav-Guard", McGuire "Prowrap", or equivalent. Provide off-set tail piece fittings on all handicap accessible laboratories and sinks as required.
5. Flush valves shall be low water consumption type as specified on drawings. Valves shall be diaphragm or piston type, with metal oscillating non-hold open handle, screw driver back check angle stop assembly with cap, adjustable tailpiece, vacuum breaker flush connection, and spud couplings as required for wall and fixture rough-in. Exposed flush valves shall be fully chrome plated, with chrome plated supply pipe cover. Electronic and battery operated flush valves shall be furnished with chrome plated metal cover. Flush valves shall be American Standard, Delany, Delta, Sloan Regal, Sloan Royal, Zurn, Toto, or equivalent.
6. Closet seats shall be furnished for water closets as specified on the Plumbing Fixture Schedule on the drawings. Closet seats shall be white unless otherwise required to match water closet. All closet seats shall be of smooth non-absorbent material and shall be properly sized for the water closet bowl type. All closet seats for fixtures for public use shall be open-front type without cover. Water closet seats provided for handicapped fixtures shall meet all handicapped requirements. Hinges, posts, nuts, and pintles shall be of a 300 series stainless steel construction. Water closet seats shall be furnished by the plumbing fixture manufacturer as specified on the Fixture Schedule on the drawings, or shall be as manufactured by Bemis, Beneke, Centoco, Church, Olsonite, Sperzel, or equivalent.
7. Floor mounted mop sinks and shower floors shall be as specified on the Plumbing Fixture Schedule on the drawings, molded stone or terrazzo, size and arrangement as shown on the drawings, as manufactured by Acorn, Centoco, Designer's Choice, Fiat, Mustee, Stern-Williams, Zurn, or equivalent. All mop sink faucets shall be equipped with inlet checkstops.
8. Stainless steel sinks shall be as specified on the Plumbing Fixture Schedule on the drawings and as manufactured by Kohler, American Standard, Elkay, Just, Advance Tabco, Moen, Intersan, or equivalent. Countertop sinks indicated within the Architectural drawings to be handicap-compliant shall have an off-centered drain opening and a maximum sink depth of 7-inches. All sink basins shall have a center-rear outlet unless noted otherwise.
9. Electric water coolers (EWC) and drinking fountains shall be as specified on the Plumbing Fixture Schedule on the drawings and as manufactured by Acorn Aqua, Elkay, Guardian, Halsey, Haws, Murdock, Oasis, Sunroc, Taylor or equivalent.
10. Hose bibbs and wall hydrants shall be as specified on the Plumbing Fixture Schedule on the drawings and as manufactured by Zurn, Jay R. Smith, Wade, Woodford, Acorn, Chicago, T&S Brass, Watts, Prier, or equivalent. Handles, if specified shall be constructed of metal or brass and finished to match valve unit.
11. Shower valves and mixing valves shall be as specified on the Plumbing Fixture Schedule on the drawings, and as manufactured by Powers, Leonard, Lawler, Speakman, Symmons, Bradley, or equivalent.

12. Emergency fixtures including showers and eyewash shall be as specified on the Plumbing Fixture Schedule on the drawing and as manufactured by Bradley, Chicago, Haws, Speakman, Western, Guardian, Acorn Safety, or equivalent.
13. Plumbing fixture faucets shall be brass construction and fully chrome plated, unless special finish is specified on the Plumbing Fixture Schedule on the drawings. Faucets shall be furnished complete with all accessories required for the necessary application, including aerators, handles, spouts, and operating cartridges. Contractor shall coordinate exact faucet requirements with required fixture drilling and water and waste rough-in. Faucets for handicapped fixtures shall meet all handicapped and ADA requirements, including a maximum of five (5) pounds of force to activate controls and adjustable metering faucet water flow duration of ten (10) seconds, minimum. Single hole faucets shall have anti-clocking pin to prevent rotation of valve body.
14. Plumbing fixture faucets shall be furnished by the fixture manufacturer as specified in the Plumbing Fixture Specification on the drawings and Paragraph 2.1 herein, or shall be as manufactured by Chicago, Delta, Moen, Speakman, T&S Brass, Zurn, or equivalent, and shall be commercial grade.
15. Plumbing fixture trim including P-traps, supplies, and strainers shall be furnished by the fixture manufacturer as specified in the Plumbing Fixture Specification on the drawings and Paragraph 2.1 herein, or shall be as furnished by Chicago, Brass Craft, McGuire, T&S Brass, EBC, Zurn, or equivalent.
16. Traps shall be copper-alloy adjustable tube-type with slip joint inlet and swivel, not less than 20 gauge and without cleanout. Inlets shall have rubber washer and copper alloy nuts for slip joints above the discharge level and swivel joints below the discharge level, metal-to-metal or metal-to-plastic type as required for the application. Outlet shall be threaded or socket for solder joint connection as required by the application. Tailpiece shall be copper-alloy, offset style, to match P-trap. Furnish brass or copper wall escutcheon at waste penetration through walls. P-traps, tailpieces, escutcheon, and all piping for above floor exposed installations, including installation within cabinets and casework shall be chrome plated.
17. Fixture supplies, strainers, and trim shall be brass construction. Supplies shall be commercial grade, quarter-turn all brass ball valves, plastic stems and handles are not acceptable. Furnish supply with loose key unless otherwise specified. Supply pipe shall be 3/8" O.D., with smooth (non-corrugated) flexible copper riser and wall escutcheon. Supply assembly shall be completely chrome plated for all exposed installations, including installation within cabinets and casework. Strainers and other miscellaneous fixture trim shall be furnished as required for the proper installation and shall be chrome plated to match faucets, unless special finish is required.
18. Fixture mounting height shall conform to the ADA Accessibility Requirements
19. Fixture carriers shall be provided for all wall hung plumbing fixtures, including water closets, urinals, lavatories, sinks, etc., as manufactured by Josam, Jay R. Smith, Watts, Wade, Zurn, MiFab, or equivalent. Carriers shall be bolted to the floor using all of the support bolts recommended by the manufacturer. Where the water closet nipple and studs extend beyond the maximum carrier recommended length, provide additional carrier support as recommended by manufacturer. Water closet carriers shall be horizontal or vertical, single or back-to-back units as required for the fixture installation and piping arrangement, and shall be adjustable.
20. Single water closet carriers shall have factory installed rear hold down lugs and anchor foot to provide cantilever support.

21. Wall hung urinals shall be provided with floor mounted fixture carrier complete with upper and lower fixture support plates as required to match fixture installation requirements.
22. Wall hung lavatories and sinks shall be provided with floor mounted concealed arm type chair carriers, single or double (back-to-back) units as required for the fixture installation and arrangement.

Section 23 0500 Common Work Results for Mechanical

1. Adopted Codes listed here:
 - 2012 International Building Code
 - 2012 International Plumbing Code
 - 2012 International Mechanical Code
 - National Electrical Manufacturer's Association
 - National Electrical Code
 - Underwriters Laboratories
 - American National Standards Institute
 - American Society for Testing Materials
 - Local utility companies
 - National Fire Protection Association
 - ASME Boiler and Pressure Vessel Codes
 - Occupational Safety and Health Administration
 - American Society of Heating Refrigeration and Air Conditioning Engineers
 - Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)
 - American Society of Sanitary Engineering
 - American Gas Association
2. Coordination Drawings shall be provided prior to start of construction.
3. All specified equipment shall be rated for the altitude of the project.
4. All equipment and materials shall be listed and labeled by a nationally recognized laboratory (NRTL).
5. All ground mounted equipment shall be provided with a minimum 4" high concrete housekeeping pad.
6. All motors shall be premium efficiency type, with nominal efficiencies not less than the following as per the Consortium on Energy Efficiency (CEE), and minimum power factor of 0.85.
7. VFD's shall be factory fabricated, variable voltage and frequency type for driving the specified AC motor in a typical HVAC variable torque application, listed per UL-508, and rated for installation within a return air plenum. Performance specified here is based on driving a 4-pole NEMA B induction motor. Select and size VFDs so they are compatible to drive motors with characteristics as indicated on the drawings. VFDs shall be ABB no exceptions..

Section 23 0504 Pipe and Pipe Fittings

1. Pipe couplings and fittings as manufactured by Victaulic, Tyco-Grinnell, or equivalent may be utilized for steel piping systems in lieu of butt weld fittings as approved.

2. Pipe fittings for copper piping system shall be wrought copper conforming to ANSI B16.22. Cast brass fittings conforming to ANSI B16.23, may be utilized for sanitary drainage, waste and vent systems, HVAC gravity condensate drainage system, and other non pressure applications.
3. Bronze flanges, Class 125 and Class 150, shall conform to ANSI B16.24.
4. Cast iron fittings for cast iron sanitary soil, waste, and venting piping systems shall be as specified in Division 22.
5. Where uncovered, exposed pipes pass through finished floors, finished walls, or finished ceilings, they shall be fitted with chromium plated spun brass escutcheon plates. Plates shall be large enough to completely close the hole around the pipe, and shall be not less than 1 1/2" or more than 2 1/2" larger than the diameter of the pipes. All plates shall be securely held in place.
6. Piping 2 1/2" and larger shall be provided with bolted flange union connections. Weld flanges and bolting shall conform to ANSI B16.5. Bronze flanges shall conform to ANSI B16.24. Flange class shall be as specified in the applicable Sections of the Specifications.
7. Malleable iron grooved joint unions with brass to iron seats, Class 125, 250, or 300, as required by the application and compatibility requirements with the piping system fitting classification, conforming to MSS SP 77 and ANSI B16.39, shall be provided in piping systems 2" and smaller. Copper unions conforming to ANSI B16.22 shall be provided in copper piping systems. Union connections shall be installed at all coils, control valves, equipment connections, and as required for proper system operation and maintenance.
8. Dielectric insulating fittings shall be provided to connect dissimilar metals, such as copper tubing to ferrous metal pipe. Connections 2" and smaller shall be threaded dielectric union conforming to ANSI B16.39. Connections 2 1/2" and larger shall be flange union with dielectric gasket and bolt sleeves, conforming to ANSI B16.42.
9. All piping shall be rigidly supported from the building structure by means of hanger assemblies properly selected and sized for the application in accordance with the manufacturer's recommendations and specifications. Pipe hangers shall be Grinnell, B-Line, Erico, or equivalent.
10. Vertical piping shall be supported at each floor level by means of riser clamps, Grinnell Fig. 261 and Fig. G-121, Erico, copper clad for copper piping systems, or equivalent.
11. Pipe sleeves in concrete and masonry construction, footings and beams shall be Schedule 40 black steel pipe through 10", standard wall thickness for sizes 12" and larger, ASTM A 53, A 106, or A 120.
12. Pipe sleeves in gypsum board construction shall be galvanized steel metal, minimum 24 gauge; round tube closed with welded longitudinal joint and flanges on both sides.
13. Screwed Joints: Shall have American Taper pipe threads. Ream pipe ends and remove burrs after threading. Make up joints using Teflon tape or other approved compound applied to the male threads only.
14. Solder Joints: Joints for sweated fittings shall be made with a non-corrosive paste flux and solid 95 5 tin antimony wire solder, unless otherwise specified. Cored solder will not be permitted. 50/50 lead solder shall not be permitted for any applications.
15. Welded Joints: On black steel piping 2-1/2" and above in size, the joints may be welded. Welding shall be done using either gas or electric welding equipment.

16. Flanged Joints: Flanged joints shall conform to the American Standard for cast iron flanged pipe fittings, Class 125, 150 or 300 as specified in the applicable Sections of these specifications. Gaskets shall be full face or ring type, non asbestos, suitable for the service on which used.
17. All piping connecting to pumps and other equipment whether connected utilizing flexible connectors or with solid pipe connectors, shall be installed without strain at the pipe connection of the equipment.
18. Underground steel pipe shall be wrapped with "Scotchwrap" No. 50 tape or equivalent, to give not less than two complete layers on the entire underground piping system, or piping shall have X Tru Coat factory applied plastic protective covering.

Section 23 0505 Piping Specialties

1. Strainers suitable for the application shall be located on the high pressure side of pressure reducing valves, pressure regulating valves, suction side of pumps, inlet of indicating and control instruments and equipment subject to sediment damage, and as shown on the drawings. Every strainer shall be provided with a blow off connection not less than 1/2" NPT and provided with a ball valve the full size of the strainer outlet tapping. Strainers located outside of mechanical equipment rooms and above ceilings shall be provided with hose connection and cap on the outlet of the blowoff valve. Strainers shall be Spirax Sarco, Armstrong, Febco, Grinnell, Hoffman, Keckley, Metraflex, Mueller, Yarway, or equivalent.
2. Suction diffuser may be used at pump inlets in lieu of a strainer.
3. Pressure gauges shall be 5-inch glycerin filled, SS case, 1.5% accuracy, dual scale (PSI & KPA), bronze bourdon tube and 0.25-inch NPT connection, brass snubber with properly selected filter disc for the application, and needle valve with knurled brass or ABS plastic handle. Provide multiple ball valves where a single pressure gauge is used to measure pressure at multiple points. Provide siphon for steam gauges. Winters, Weiss, Marshalltown, Ashcroft, Terice, Weksler, or equivalent.
4. Thermometers and thermometer valves shall be installed where appropriate and, either liquid filled or digital type, vari-angle, 3-1/2" stem for pipe sizes through 6" and 6" stem for pipe sizes 8" and larger, dual scale (degrees F & C), separable brass socket, extension neck where installed in insulated piping, and accuracy 1% of range. Winters, Weiss, Moeller, Terice, Weksler, Duro, or equivalent.
5. Manual air vents shall be provided at the high point of all liquid piping system and as otherwise required for proper air elimination and liquid circulation.
6. Provide automatic air vents for all separators, at the high point of all hydronic systems and at locations indicated on the drawings. Automatic air vents shall be 3/4" size, minimum. Provide manual shut off ball valve between automatic air vent and piping system. Automatic air vents shall be float type, 150 PSIG maximum working pressure, 3/4" NPT system connection, Amtrol Model No. 720, Taco, Armstrong, Watson-McDaniel, Hofmann, or equivalent.
7. Provide manual drain valves at the low points of all liquid piping systems, and as otherwise required for proper draining of systems. Manual drain valves shall be not less than 3/4" size, brass ball valve. Pipe discharge from drain valves to floor drain, floor sink, or as otherwise directed for indirect discharge into sanitary sewer system. For drain valves located above ceiling

or in location outside mechanical equipment areas provide brass hose connection and cap for valve discharge.

8. Temperature and pressure test plugs shall be 0.25 or 0.5-inch NPT with brass body, EPDM core, and brass gasketed cap. Winters, Peterson, or approved equal. Supply one pressure/temperature test kit with two 4" Duro #105 pressure gauges of 1% accuracy and ranges as required by application; and two 2" Tel Tru #39R Bi metal thermometers with 8" stem, 1% accuracy, and ranges as required by the applications; and a protective carrying case.
9. Calibrated balance valves shall be equivalent to Bell and Gossett "circuit setter," Griswold, Taco, Armstrong, or equivalent at locations indicated on the drawings. Flow balance valves shall be not less than full line size with maximum pressure drop of 10 feet.
10. Pipe anchors shall be arranged as shown on the drawings and as required to properly control/piping system expansion and contraction in conjunction with system flexibility due to off sets, bends, and loops and expansion joints and compensators.
11. Expansion Joints shall be corrugated bellows expansion joint, Hyspan Series 1500, Metra-Flex, Keflex, Proco, Flexonics, or equivalent, self-equalizing, for the appropriate working pressure. Furnish limit rods to prevent expansion joint from exceeding rated travel.
12. Expansion compensators, shall be Hyspan series 8500, Metra-Flex, Keflex, Proco, Flexonics, or equivalent, stainless steel laminated bellows with stainless steel or carbon steel shroud, 175 PSIG pressure rating at 250oF, 2 inch straight line expansion and 1/2 inch contraction. .
13. Steel pipe alignment guides shall be, Hyspan Series 9500, Metra-Flex, Keflex, Proco, Flexonics, or equivalent, to maintain the longitudinal position of pipe centerline between expansion joints and compensators with axial restraint.
14. Pipe anchors shall be constructed of welded steel and detailed on the drawings.

Section 23 0523 Valves

1. All Gate, Globe, Check, Ball valves shall be manufactured by Milwaukee, Nibco, Apollo, Stockham, Powell, Crane, Tyco-Grinnell, or equivalent.
2. All lubricated plug valves shall be as manufactured by Rockwell, Walworth, Homestead, or equivalent.
3. Butterfly valves shall be as manufactured by Milwaukee, W. C. Norris, Centerline, Crane, Demco, Keystone, Tyco-Grinnell, Victaulic, Nibco, or Dezurik, or equivalent. Butterfly valves may be used for closed circuit chilled water, heating hot water (200oF maximum) run-around coil and heat pump circulating water systems and for condensing water systems. Butterfly valves shall not be used for domestic water or other non-specified service. Valves greater than 4" shall have gear operators.
4. Ball valves shall be utilized in lieu of gate valves and globe valves for all HVAC and plumbing systems for sizes 2" and smaller.
5. Provide chain operators for valves 4" and larger installed within mechanical equipment spaces where valves center line is more than 8 feet above the floor or operating platform.
6. Check valves for pump discharge and other required non-slam silent operation, shall be center guided, suitable for vertical or horizontal installation position, cast iron in semi-steel body,

bronze disc and trim, stainless steel spring, Buna-N seats. Milwaukee 1400 Series (wafer) or equivalent. Milwaukee 1800 Series (globe) or equivalent.

7. Isolation valves shall be installed to isolate all equipment, at points of future connection and at all branch piping serving more than one piece of equipment. Isolation valves shall be installed on the system side of any control valve to facilitate service of chillers, boilers, and water coils.

Section 23 0548 Vibration and Seismic Controls for HVAC

1. All mechanical systems shall be designed to be restrained for Seismic events in accordance with local Codes.
2. All mechanical equipment and systems shall be isolated from the building structure in accordance with ASHRAE standards for vibration isolation.

Section 23 0593 Testing, Adjusting and Balancing of Mechanical Systems

1. Testing and balancing shall be specified to be provided for all projects, including all airside and water side systems.

Section 23 0700 Insulation of Mechanical Systems

1. All piping and ductwork shall be insulated in accordance with the 2012 International Energy Conservation Code.

Section 23 2113 Heating Hot Water System

1. Hot water heating piping shall be black steel pipe A53 grade A or B, seamless ERW or BW, standard wall Schedule 40 through 10" diameter.
2. Type L hard drawn copper tubing, ASTM B88 may be used for hot water piping sizes 2" and smaller.
3. Fittings for steel piping, 2" and smaller, shall be either screwed or welded.
4. Fittings for steel piping, 2-1/2" and larger shall be standard weight steel butt-welding fittings, conforming to ANSI B16.9.
5. Fittings for copper piping shall be wrought copper conforming to ANSI B16.22, with 95-5 solder joints.
6. Flanges for steel piping system shall be forged steel, weld neck or slip-on, 1/16" raised face flanges conforming to ANSI B16.5.
7. Boilers shall be Lochinvar, Raypak or approved equal.

Section 23 2114 Chilled Water System

1. Chilled water piping shall be black steel pipe ASTM A120 or A53 grade A or B, ERW or BW, standard wall Schedule 40 through 10" diameter.
2. Type L hard drawn copper tubing, ASTM B88 may be used for chilled water piping sizes 2" and smaller.
3. Fittings for steel piping, 2" and smaller, shall be either screwed or welded.
4. Fittings for steel piping, 2 1/2" and larger shall be standard weight steel butt welding fittings, conforming to ANSI B16.

5. Fittings for copper piping shall be wrought copper conforming to ANSI B16.22, with 95-5 solder joint.
6. Flanges for steel piping system shall be forged steel, weld neck or slip on, 1/16" raised face flanges conforming to ANSI B16.5.
7. Chillers shall have differential pressure sensors across both evaporator and condenser barrels and be connected to the building BACnet EMS control system.

Section 23 2115 Condensing Water System

1. Condenser water piping shall be black steel pipe ASTM A120 or A53 Grade A or B, ERW or BW, standard wall Schedule 40 through 10" diameter.
2. Type L hard drawn copper tubing, ASTM B88 may be used for condenser water piping sizes 2" and smaller.
3. Fittings for steel piping, 2" and smaller, shall be either screwed or welded.
4. Fittings for steel piping, 2-1/2" and larger shall be standard weight steel butt-welding fittings.
5. Fittings for copper piping shall be wrought copper conforming to ANSI B16.22, with 95-5 solder joints.
6. Flanges for steel piping system shall be forged steel, weld neck or slip-on, 1/16" raised face flanges conforming to ANSI B16.5.

Section 23 2123 Pumps

1. Pumps shall have differential pressure sensors across both pump inlet and outlet and be connected to the building BACnet EMS control system.

Section 23 2213 Steam and Condensate System and Equipment

1. Steam piping, steam safety valve relief piping, steam and condensate vent piping, and drain piping for boiler and boiler accessories shall be black steel pipe, ASTM A53 or A106, grade A or B, seamless, or ERW standard wall schedule, through 10" diameter.
2. Boiler feed water piping, boiler blow-off piping, and pump recirculating lines shall be black steel pipe, ASTM A53 or A106, grade A or B, seamless or ERW, extra strong wall, Schedule 80, through 8" diameter. Piping larger than 8" shall have 1/2" wall thickness.
3. Condensate piping, including all gravity, and pump return piping shall be black steel pipe, ASTM A120, A53, or A106, Grade A or B, seamless, ERW, or continuous weld, as applicable, extra strong wall Schedule 80, through 8" diameter. Piping larger than 8" shall have 1/2" wall thickness.
4. Steam, low pressure (15 PSIG and below), steam safety relief valve piping, steam and condensate vent piping and drain piping: Fittings for steel piping 2" and smaller shall be either screwed or welded. Fittings for steel piping 2-1/2" and larger shall be welded.
5. Steam, high pressure (above 15 PSIG to 150 PSIG maximum): Fittings for steel piping 2" and smaller shall be either screwed or welded. Fittings for steel piping 2-1/2" and larger shall be welded.
6. Condensate piping, boiler feed water piping, boiler blow-off piping, and pump re-circulating lines: Fittings for steel piping 2" and smaller shall be either screwed or welded.

7. Fittings for boiler blow-off piping shall be Schedule 40 butt weld with all ells long radius and wye-form laterals in lieu of tees.
8. Piping furnished as a part of equipment packages include boiler burner piping and fuel trains and deaeration feed water, make-up water, and steam supply piping may be manufacturer's standard materials and assembly. Burner system piping shall comply with ANSI B31.1 for the actual operating conditions.
9. Flanges for steel piping system shall be forged steel, weld neck or slip-on, 1/16" raised face Class 150 or Class 300 flanges conforming to ANSI B16.5 to match equipment, fitting, and valve connection requirements.
10. Provide steam traps at condensate discharge of all steam fire equipment including convector, humidifiers, hot water generators, converters, heating coils, and other steam condensing equipment including sterilizer, laundry, and kitchen equipment furnished under other Sections of this Specification or furnished by the Owner. In addition, furnish steam traps at end of mains, boiler headers, pressure reducing valve stations, at steam piping system low points, and at not more than 300-foot intervals on steam mains.
11. Steam traps for steam fired equipment operating at steam pressure of 30 psig and below shall be float and thermostatic type. Unless otherwise indicated, the flow capacity of traps shall be based on two times the maximum steam condensing rate for the equipment. For equipment with modulating control valves, trap selection shall be at 1/4 psi pressure differential across the trap based on the inlet of the trap being 12 inches below the condensate outlet on the equipment. Condensate from equipment with modulating control valves shall not be lifted but shall flow by gravity to the return receiver.
12. Steam traps on steam drip lines and equipment applications with steam operating pressure in excess of 30 psig shall be inverted bucket type with bi-metallic thermal element for air removal and working pressure range suitable for maximum line pressure. Unless otherwise indicated, end-of-main drip traps and traps at low points shall be sized for 200 pounds per hour with trap differential at approximately 70 percent of line operating pressure. In these applications, if necessary due to piping arrangement, condensate may be lifted to gravity return line except for equipment with modulating control valves.
13. Steam trap bodies shall be constructed of bronze, cast iron, or semi-steel, designed for ease of removal and servicing working parts without disturbing connection piping, 125 psig working pressure.
14. Steam traps shall be Armstrong, Sarco, Watson-McDaniel, Clark-Reliance, or equivalent.
15. Steam pressure reducing valves shall be McAlear, Spence, Fishers, or equivalent.
16. Provide ASME labeled and National Board stamped steam safety relief valves at the discharge of all steam pressure reducing valves and stations, where required to protect system and equipment for overpressure conditions, on all steam boilers and generators, and other locations as shown on the Drawings. Safety valves shall be properly sized to relieve the full capacity of the equipment, pressure reducing valve, or piping system and shall comply with ASME Boiler and Pressure Vessel Code, Chapter 8. Safety valve capacities shall be certified by National Board with maximum accumulation of 10 percent. Outlet from safety valves shall be discharged safely in an approved manner outside the building. Safety valves shall be installed vertically. Inlet and

outlet shall be a minimum size equal to the valve connection. No shut-off valve shall be installed in inlet or outlet piping. A drip pan elbow, equal to Kunkle Figure 299, or equivalent, shall be furnished and installed. Safety valve setting shall be 10 psig or 20 percent above equipment or system operating pressure, whichever is greater, unless otherwise shown on the Drawings. Steam safety relief valves shall be as manufactured by Kunkle, Keckley, Jordan, Hoffman, or equivalent.

17. Flash tanks shall be Webe-Jarco, Industrial Steam, Kewanee, Clever-Brooks, or equivalent.
18. Steam blow-down tanks shall be Webe-Jarco, Industrial Steam, Kewanee, Clever-Brooks, or equivalent.
19. Boiler steam system isolation valves, including stop-check valve, shall be provided in accordance with ASME code for power boilers.
20. Boiler stop-check valves shall be provided in accordance with ASME Boiler and Pressure Vessel Code. Steam boilers shall be furnished with properly sized boiler stop-check valve angle or straight Y-pattern, equivalent to Crane No. 28E or 30E, 250 PSIG saturated steam working pressure, 450o F maximum temperature, ferro-steel body, OS & Y, bolted bonnet, renewable seat and disc, flanged connection. All sizing calculations shall accompany submittal for approval.
21. Boiler blow-down valves shall be designed to meet requirements of ASME Power Boiler Code, Section 1, Class 250 construction, ASTM A126, Class B cast iron body, flanged connections, seatless, sliding plunger or sliding disc type. Each boiler blowdown line shall be provided with one-slow opening valve and one quick-opening valve. Where boiler is provided with multiple blow-down connections, a single master slow-opening blow-down valve may be provided on the common blow-down line from the boiler and quick-opening blow-down valves provided on each individual blow-down line, in lieu of a slow-opening and quick-opening blow-down valve for each individual blow-down line. Quick opening valves shall be installed closest to the boiler blow-down connection.
22. Slow-opening blow-down valve shall be seatless, sliding plunger type with hard wheel operator, angle or straight-way pattern as required by the installation. Yarway Figure No. 3482-R (angle), or equivalent. Yarway Figure No. 3484-R (straight), or equivalent.
23. Quick opening blow-down valve shall be double tightening, level operated, flat seat, sliding disc type with spring loaded seal sealing bushing. Yarway Figure No. 3746 (1-1/4" through 2" size), or equivalent. Yarway Figure No. 3748 (2-1/2" size), or equivalent.
24. Piping support practices and recommendations by ASME B-31, Code for Pressure Piping, and MSS, Manufacturers' Standardization Society shall be adhered to.

Section 23 2313 Refrigerant Piping System and Equipment

1. Provide refrigerant piping using Type "L" hard drawn copper tubing and Federal Specification WW-T-749, with silver solder joint.
2. Expansion valves shall be of the thermostatic type as manufactured by Alco, Sporlan, or equivalent, and shall be gas charged with capillary tube, external superheat adjustment and external equalizing connection.

3. Solenoid valves shall be suitable for the system in which they are used and shall be designed specifically for use with Freon refrigerants. Solenoid valves shall be furnished with the packaged reciprocating unit.
4. Refrigerant line valves shall be packless type or packed type with gas tight cap seal with wheel, globe, angle, or "T" needle type, with hard metal seats and shoulders on stems to permit packing stuffing boxes while open under pressure, or sealed diaphragm type.
5. In each liquid line, install a suitable filter and desiccant dryer, Sporlan catch-all filter drier .

Section 23 3000 Air Tempering System and Equipment

1. Ductwork shall be constructed as indicated by current SMACNA standards
2. Flexible Ducts shall be factory fabricated, listed as a Class 1 Air Duct per UL 181 with aluminum foil interior liner, corrosion resistant helix mechanically locked to fabric to ensure dimensional stability, helix separated from air stream. Flexmaster Type 3, Technaflex 57K, OAE.
3. Dampers shall be factory fabricated, suitable for use with air at -20 to +240oF, galvanized steel housing and blades and rated for indicated pressures in either direction and performance rated per AMCA-500, as manufactured by Ruskin or equivalent.
4. Flexible connectors shall be heavy fiberglass cloth; coated to be air tight, water tight, fire retardant; suitable for temperatures of -20 to +200o F; rated for 10 in. wg positive or negative; with tensile strength minimum 450 lb/inch in the warp and 340 lb/inch in the filling.
5. Duct and Plenum Access Doors: Galvanized steel, gasketed. Size as required to properly inspect and service components located within the ductwork as manufacturered by Ruskin, Acudoor, or Ductmate.
6. Provide turning vanes for all rectangular elbows. Aero/Dyne Co. Model HEP, Airsan, Elgen, or equivalent.
7. Provide roof curbs and equipment support rails for all rooftop equipment. Dog houses are not allowed.
8. Louvers shall be 4-inch extruded 6063-T5 aluminum alloy frame and blades with flange, mill finish, and 1/2-inch galvanized steel bird screen. Ruskin ELF375DX OAE.
9. Barometric pressure balance dampers shall be as manufactured by Air Balance, Inc. units with adjustable counter weight, aluminum air foil design blades, nylon bearings.
10. Flue vents shall be factory built, UL listed and of the type specified for the specific requirements of the gas fired equipment.
11. Fire and smoke control dampers shall be factory assembled and UL listed as an assembly, suitable for horizontal or vertical air flow and for ducted or un-ducted applications. Fire dampers (FDs) shall be listed per UL 555, smoke dampers (SMDs) shall be listed per UL 555S, and fire/smoke dampers (FSDs) shall be listed per UL 555 and UL 555S. Units shall be galvanized steel except as noted. Approved manufacturers: Greenheck, Ruskin, Potorff, or approved equal.
12. Filters shall be rated per ASHRAE Std. 52.1; Class 1 or 2 per UL Std. 900; glass fiber media; suitable for operation from -20o F to +170o F; corrosion resistant; suitable for installation with pleats either horizontal or vertical, and for air flow horizontal, vertical upflow, or vertical downflow; suitable for face velocity up to 625 FPM. Unless specified elsewhere, pre-filters shall

be MERV-7, and final filters (where specified) shall be MERV-14. AAF, Camfil Farr, or approved equal.

13. Provide a filter gauge for each bank of filters. Gauges shall be magnehelic type with static pressure taps and inter-connecting piping. Ranges shall be 0-1 inch w.g. for all filters except bag filters which shall have a range of 0-2 inches w.g.
14. Grilles, diffusers and registers shall be performance rated per ASHRAE Std 70, Method of Testing for Rating the Performance of Air Outlets and Inlets, steel with baked white enamel finish except as noted, for installation on a fixed surface or a lay-in T-bar ceiling as indicated on architectural drawings, rigidly constructed, vibration free, with inlet collar of sufficient length to connect inlet ductwork, sized as shown on drawings. Where frames are provided for installation in fixed surfaces, frames shall be approximately 1-1/8" wide. Sound performance rated per ADC and based on room absorption of 10dBre10-12 Watts and one diffuser. As manufactured by Price, Krueger, Titus, Anemostat.
15. Air Handling Units shall be Temptrol or approved equal.

DIVISION 26 ELECTRICAL

Section 26 0500 Common Work Results for Electrical

1. Adopted Codes listed here
 - ADOA furnished criteria and guidelines.
 - Americans with Disabilities Act of 1990 (ADA)
 - Department of Energy (DOE) Regulations
 - Energy Efficiency & Renewable Energy (EERE)
 - Energy Star
 - Arizona Energy Code/ASHRAE 90.1 2013 Edition as applicable.
 - IEEE STD 143-1992-Grounding of Industrial and Commercial Power Systems
 - Illumination Engineering Society of North America (IESNA) Handbook – 9th Edition
 - International Building Code (IBC – 2012 Edition)
 - International Fire Code (IFC – 2012 Edition)
 - NFPA 70 – National Electric Code (2011 edition)
 - NFPA 72 – National Fire Alarm Code
 - NFPA 101 – Life Safety Code
 - NFPA 780 – Lightning Protection Systems
 - State of Arizona Fire Code (Latest Edition)
 - 2010 AIA Healthcare guidelines
2. Load analysis to be performed to determine adequacy of distribution equipment and feeders.
3. Blue stake required for all underground excavation.
4. “Provide” means furnish, install, connect and test unless otherwise noted.
5. Contractor shall provide coordination drawings prior to start of construction.
6. All specified equipment shall be rated for the altitude of the project.
7. All equipment and materials shall be listed and labeled by a nationally recognized laboratory (NRTL).
8. All ground mounted equipment shall be provided with a minimum 4” high concrete housekeeping pad.

Section 26 0502 Electrical Demolition

1. Beginning of demolition means Contractor accepts existing conditions.
2. Disconnect and remove electrical systems in walls, floors, and ceilings scheduled for removal in their entirety. Conduit located in concrete shall be cut flush, capped, and sealed. Label as “abandoned.”
3. Provide temporary wiring and connections to maintain existing systems in service during construction.
4. Existing electrical services: Maintain existing system in service until new system is complete and ready for service. Disable system only to make switch overs and connections.

5. Obtain permission from the Owner's Representative at least **72** hours before partially or completely disabling any system.
6. Panelboards: Clean exposed surfaces and check tightness of electrical connections. Replace damaged circuit breakers and provide closure plates for vacant positions. Provide typed circuit directory showing revised circuiting arrangement.
7. Luminaries: Remove existing luminaries for cleaning, as indicated on drawings. Use mild detergent to clean all exterior and interior surfaces; rinse with clean water and wipe dry. Replace lamps, ballasts and broken electrical parts.
8. Materials and equipment to be salvaged: Remove, demount, and disconnect existing electrical materials and equipment indicated to be removed and salvaged, and deliver materials and equipment to the location designated for storage.
9. Repair adjacent construction and finishes damaged during demolition and extension work. Any damage to building, piping or equipment shall be repaired by skilled mechanics of the trades involved at no additional cost to the Owner.
10. Removal and replacement of ceiling tile(s) to perform work operations shall be the responsibility of the Contractor. The Contractor shall be responsible for replacement of any ceiling tiles or framework that may become damaged at no cost to the Owner.

Section 26 0513 Medium Voltage Cables

Section 26 0519 Low Voltage Electrical Power Conductors and Cables

1. Acceptable Manufacturers:
 - A. Alcan Products Corporation; Alcan Cable Division.
 - B. Alpha Wire.
 - C. Belden Inc.
 - D. Encore Wire Corporation.
 - E. General Cable Technologies Corporation.
 - F. Southwire Incorporated
2. Minimum #12 AWG wire
3. Maximum 500kCMIL wire
4. All Conductors shall be Copper and solid for No. 12 and smaller; stranded for No. 10 and larger.
5. Conductor Insulation shall be THW-2, THHN-2-THWN-2
6. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies.
7. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly.
8. All feeders will be loaded to approximately 70% of connected load per NEC, so up to 30% additional capacity will be available.

Section 26 0523 Control-Voltage Electrical Power Cables

Section 26 0526 Grounding and Bonding for Electrical Systems

1. Acceptable Manufacturers:
 - A. Burndy; Part of Hubbell Electrical Systems.
 - B. ERICO International Corporation.
 - C. Harger Lightning and Grounding.
 - D. ILSCO.
 - E. O-Z/Gedney; A Brand of the EGS Electrical Group.
 - F. Siemens Power Transmission & Distribution, Inc.
2. Conductors shall be Copper.
3. Provide Ground Bus in all electrical and telecom rooms. Provide predrilled rectangular bars of annealed copper, 1/4 by 4 inches in cross section, with 9/32-inch holes spaced 1-1/8 inches apart. Stand-off insulators for mounting shall comply with UL 891 for use in switchboards, 600 V and shall be Lexan or PVC, impulse tested at 5000 V.
4. Ground Rods: Copper-clad; 3/4 inch by 10 feet.

Section 26 0529 Hangers and Supports for Electrical Systems

1. Acceptable Manufacturers:
 - A. Allied Tube & Conduit.
 - B. Cooper B-Line, Inc.; a division of Cooper Industries.
 - C. ERICO International Corporation.
 - D. Thomas & Betts Corporation.
 - E. Unistrut; Tyco International, Ltd.
2. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported electrical Metallic Tubing (EMT) in walls, concealed.
3. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits.
4. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
5. Concrete Inserts: Steel or malleable-iron, slotted support system units.
6. Through Bolts: Structural type, hex head, and high strength.
7. Toggle Bolts: All-steel springhead type.
8. Hanger Rods: Threaded steel.
9. Support parallel runs of horizontal raceways together on trapeze-type hangers.
10. Support individual horizontal raceways by separate pipe hangers
11. Support exposed and concealed raceway within 1 foot of an unsupported box and access fittings.

12. Sleeves: Install in concrete slabs and walls and all other fire- rated floors and walls for raceways and cable installations.
13. Conduit Seals: Install seals for conduit penetrations of slabs on grade and exterior walls below grade and where indicated
14. Spacing for Raceway Supports: up to 1" conduit, maximum 7 feet. 1" and larger – maximum 10 feet.

Section 26 0533 Raceway and Boxes for Electrical Systems

1. Acceptable Manufacturers:
 - A. AFC Cable Systems, Inc.
 - B. Allied Tube & Conduit.
 - C. Anamet Electrical, Inc.
 - D. Electri-Flex Company.
 - E. O-Z/Gedney.
 - F. Picoma Industries.
 - G. Republic Conduit.
 - H. Robroy Industries.
 - I. Southwire Company.
 - J. Thomas & Betts Corporation.
 - K. Western Tube and Conduit Corporation.
 - L. Wheatland Tube Company.
2. Outdoors: conduit shall not be smaller than 1" trade size, unless approved by ADOA.
 - A. Exposed Conduit: Galvanized Rigid Conduit.
 - B. Concealed Conduit, Aboveground: Galvanized Rigid Conduit.
 - C. Underground Conduit: Rigid Non-Metallic Conduit.
 - D. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): Liquid Tight Metallic Conduit.
 - E. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R
3. Indoors: conduit shall not be smaller than 3/4" trade size, unless approved by ADOA.
 - A. Exposed, Not Subject to Physical Damage: Electrical Metallic Tubing.
 - B. Exposed, Not Subject to Severe Physical Damage: Electrical Metallic Tubing.
 - C. Exposed and Subject to Severe Physical Damage: Galvanized Rigid Conduit.
 - D. Concealed in Ceilings and Interior Walls and Partitions. Electrical Metallic Tubing.
 - E. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
 - F. Damp or Wet Locations: Galvanized Rigid Conduit.
 - G. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4 stainless steel in institutional and commercial kitchens and damp or wet locations.
4. Electrical Metallic Tubing (EMT) in walls, concealed
5. Provide pullwire in all empty conduit.

6. Underground 90 degree elbows 2-inch trade size or larger, use plastic coated or tape wrapped intermediate metal or rigid steel conduit. Comply with NEC for grounding.
7. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
8. Arrange stub-ups so curved portions of bends are not visible above finished slab.
9. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 12 inches of changes in direction.
10. Support conduit within 12 inches of enclosures to which attached.
11. Stub ups above recessed ceilings:
 - A. Use Electrical Metallic Tubing
 - B. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.
12. At expansion joints, use expansion fittings that provide expansion and contraction.
13. No flex longer than six feet will be permitted.
14. Conduit color coding shall be utilized
 - Building Management Systems - Blue Colored Conduits
 - Fire Alarm - Red Colored Conduits (All boxes and covers shall be red).
 - Security Systems – Purple Colored Conduits
 - Nurse Call/Code Blue – Green Colored Conduits
 - Paging – White Colored Conduits
 - Communications – Orange Colored Conduits (When required)

Section 26 0536 Cable Trays for Electrical Systems

1. Acceptable Manufacturers:
 - A. B-line, an Eaton business.
 - B. Chalfant Manufacturing Company.
 - C. Cope Cable Tray; A Part of Atkore International.
 - D. MonoSystems, Inc.
 - E. MP Husky USA Cable Tray & Cable Bus.
 - F. Niedax Inc.
 - G. Thomas & Betts Corporation; A Member of the ABB Group.
2. Provide Trough type aluminum trays
3. Install cable tray as a complete system, including fasteners, hold-down clips, support systems, barrier strips, adjustable horizontal and vertical splice plates, elbows, reducers, tees, crosses, cable dropouts, adapters, covers, and bonding.

Section 26 0543 Underground Ducts and Raceways for Electrical Systems

Section 26 0553 Identification for Electrical Systems

1. All equipment shall be labeled with equipment Name, source of power and circuit designation.
2. Provide engraved Legends for equipment:
 - A. Normal Power – White letters on black face, unless noted otherwise on Drawings.
 - B. Emergency Power – White letters on red face, unless noted otherwise on Drawings.
 - C. UPS Power – White letters on blue face, unless noted otherwise on Drawings.
3. Provide: Color-Coding for Phase and Voltage Level Identification, 600 V or Less: Use colors listed below for ungrounded feeder and branch-circuit conductors.
 - A. Color shall be factory applied.
 - B. Colors for 208/120-V Circuits:
 - i. Phase A: Black.
 - ii. Phase B: Red.
 - iii. Phase C: Blue.
 - iv. Neutral: White
 - C. Colors for 240-V Circuits:
 - i. Phase A: Black.
 - ii. Phase B: Red.
 - D. Colors for 480/277-V Circuits:
 - i. Phase A: Brown.
 - ii. Phase B: Orange.
 - iii. Phase C: Yellow.
 - iv. Neutral: Gray
 - E. Color for Equipment Grounds: Green.
 - F. Colors for Isolated Grounds: Green with white stripe.
4. Provide color banding on raceways with snap-around color-coding bands. Locate at changes in direction, at penetrations of walls and floors and at 25-foot maximum intervals.
5. Identify the covers of each junction and pull box of the following systems with self-adhesives labels containing the wiring system legend and system voltage and circuit identification. “Emergency Power”, “Power”, “UPS”.
6. Provide warning tape for all underground Lines.
7. Workspace Identification: Provide floor marking tape to finished surfaces. Show working clearances in the direction of access to live parts.
8. Provide warning labels for indoor cabinets, boxes, and enclosures for power and lighting.
9. Provide arc-flash warning labels.

Section 26 0573.16 Coordination Studies

1. Acceptable Manufacturers:
 - SKM Systems Analysis, Inc.

2. Provide recommended settings of protective devices for:
 - Phase and Ground Relays:
 - Device tag.
 - Relay current transformer ratio and tap, time dial, and instantaneous pickup value.
 - Recommendations on improved relaying systems, if applicable.
 - Circuit Breakers:
 - Adjustable pickups and time delays (long time, short time, ground).
 - Adjustable time-current characteristic.
 - Adjustable instantaneous pickup.
 - Recommendations on improved trip systems, if applicable.
 - Fuses: show current rating, voltage and class

Section 26 0573.19 Arc-Flash Hazard Analysis

1. Acceptable Manufacturers:
 - A. SKM Systems Analysis, Inc.

2. Incident Energy and Flash Protection Boundary Calculations for:
 - A. Arcing fault magnitude.
 - B. Protective device clearing time.
 - C. Duration of arc.
 - D. Arc-flash boundary.
 - E. Restricted approach boundary.
 - F. Limited approach boundary.
 - G. Working distance.
 - H. Incident energy.
 - I. Hazard risk category.

3. Provide Arc-Flash warning labels:

Section 26 1213 Liquid Filled, Medium Voltage Transformers

Section 26 1300 15 kV Pad-Mounted Switchgear

Section 26 2213 Low Voltage Distribution Transformers

1. Acceptable Manufacturers:
 - A. Eaton Electrical Inc.; Cutler-Hammer Products.

- B. General Electric Company.
 - C. Hammond Co.; Matra Electric, Inc.
 - D. Magnetek Power Electronics Group.
 - E. Myers Power Products, Inc.
 - F. Powersmiths International, Corp.
 - G. Siemens Energy & Automation, Inc.
 - H. Square D; Schneider Electric.
2. All transformers to be copper wound. Aluminum is not permitted.
 3. Enclosure to be ventilated. Core and coil shall be encapsulated within resin compound, sealing out moisture and air.
 4. Taps: Two 2.5 percent taps above and four 2.5 percent taps below normal full capacity.
 5. Insulation Class: 220 deg C, deg C, UL-component-recognized insulation system with a maximum of 150 deg C rise above 40 deg C ambient temperature.
 6. Energy Efficiency for Transformers Rated 15 kVA and Larger:
 - A. Complying with NEMA TP 1, Class 1 efficiency levels.
 - B. Tested According to NEMA TP 2.
 7. Provide K-rated transformers for nonsinusoidal loads.
 8. Electrostatic Shielding: Each winding shall have an independent, single, full-width copper electrostatic shield arranged to minimize interwinding capacitance.
 9. Wall mounted transformers allowed for sizes 45kVA or less.
 10. All dry type transformers will be loaded to approximately 70% of connected load per NEC, so up to 30% additional capacity will be available.

Section 26 2413 Switchboards

1. Acceptable Manufacturers:
 - A. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
General Electric Company; GE Consumer & Industrial - Electrical Distribution.
Siemens Energy & Automation, Inc.
Square D; a brand of Schneider Electric.
2. Provide customer metering capable of recording peak load.
3. Phase and Neutral bus shall be hard-drawn copper of 98 percent conductivity.
4. Ground bus shall be ¼ by 2 inch hard-drawn copper of 98 percent conductivity equipped with mechanical connectors for feeder and branch circuit ground conductors.
5. Neutral buses shall be 100% percent rated.
6. Provide with Surge Protection Device.
7. Install on 4" thick concrete housekeeping pads.
8. Provide with temporary Lifting provisions.
9. All switchboards will be loaded to a maximum of 75%, allowing a minimum of 25% spare capacity for future use.

Section 26 2416 Panelboards

1. Acceptable Manufacturers:
 - A. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
General Electric Company; GE Consumer & Industrial - Electrical Distribution.
Siemens Energy & Automation, Inc.
Square D; a brand of Schneider Electric.
2. Phase, Neutral, and ground bus shall be hard-drawn copper of 98 percent conductivity.
3. Neutral buses shall be 100% percent rated.
4. Panelboards 100 amps or less shall have a minimum of 10,000 AIC bracing. Panelboards over 100 amps or less, shall have a minimum bracing of 22,000 AIC. Panelboards 400 amps and over will have a minimum of 35,000 AIC. Panelboards 600 amps and over will have a minimum of 65,000 AIC.
5. Hinged Front Cover: The door over the interior of the panel shall be provided with hinge and combination lock and latch. The outside door over the panel gutters shall have a hinge on one side and combination lock and latches
6. Mount top to trim 74 inches above finished floor.
7. Provide filler plates in unused spaces.
8. Provide four 1 inch conduit stubs from panelboard into accessible ceiling space or space designated to be ceiling space in the future.
9. Labels for identifying the breakers shall be engraved laminated plastic strips attached by screws or Phenolic buttons or small window frame type. Adhesive stick-on labels will not be acceptable.
10. Create a directory to indicate installed circuit loads (after balancing panelboard loads); incorporate Owner's final room designations. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.
11. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification.
12. All Lighting and Receptacle branch panelboards will be loaded to a maximum of 75%, allowing a minimum of 25% spare capacity for future use.

Section 26 2419 Motor Control Centers

1. Acceptable Manufacturers:
 - A. ABB; Control Products.
Eaton Electrical Inc.; Cutler-Hammer Business Unit.
General Electric Company; GE Industrial Systems.
Rockwell Automation, Inc.; Allen-Bradley Brand.
Siemens Energy & Automation, Inc.; Power Distribution.
Square D; a brand of Schneider Electric.
2. Provide customer metering capable of recording peak load.
3. Phase and Neutral bus shall be hard-drawn copper of 98 percent conductivity.

4. Ground bus shall be ¼ by 2 inch hard-drawn copper of 98 percent conductivity equipped with mechanical connectors for feeder and branch circuit ground conductors.
5. Neutral buses shall be 100% percent rated.
6. Provide with Surge Protection Device.
7. Install on 4" thick concrete housekeeping pads.
8. Provide with temporary Lifting provisions.
9. Provide with push buttons, Pilot lights, and selector switches.
10. Provide with Normally Open and Normally Closed auxiliary contacts.

Section 26 2500 Enclosed Bus Assemblies

1. Acceptable Manufacturers:
 - A. Calvert Company (The).
Eaton Electrical Inc.; Cutler-Hammer Products.
General Electric Company; Electrical Distribution & Control Division.
Siemens Energy & Automation, Inc.
Square D; Schneider Electric.
2. Bus Materials: Current-carrying copper conductors, fully insulated with Class 130C insulation except at stabs and joints; plated surface at stabs and joints.
3. Ground: 50 percent capacity internal bus bar of material matching bus material.
4. Provide heavy duty fusible plug-in devices.

Section 26 2726 Wiring Devices

1. Acceptable Manufacturers:
 - A. Cooper Wiring Devices; Division of Cooper Industries, Inc. (Cooper).
Hubbell Incorporated; Wiring Device-Kellems (Hubbell).
Leviton Mfg. Company Inc. (Leviton).
Pass & Seymour/Legrand (Pass & Seymour).
2. Convenience Receptacles shall be: 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, and FS W-C-596.
3. Hospital-Grade, Duplex Convenience Receptacles shall be: 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498 Supplement sd, and FS W-C-596.
4. Isolated-Ground, Duplex Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, and FS W-C-596.
5. Tamper-Resistant Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498 Supplement sd, and FS W-C-596.
6. Toggle switches shall be quit tumbler type.

7. Hospital grade devices shall be used in all healthcare facilities.
8. Wall plates shall match the device color,
9. Device color: Normal power devices and plates shall be white. Emergency power shall be red, UPS power shall be blue.
10. Ground pin of vertically mounted receptacles shall be down, and on horizontally mounted receptacles to the right.
11. Install hospital-grade receptacles in patient-care areas with the ground pin or neutral blade at the top.
12. Identify each receptacle with panelboard identification and circuit number. Use hot, stamped, or engraved machine printing with black-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.
13. All receptacle outlet boxes will be 4"x4"x2.5" with vertical single-gang device mounting ring and duplex 20 amp grounding type.
14. The mounting height for convenience receptacles will be 18" above the finish floor to comply with the Americans with Disabilities Act (ADA) requirements.

Section 26 2813 Fuses

1. Acceptable Manufacturers:
 - A. Cooper Bussmann, Inc.
 - Edison Fuse, Inc.
 - Ferraz Shawmut, Inc.
 - Littelfuse, Inc.
2. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.
3. Provide spare fused cabinet.

Section 26 2816 Enclosed Switches and Circuit Breakers

1. Acceptable Manufacturers:
 - A. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 - General Electric Company; GE Consumer & Industrial - Electrical Distribution.
 - Siemens Energy & Automation, Inc.
 - Square D; a brand of Schneider Electric.
2. All enclosed switches shall be heavy duty rated rated.
3. Indoor, Dry and Clean Locations: NEMA 250, Type 1.
4. Outdoor Locations: NEMA 250, Type 3R.
5. Kitchen or Wash-Down Areas: NEMA 250, Type 4X.
6. Other Wet or Damp, Indoor Locations: NEMA 250, Type 4.

7. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 12.
8. Hazardous Areas Indicated on Drawings: NEMA 250, Type 9.

Section 26 2913 Enclosed Controllers

1. Acceptable Manufacturers:

Eaton Electrical Inc.; Cutler-Hammer Business Unit.
General Electric Company; GE Consumer & Industrial - Electrical Distribution.
Rockwell Automation, Inc.; Allen-Bradley brand.
Siemens Energy & Automation, Inc.
Square D; a brand of Schneider Electric.

2. Indoor, Dry and Clean Locations: NEMA 250, Type 1.
3. Outdoor Locations: NEMA 250, Type 3R.
4. Kitchen or Wash-Down Areas: NEMA 250, Type 4X.
5. Other Wet or Damp, Indoor Locations: NEMA 250, Type 4.
6. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 12.
7. Hazardous Areas Indicated on Drawings: NEMA 250, Type 9.
8. Indoor, Dry and Clean Locations: NEMA 250, Type 1.
9. Outdoor Locations: NEMA 250, Type 3R.
10. Provide with Push Buttons, Pilot Lights, and Selector Switches: Heavy-duty, Pilot light type.
11. Provide with Normally closed and normally open auxiliary contacts.
12. Floor mounted controllers shall be provided with 4" high concrete housekeeping pads.

Section 26 3213 Engine Generators

1. Acceptable Manufacturers:

A. Caterpillar; Engine Div.
Generac Power Systems, Inc.
Kohler Co.; Generator Division.
Onan/Cummins Power Generation; Industrial Business Group.

2. Noise Emission: Comply with applicable state and local government requirements for maximum noise level at adjacent property boundaries due to sound emitted by generator set including engine, engine exhaust, engine cooling-air intake and discharge, and other components of installation.
3. Generator sizing shall consider altitude derating factors.
4. Generators shall not be located within 5 feet of combustible materials per NFPA.
5. Generators shall be Diesel fuel oil, Grade DF-2. Natural Gas may be used upon approval of ADOA.
6. Rated engine speed shall be 1800 RPM.

7. Maximum piston speed for four-cycle engines shall be 2250 fpm.
8. Provide minimum eight hours' continuous fuel capacity rated at 100 percent rated power output. Fuel capacity may be higher and will be determined by the project conditions. Final approval by ADOA.
9. Outdoor Generator set enclosure shall be vandal-resistant, weatherproof steel housing, wind resistant up to 100 mph. Multiple panels shall be lockable and provide adequate access to components requiring maintenance. Panels shall be removable by one person without tools. Instruments and control shall be mounted within enclosure
10. Provide restrained vibration spring isolators with minimum 1-inch deflection.
11. All generators shall be mounted on 4-inch high concrete bases.

Section 26 3353 Static Uninterruptible Power Supply

1. Acceptable Manufacturers:
 - A. APC by Schneider Electric.
Eaton.
Emerson Power Systems
GE Electrical Distribution & Control.
Liebert; a brand of Emerson Electric Co.

Section 26 3623 Automatic Transfer Switches

1. Acceptable Manufacturers:
 - A. ASCO
 - B. Caterpillar, Inc.; Electric Power Division.
Cummins Power Generation.
Eaton.
Emerson.
GE Zenith Controls.
Generac Power Systems, Inc.
General Electric Company.
Russelectric.
Zenith

Section 26 4113 Lightning Protection for Structures

1. Acceptable Manufacturers:

East Coast Lightning Equipment Inc.
ERICO International Corporation.
Harger.
Heary Bros. Lightning Protection Co. Inc.
Independent Protection Co.

Preferred Lightning Protection.
Robbins Lightning, Inc.
Thompson Lightning Protection, Inc.

2. Shall comply with UL 96 and NFPA 780.
3. Air terminals shall be 24" high copper, unless otherwise approved by ADOA.
4. Main bonding conductors shall be copper.
5. Ground rods shall be Copper-Clad, 3/4 inch in diameter by 10 feet.
6. Heavy-Duty, Stack-Mounted, Lightning Protection Components: Solid copper
7. The following conductors shall be concealed: system, down, and interior conductors.

Section 26 4313 Surge Protection for Low Voltage Electrical Power Circuits

1. Acceptable Manufacturers:

A. ABB USA.
Current Technology Inc.
Eaton.
General Electric Company.
Leviton Manufacturing Co., Inc.
Liebert; a brand of Emerson Electric Co.
Schneider Electric USA, Inc.
SIEMENS Industry, Inc.; Energy Management Division.

Section 26 5113 Interior Lighting Fixtures, Lamps and Ballasts

1. Provide photometric data complying with IESNA Lighting calculation guides.
2. Minimum CRI shall be 80.
3. Color temperature shall be 3500K, unless otherwise indicated.
4. Provide Light Emitting Diode (LED) type lighting unless conditions dictate otherwise.
5. All luminaire shall remain wrapped with clear plastic cover until final completion of construction.
6. Lighting levels per IESNA as follows:

<u>Area</u>	<u>Average Lighting Level at the Work Plane (fc)</u>
Offices	40 – 60
Conference	30 – 50
Lobby	20 - 30
General Corridors	10 - 20
Storage/Janitor's Rooms	10 - 20
Toilets	20 - 30
Electrical/Mechanical Rooms	20 – 30
Exam/Consult Rooms	60 - 80
Laboratory	50 – 100
Print Shop	50 - 100

Patient Rooms	30 – 40 + exam light
Intensive Care	90 – 100 + exam light
LDRP	80 – 100 + birthing/exam light
Operating Rooms/C-Section minimum	100 (+ O.R. Light)
OR/Surgical Corridors	100
Scrub Room	100
Radiographic Suite	2-200 dimmable
Diagnostic Imaging (CT/MRI)	30 – 150 dimmable/multi-level
Nurseries	0 - 30

Section 26 5612 Exterior Lighting

1. Provide photometric data complying with IESNA Lighting calculation guides.
2. Minimum CRI shall be 80.
3. Color temperature shall be 3500K, unless otherwise indicated.
4. Provide Light Emitting Diode (LED) type lighting unless conditions dictate otherwise.
5. Provide in-line fuse(s) for each luminaire.
6. Lamp rating shall be marked for outdoor use.
7. Pole color shall match luminaire color.
8. If approved by ADOA, use selected permanent luminaires for temporary lighting. When construction is substantially complete, clean luminaires used for temporary lighting and install new lamps.

DIVISION 27 COMMUNICATIONS

Section 27 0526 Grounding and Bonding for Communications Systems

Section 27 0528 Pathways for Communications Systems

Section 27 0529 Hangers and Supports for Communications Systems

Section 27 0536 Cable Tray for Communications Systems

Section 27 0543 Underground Pathways and Structures for Communication

Section 27 0544 Sleeves and Sleeve Seals for Communications Pathways and Cabling

Section 27 0553 Identification for Communications Systems

Section 27 1100 Communications Equipment Room Fittings

Section 27 1333 Communications Coaxial Backbone Cabling

Section 27 1513 Communications Copper Horizontal Cabling

Section 27 1523 Communications Optical Fiber Horizontal Cabling

Section 27 5116 Public Address Systems

Section 27 5119.11 Sound Masking Systems

Section 27 5123.20 Commercial Intercommunications and Program Systems

Section 27 5223 Nurse Call-Code Blue Systems

Section 27 5313 Clock Systems

DIVISION 28 ELECTRONIC SAFETY AND SECURITY

Section 28 1300 Access Control Software and Database Management

Section 28 1500 Access Control Hardware Devices

Section 28 2000 Video Surveillance

Section 28 3100 Intrusion Detection

Section 28 3121 Area and Perimeter Intrusion Detection

Section 28 4400 Refrigerant Detection and Alarm

Section 28 4621 Addressable Fire-Alarm Systems

1. Acceptable Manufacturers:
Edwards United Technologies (EST-3).
2. For Fire alarm upgrades or replacements, ADOA shall be notified 7 days prior to any shutdowns. Do not proceed with interruption of Fire-Alarm
3. Installation shall be by personnel certified by NICET as fire-alarm Level III.
4. Provide Spare Maintenance Materials as indicated below:
 - A. Lamps for Remote Indicating Lamp Units: Quantity equal to 10 percent of amount installed, but no fewer than one unit.
 - B. Lamps for Strobe Units: Quantity equal to 10 percent of amount installed, but no fewer than one unit.Smoke Detectors, Fire Detectors: Quantity equal to 10 percent of amount of each type installed, but no fewer than one unit of each type.
Detector Bases: Quantity equal to 10 percent of amount of each type installed, but no fewer than one unit of each type.
Keys and Tools: One extra set for access to locked or tamper proofed components.
Audible and Visual Notification Appliances: Quantity equal to 10 percent of amount installed, but no fewer than one unit.
Fuses: Two of each type installed in the system. Provide in a box or cabinet with compartments marked with fuse types and sizes.
Filters for Air-Sampling Detectors: Quantity equal to 10 percent of amount of each type installed, but no fewer than one unit of each type.
Air-Sampling Fan: Quantity equal to one for every five detectors, but no fewer than one unit of each type.
5. Visible Notification Appliances: Xenon strobe lights Xenon strobe lights complying with UL 1971, with clear or nominal white polycarbonate lens mounted on an aluminum faceplate. The word "FIRE" is engraved in minimum 1-inch- high letters on the lens.

Rated Light Output: 15/30/75/110 cd, selectable in the field.

Section 28 4700 Mass Notification Systems

Section 28 5211 Detention Monitoring and Control Systems