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WMU Design Guidelines

WMU Design Guidelines Instructions: These guidelines are to be used by the Design Professional to inform the design process and outline WMU-specific desires for all University projects. These guidelines have been edited to reflect WMU preferences, and the intent is for the Design Professional to use this information to guide their normal specifications-writing process. Straying from what is indicated in the guidelines is not prohibited, but shall be discussed with WMU during the development of the project.

SECTION 21 0500 - COMMON WORK RESULTS FOR FIRE SUPPRESSION

PART 1 - GENERAL

DESIGNER NOTE: The University’s Fire Suppression Standard includes only the basic systems that are required for most projects (Wet Pipe, Pre-Action, Dry-Pipe). Specialty or Chemical-Type systems shall be specified and discussed with the University as needed per project.

1.1 SUMMARY

A. This Section includes the following:

1. Piping materials and installation instructions common to most piping systems.
2. Sleeve-seal systems.
3. Sleeves.
4. Stack-sleeve fittings.
5. Escutcheons.
6. Floor plates.
7. Grout.
8. Fire-suppression equipment and piping demolition.
9. Equipment installation requirements common to equipment sections.
10. Painting and finishing.
11. Concrete bases.
12. Supports and anchorages.

B. Related Sections:

1. Division 01 Section "Alternates" for requirements of alternates that relate to this Division.

1.2 DEFINITIONS

1.3 SUBMITTALS

1.4 QUALITY ASSURANCE

A. Provide fire-suppression systems, equipment, and materials in accordance with NFPA and other applicable codes and regulations, and with authorities having jurisdiction.

B. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."

1 COMMON WORK RESULTS FOR FIRE SUPPRESSION

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C. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

D. Electrical Characteristics for Fire-Suppression Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

C. Deliver products to project properly identified with names, model numbers, types, grades, compliance labels, and similar information needed for distinct identifications; adequately packaged and protected to prevent damage during shipment, storage, handling, and up to substantial completion. Coordinate deliveries of mechanical materials and equipment to minimize construction site congestion.

1.6 COORDINATION

A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for fire-suppression installations.

B. Coordinate installation of required supporting devices and sleeves with structural components.

C. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

D. Coordinate requirements for access panels and doors for fire-suppression items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Division 08 Section "Access Doors and Frames."

1. In inmate occupied areas, provide security type access doors and panels. [Refer to Drawing A110.]

1.7 PROJECT COMMISSIONING

A. Project is attempting to obtain Leed Certification and has an independent commissioning authority (CxA). Contractors for this project shall meet CxA requirements and shall coordinate with and participate in commissioning activities.
PART 2 - PRODUCTS

2.1 MANUFACTURERS

2.2 PIPE, TUBE, AND FITTINGS

A. Refer to individual Division 21 piping Sections for pipe, tube, and fitting materials and joining methods.

B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

C. All grooved joint couplings, fittings, valves, and specialties shall be the products of a single manufacturer. Grooving tools shall be of the same manufacturer as the grooved components.
   1. All castings used for coupling housings, fittings, valve bodies, etc., shall include listing/approval stamp, label, or other markings made to specified standards.

2.3 JOINING MATERIALS

A. Refer to individual Division 21 piping Sections for special joining materials not listed below.

B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
   1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.
      a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
      b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
   2. AWWA C110, rubber, flat face, 1/8 inch thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.

C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.
   1. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

D. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

E. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.

F. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

2.4 SLEEVE-SEAL SYSTEMS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Advance Products & Systems, Inc.
2. CALPICO, Inc.
3. Metraflex Company (The).
4. Pipeline Seal and Insulator, Inc.
5. Proco Products, Inc.
6. Thunderline

B. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.

1. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
2. Sealing Elements: [EPDM-rubber] [NBR] interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
4. Pressure Plates: [Carbon steel] [Plastic] [Stainless steel].
5. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, of length required to secure pressure plates to sealing elements.
6. Connecting Bolts and Nuts: [Carbon steel, with corrosion-resistant coating,] [Stainless steel] of length required to secure pressure plates to sealing elements.

2.5 SLEEVES

A. Cast-Iron Wall Pipes: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

B. Galvanized-Steel Wall Pipes: ASTM A 53/A 53M, Schedule 40, with plain ends and welded steel collar; zinc coated.

C. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.


E. Galvanized-Steel-Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

F. Molded-PE or -PP Sleeves: Removable, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to [wooden forms].

G. Molded-PVC Sleeves: With nailing flange for attaching to wooden forms.
2.6 STACK-SLEEVE FITTINGS

A. Description: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring, bolts, and nuts for membrane flashing.
   1. Underdeck Clamp: Clamping ring with setscrews.

2.7 ESCUTCHEONS

A. Description: Manufactured wall and ceiling escutcheons with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.

B. One-Piece, Cast-Brass Type: With polished, chrome-plated or rough-brass finish and setscrew fastener.

C. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with chrome-plated finish and spring-clip fasteners.

D. One-Piece, Stamped-Steel Type: With chrome-plated finish and spring-clip fasteners.

E. Split-Casting Brass Type: With polished, chrome-plated or rough-brass finish and with concealed hinge and setscrew.

F. Split-Plate, Stamped-Steel Type: With chrome-plated finish, concealed or exposed-rivet hinge, and spring-clip fasteners.

2.8 FLOOR PLATES

A. Description: Manufactured floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.

B. One-Piece Floor Plates: Cast-iron flange.

C. One-Piece Floor Plates: Cast-iron flange [with holes for fasteners].

D. Split-Casting Floor Plates: Cast brass with concealed hinge.

2.9 GROUT


B. Characteristics: Nonshrink; recommended for interior and exterior applications.

C. Design Mix: 5000-psi, 28-day compressive strength.

D. Packaging: Premixed and factory packaged.
3.1 FIRE-SUPPRESSION DEMOLITION

A. Refer to Division 01 Section "Execution" and Division 02 Section "Selective Demolition" for general demolition requirements and procedures.

B. Disconnect, demolish, and remove fire-suppression systems, equipment, and components indicated to be removed.
   1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
   2. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
   3. Equipment to Be Removed: Disconnect and cap services and remove equipment.
   4. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
   5. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.

C. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

3.2 PIPING SYSTEMS - COMMON INSTALLATION REQUIREMENTS

A. Install piping according to the following requirements and Division 21 Sections specifying piping systems.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Install piping as indicated unless deviations to layout are approved.
   1. Drawings are diagrammatic with no attempt made to show every ell, tee, transition, fitting, or appurtenance. Provide installations that are complete in every detail, compliant with all applicable codes, and as required to provide a fully functional and operational system even though every item is not specifically indicated.

C. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

D. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.

E. Install piping at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
F. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

G. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

H. Install piping to permit valve servicing.

I. Install piping at indicated slopes.

J. Install piping free of sags and bends.

K. Install fittings for changes in direction and branch connections.

L. Install piping to allow application of insulation.

M. Select system components with pressure rating equal to or greater than system operating pressure.

3.3 ESCUTCHEON INSTALLATION

A. Install escutcheons for penetrations of walls, ceilings, and finished floors according to the following:

1. Escutcheons for New Piping:
   a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
   b. Chrome-Plated Piping: One-piece, cast-brass or split-casting brass type with polished, chrome-plated finish.
   c. Insulated Piping: One-piece, stamped-steel type or split-plate, stamped-steel type with concealed hinge.
   d. Insulated Piping: One-piece, stamped-steel type or split-plate, stamped-steel type with concealed hinge or split-plate, stamped-steel type with exposed-rivet hinge.
   e. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass or split-casting brass type with polished, chrome-plated finish.
   f. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, stamped-steel type or split-plate, stamped-steel type with concealed hinge or split-plate, stamped-steel type with exposed-rivet hinge.
   g. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, cast-brass or split-casting brass type with polished, chrome-plated finish.
   h. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, stamped-steel type or split-plate, stamped-steel type with concealed hinge or split-plate, stamped-steel type with exposed-rivet hinge.
   i. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass or split-casting brass type with polished, chrome-plated or rough-brass finish.
   j. Bare Piping in Unfinished Service Spaces: One-piece, stamped-steel type or split-plate, stamped-steel type with concealed hinge or split-plate, stamped-steel type with exposed-rivet hinge.
   k. Bare Piping in Equipment Rooms: One-piece, cast-brass or split-casting brass type with polished, chrome-plated or rough-brass finish.
1. Bare Piping in Equipment Rooms: One-piece, stamped-steel type[ or split-plate, stamped-steel type with concealed hinge] [ or split-plate, stamped-steel type with exposed-rivet hinge].

2. Escutcheons for Existing Piping:
   a. Chrome-Plated Piping: Split-casting brass type with polished, chrome-plated finish.
   b. Insulated Piping: Split-plate, stamped-steel type with concealed or exposed-rivet hinge.
   c. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split-casting brass type with polished, chrome-plated finish.
   d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split-plate, stamped-steel type with [concealed] [or] [exposed-rivet] hinge.
   e. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-casting brass type with polished, chrome-plated finish.
   f. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-plate, stamped-steel type with [concealed] [or] [exposed-rivet] hinge.
   g. Bare Piping in Unfinished Service Spaces: Split-casting brass type with polished, chrome-plated or rough-brass finish.
   h. Bare Piping in Unfinished Service Spaces: Split-plate, stamped-steel type with [concealed] [or] [exposed-rivet] hinge.
   i. Bare Piping in Equipment Rooms: Split-casting brass type with polished, chrome-plated or rough-brass finish.
   j. Bare Piping in Equipment Rooms: Split-plate, stamped-steel type with [concealed] [or] [exposed-rivet] hinge.

3.4 FLOOR PLATE INSTALLATION

A. Install floor plates for piping penetrations of equipment-room floors.
   1. New Piping: One-piece, floor-plate type.
   2. Existing Piping: Split-casting, floor-plate type.

3.5 SLEEVE INSTALLATION

A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.
   1. Sleeves are not required for core-drilled holes.

B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls.

C. Install sleeves in concrete floors, concrete walls and masonry walls as new slabs and walls are constructed.

D. Install sleeves in concrete floors[, concrete roof slabs], concrete walls and masonry walls as new slabs and walls are constructed.
1. Permanent sleeves are not required for holes in slabs formed by molded-PE or -PP sleeves.
2. Cut sleeves to length for mounting flush with both surfaces.
   a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.
3. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.

E. Install sleeves for pipes passing through interior partitions.
1. Cut sleeves to length for mounting flush with both surfaces.
2. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in Section 07 9200 “Joint Sealants.”

F. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Section 07 8413 “Penetration Firestopping.”

3.6 STACK-SLEEVE-FITTING INSTALLATION
A. Install stack-sleeve fittings in new slabs as slabs are constructed.
1. Install fittings that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
2. Secure flashing between clamping flanges for pipes penetrating floors with membrane waterproofing. Comply with requirements for flashing specified in Section 07 6200 “Sheet Metal Flashing and Trim.”
3. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level.
4. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
5. Using grout, seal the space around outside of stack-sleeve fittings.

B. Fire-Barrier Penetrations: Maintain indicated fire rating of floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Section 07 8413 “Penetration Firestopping.”

3.7 SLEEVE-SEAL-SYSTEM INSTALLATION
A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.

B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and
sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.8 SLEEVE AND SLEEVE-SEAL SCHEDULE

A. Use sleeves and sleeve seals for the following piping-penetration applications:

1. Exterior Concrete Walls Above Grade:
   a. Piping Smaller Than NPS 6: Cast-iron wall sleeves, galvanized-steel wall sleeves, or galvanized-steel-pipe sleeves.
   b. Piping Smaller Than [NPS 6] <Insert pipe size>: [Cast-iron wall sleeves] [Galvanized-steel wall sleeves] [Galvanized-steel-pipe sleeves] [Sleeve-seal fittings] <Insert material>.
   c. Piping NPS 6 and Larger: Cast-iron wall sleeves, galvanized-steel wall sleeve, or galvanized-steel-pipe sleeves.
   d. Piping [NPS 6] <Insert pipe size> and Larger: [Cast-iron wall sleeves] [Galvanized-steel wall sleeves] [Galvanized-steel-pipe sleeves] <Insert material>.

2. Exterior Concrete Walls below Grade:
   a. Piping Smaller Than NPS 6: Cast-iron wall sleeves with sleeve-seal system.
   b. Piping Smaller Than [NPS 6] <Insert pipe size>: [Cast-iron wall sleeves with sleeve-seal system] [Galvanized-steel wall sleeves with sleeve-seal system] [Galvanized-steel-pipe sleeves with sleeve-seal system] [Sleeve-seal fittings] <Insert material>.
      1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
   c. Piping NPS 6 and Larger: Cast-iron wall sleeves with sleeve-seal system.
   d. Piping [NPS 6] <Insert pipe size> and Larger: [Cast-iron wall sleeves with sleeve-seal system] [Galvanized-steel wall sleeves with sleeve-seal system] [Galvanized-steel-pipe sleeves with sleeve-seal system] <Insert material>.
      1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

3. Concrete Slabs-on-Grade:
   a. Piping Smaller Than NPS 6: Cast-iron wall sleeves with sleeve-seal system.
   b. Piping Smaller Than [NPS 6] <Insert pipe size>: [Cast-iron wall sleeves with sleeve-seal system] [Galvanized-steel wall sleeves with sleeve-seal system] [Galvanized-steel-pipe sleeves with sleeve-seal system] [Sleeve-seal fittings] <Insert material>.
      1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
   c. Piping NPS 6 and Larger: Cast-iron wall sleeves with sleeve-seal system.
d. Piping [NPS 6] <Insert pipe size> and Larger: [Cast-iron wall sleeves with sleeve-seal system] [Galvanized-steel wall sleeves with sleeve-seal system] [Galvanized-steel-pipe sleeves with sleeve-seal system] [Galvanized-steel-pipe sleeves] <Insert material>.

1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

4. Concrete Slabs above Grade:
   a. Piping Smaller Than NPS 6: Stack-sleeve fittings.
   b. Piping Smaller Than [NPS 6] <Insert pipe size>: [Galvanized-steel-pipe sleeves] [PVC-pipe sleeves] [Stack-sleeve fittings] [Sleeve-seal fittings] [Molded-PE or -PP sleeves] [Molded-PVC sleeves] <Insert material>.
   c. Piping NPS 6 and Larger: Stack-sleeve fittings.
   d. Piping [NPS 6] <Insert pipe size> and Larger: [Galvanized-steel-pipe sleeves] [PVC-pipe sleeves] [Stack-sleeve fittings] <Insert material>.

5. Interior Partitions:

3.9 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 21 Sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA’s "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.


F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

G. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance” Article.

H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

I. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
   1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
   2. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.

J. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D 3139.

3.10 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Sequence, coordinate, and integrate installations of fire suppression equipment.

B. Sequence, coordinate, and integrate installations of fire suppression equipment[, giving particular attention to large equipment requiring positioning prior to closing in the building].

C. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.

D. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

E. Install equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations.

F. Install equipment to allow right of way for piping installed at required slope.

G. Installing contractor shall bear all additional costs, including that of Architect/Engineer redesign and that of other trades, incurred as a result of installation of other than scheduled equipment.

H. Verify final equipment locations for roughing-in.

I. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.11 PAINTING

A. Painting of fire-suppression systems, equipment, and components is specified in Division 09 painting sections.
B. Painting of fire-suppression systems, equipment, and components is specified in Division 09 Sections "Interior Painting" and "Exterior Painting."

C. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.12 CONCRETE BASES

A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.

1. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit.
2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of the base.
3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
5. Install anchor bolts to elevations required for proper attachment to supported equipment.
6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
7. Use 3000-psi, 28-day compressive-strength concrete and reinforcement as specified in Division 03 section for cast-in-place concrete.
8. Use [3000-psi] <Insert other>, 28-day compressive-strength concrete and reinforcement as specified in Division 03 Section "[Cast-in-Place Concrete] [Miscellaneous Cast-in-Place Concrete]."

3.13 ERECTION OF METAL SUPPORTS AND ANCHORAGES

A. Refer to Division 05 Section "Metal Fabrications" for structural steel.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor fire-suppression materials and equipment.

C. Field Welding: Comply with AWS D1.1.

3.14 ERECTION OF WOOD SUPPORTS AND ANCHORAGES

A. Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support, and anchor fire-suppression materials and equipment.

B. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.

C. Attach to substrates as required to support applied loads.
3.15 GROUTING

A. Mix and install grout for fire-suppression equipment base bearing surfaces, pump and other equipment base plates, and anchors.

1. Clean surfaces that will come into contact with grout.
2. Provide forms as required for placement of grout.
3. Avoid air entrapment during placement of grout.
4. Place grout, completely filling equipment bases.
5. Place grout on concrete bases and provide smooth bearing surface for equipment.
6. Place grout around anchors.
7. Cure placed grout.

B. Mix and install grout for fire protection installations.

1. Clean surfaces that will come into contact with grout.
2. Provide forms as required for placement of grout.
3. Avoid air entrapment during placement of grout.
4. Cure placed grout.

3.16 INSTALLATION OF ACCESS DOORS

A. Where lay-in ceilings are used, the access to ceiling space is provided through the removable ceiling panels. Where access is required to valves, pipes, dampers or other devices in spaces above non-removable ceilings or in chases, the Contractor requiring the access doors shall provide access doors. Access doors required in rated walls and ceiling shall bear the same rating. Access panels and doors are specified in Division 08 Section "Access Doors and Frames."

1. Set frames accurately in position and securely attached to supports, with face panels plumb and level in relation to adjacent finish surfaces.
2. Adjust hardware and panels after installation for proper operation.

3.17 FIELD QUALITY CONTROL

A. Replace broken and damaged escutcheons and floor plates using new materials.

END OF SECTION 21 0500
WMU Design Guidelines Instructions: These guidelines are to be used by the Design Professional to inform the design process and outline WMU-specific desires for all University projects. These guidelines have been edited to reflect WMU preferences, and the intent is for the Design Professional to use this information to guide their normal specifications-writing process. Straying from what is indicated in the guidelines is not prohibited, but shall be discussed with WMU during the development of the project.

SECTION 21 0513 - COMMON MOTOR REQUIREMENTS FOR FIRE SUPPRESSION EQUIPMENT

PART 1 - GENERAL

**DESIGNER NOTE:** Fire Suppression Motors apply primarily to fire pumps and jockey pumps.

1.1 SUMMARY

A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on ac power systems up to 600 V and installed at equipment manufacturer’s factory or shipped separately by equipment manufacturer for field installation.

B. Section includes general requirements for single-phase and polyphase, general-purpose, small and medium, squirrel-cage induction motors for use on ac power systems up to 600 V and installed in field as a replacement.

1.2 ACTION SUBMITTALS

A. Product Data for Replacement Motors: For each type and size of motor indicated, provide nameplate data and ratings; mounting arrangements; size, type, and location of winding terminations; conduit entry and ground lug locations; and information on coatings or finishes.

B. Shop Drawings for Field-Installed Motors: Dimensioned plans, elevations, sections, and details, including the following:

   1. Each installed unit’s type and details.
   2. Nameplate legends.

1.3 CLOSEOUT SUBMITTALS

A. Operation and maintenance data for replacement motors.

1.4 COORDINATION

A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:

   1. Motor controllers.
   2. Torque, speed, and horsepower requirements of the load.
3. Ratings and characteristics of supply circuit and required control sequence.
4. Ambient and environmental conditions of installation location.

B. For motors using variable frequency controller, motors to be designed for such application and suitable for use throughout speed range without overheating.

C. Coordinate replacement motor support with requirements for driven load; access for maintenance; installation of accessories, belts, belt guards; and adjustment of sliding rails for belt tensioning.

D. Coordinate replacement motor size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

PART 2 - PRODUCTS

2.1 GENERAL MOTOR REQUIREMENTS

A. Comply with requirements in this Section except when stricter requirements are specified in fire suppression equipment schedules or Sections.

B. Comply with NEMA MG 1 unless otherwise indicated.

C. Comply with IEEE 841 for severe-duty motors.

2.2 MOTOR CHARACTERISTICS

A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet above sea level.

B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

2.3 POLYPHASE MOTORS

A. Description: NEMA MG 1, Design B, medium induction motor.

B. Efficiency: Energy efficient, as defined in NEMA MG 1.

1. Provide premium efficient motors where scheduled or when used with a variable frequency controller.

C. Service Factor: 1.15.

D. Multispeed Motors: Variable torque.

1. For motors with 2:1 speed ratio, consequent pole, single winding.
2. For motors with other than 2:1 speed ratio, separate winding for each speed.
E. Multispeed Motors: Separate winding for each speed.

F. Rotor: Random-wound, squirrel cage.

G. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.

H. Temperature Rise: Match insulation rating.

I. Insulation: Class F.

J. Insulation: [Class F] <Insert class>.

K. Code Letter Designation:
   1. Motors 15 HP and Larger: NEMA starting Code F or Code G.
   3. Motors Smaller than 15 HP: Manufacturer's standard starting characteristic.

L. Enclosure Material: Manufacturer's standard material.

M. Enclosure Material: Cast iron for motor frame sizes [324T] <Insert number> and larger; rolled steel for motor frame sizes smaller than [324T] <Insert number>.

2.4 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS

A. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.

B. Motors Used with Variable Frequency Controllers: Ratings, characteristics, and features coordinated with controller manufacturer.

C. Motors Used with Variable Frequency Controllers: [Ratings, characteristics, and features coordinated with and approved by controller manufacturer.]
   1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width modulated inverters.
   2. Premium-Efficient Motors: Class B temperature rise; Class F insulation.
   3. Energy- and Premium-Efficient Motors: Class B temperature rise; Class F insulation.
   4. Inverter-Duty Motors: Class F temperature rise; Class H insulation.
   5. Shaft Grounding Ring: Factory or field installed Aegis Model SGR shaft grounding ring consisting of maintenance free, circumferential, bearing protection ring with conductive micro fiber shaft contacting material.
   6. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.

D. Severe-Duty Motors: Comply with IEEE 841, with 1.15 minimum service factor.
2.5  SINGLE-PHASE MOTORS

A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:

1. Permanent-split capacitor.
2. Split phase.
3. Capacitor start, inductor run.
4. Capacitor start, capacitor run.

B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.

C. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.

D. Motors 1/20 HP and Smaller: Shaded-pole type.

E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

PART 3 - EXECUTION (Not Applicable)

3.1  EXECUTION

3.2  SHAFT GROUNDING RING INSTALLATION

A. If not factory installed, field install at each three phase motors utilizing a variable frequency controller a shaft grounding ring. Attach according to manufacturer's written instructions.

3.3  REPLACEMENT MOTOR INSTALLATION

A. Anchor each motor assembly to base, adjustable rails, or other support, arranged and sized according to manufacturer's written instructions. Attach by bolting. Level and align with load transfer link.

3.4  FIELD QUALITY CONTROL OF REPLACEMENT MOTORS

A. Adjusting: Align motors, bases, shafts, pulleys and belts. Tension belts according to manufacturer's written instructions.

1. Alignment procedures are to be witnessed by Owner’s representative.

B. Testing: Perform the following field quality-control testing:
1. Run each motor with its controller. Demonstrate correct rotation, alignment, and speed at motor design load.
2. Test interlocks and control features for proper operation.
3. Verify that current in each phase is within nameplate rating.
4. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

C. Adjusting: Align motors, bases, shafts, pulleys and belts. Tension belts according to manufacturer’s written instructions.

END OF SECTION 21 0513
WMU Design Guidelines Instructions: These guidelines are to be used by the Design Professional to inform the design process and outline WMU-specific desires for all University projects. These guidelines have been edited to reflect WMU preferences, and the intent is for the Design Professional to use this information to guide their normal specifications-writing process. Straying from what is indicated in the guidelines is not prohibited, but shall be discussed with WMU during the development of the project.

SECTION 21 1000 – WATER BASED FIRE SUPPRESSION SYSTEMS

PART 1 - GENERAL

DESIGNER NOTE: The University's Fire Suppression Standard includes only the basic systems that are required for most projects (Wet Pipe, Pre-Action, Dry-Pipe). Specialty or Chemical-Type systems shall be specified and discussed with the University as needed per project.

1.1 SUMMARY

A. This Section includes the wet-pipe sprinkler systems inside the building:

B. Related Sections:

1. Division 22 Section "Facility Water Distribution Piping" for [piping outside the building].
2. Division 28 fire detection and alarm sections for alarm devices not specified in this Section.

1.2 DEFINITIONS

A. High-Pressure Sprinkler Piping: Wet-pipe sprinkler system piping designed to operate at working pressure higher than standard 175 psig, but not higher than [250 psig] [300 psig].

B. Standard-Pressure Sprinkler Piping: Wet-pipe sprinkler system piping designed to operate at working pressure of 175 psig maximum.

1.3 SYSTEM DESCRIPTIONS

A. Wet-Pipe Sprinkler System: Automatic sprinklers are attached to piping containing water and that is connected to water supply through alarm valve. Water discharges immediately from sprinklers when they are opened. Sprinklers open when heat melts fusible link or destroys frangible device.

B. Wet-Pipe Sprinkler System: Automatic sprinklers are attached to piping containing water and that is connected to water supply through alarm valve. Water discharges immediately from sprinklers when they are opened. Sprinklers open when heat melts fusible link or destroys frangible device. [Hose connections are included if indicated.]
1.4 PERFORMANCE REQUIREMENTS

A. Standard-Pressure Piping System Component: Listed for 175-psig minimum working pressure.

B. High-Pressure Piping System Component: Listed for [250-psig minimum] [300-psig] working pressure.

C. Delegated Design: Design sprinkler system(s), including comprehensive engineering analysis by a qualified professional engineer.

D. Sprinkler system design shall be approved by authorities having jurisdiction.

E. Maximum Protection Area per Sprinkler: Per UL listing, NFPA, and manufacturers specifications.

1.5 ACTION SUBMITTALS

A. Product Data: For the following:
   1. Piping materials, including flexible connections and sprinkler specialty fittings.
   2. Valves, including listed fire-protection valves, unlisted general-duty valves, and specialty valves and trim.
   3. Sprinklers, escutcheons, and guards. Include sprinkler flow characteristics, mounting, finish, and other pertinent data.
   4. Fire department connections, including type; number, size, and arrangement of inlets; caps and chains; size and direction of outlet; escutcheon and marking; and finish.
   5. Alarm devices, including electrical data.
   6. Elevator valve wall box.

B. Shop Drawings: Diagram power, signal, and control wiring.

C. Fire-hydrant flow test report.

D. Approved Sprinkler Piping Drawings: Working plans, prepared according to NFPA 13, that have been approved by authorities having jurisdiction, including hydraulic calculations, if applicable.

1.6 INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. Field quality-control test reports.

C. Field Test Reports and Certificates: Indicate and interpret test results for compliance with performance requirements and as described in NFPA 13. Include "Contractor's Material and Test Certificate for Aboveground Piping" and "Contractor's Material and Test Certificate for Underground Piping."

D. Field Test Reports and Certificates: Indicate and interpret test results for compliance with performance requirements and as described in NFPA 13 [NFPA 13 and NFPA 14] [NFPA 14].
1.7 CLOSEOUT SUBMITTALS
A. Operation and maintenance data.

1.8 QUALITY ASSURANCE
A. Installer Qualifications: Installation and alterations of fire protection piping, equipment, specialties, and accessories, and repair and servicing of equipment shall be performed only by a qualified installer experienced in such work; with a minimum of 5 previous projects similar in size and scope to this project; be familiar with all precautions required; and has complied with all the requirements of the authority having jurisdiction.

1. Installer’s responsibilities include designing, fabricating, and installing sprinkler systems and providing professional engineering services needed to assume engineering responsibility. Base calculations on results of fire-hydrant flow test.

a. Engineering Responsibility: Preparation of working plans, calculations, and field test reports by a qualified professional engineer or NICET Level III or IV certified layout technician.

B. Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. NFPA Standards: Fire-suppression-system equipment, specialties, accessories, installation, and testing shall comply with NFPA requirements.

E. NFPA Standards: Sprinkler system equipment, specialties, accessories, installation, and testing shall comply with the following:

1. NFPA 13, "Installation of Sprinkler Systems."
2. NFPA 13R, "Installation of Sprinkler Systems in Residential Occupancies up to and Including Four Stories in Height."
3. NFPA 24, "Installation of Private Fire Service Mains and Their Appurtenances."

1.9 COORDINATION
A. Coordinate layout and installation of sprinklers with other construction that penetrates ceilings, including light fixtures, HVAC equipment, and partition assemblies.
1.10 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Sprinkler Cabinets: Finished, wall-mounted, steel cabinet with hinged cover, and with space for minimum of six spare sprinklers plus sprinkler wrench. Include number of sprinklers required by NFPA 13 and sprinkler wrench.

PART 2 - PRODUCTS

2.1 DUCTILE-IRON PIPE AND FITTINGS

A. Mechanical-Joint, Ductile-Iron Pipe: AWWA C151, with mechanical-joint bell end and plain end.

1. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.

2. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron gland, rubber gasket, and steel bolts and nuts.

2.2 STEEL PIPE AND FITTINGS

A. Steel Pipe: ASTM A 53/A 53M, ASTM A 135, or ASTM A 795; Schedule 10 or schedule 40. Refer to pipe application scheduled near end of this section.

1. Main and line piping NPS 2 and larger to be Schedule 10 grooved.

2. Line piping NPS 1-1/2 and smaller to be Schedule 40 threaded.

a. If hydraulically proven, NPS 1-1/4 and NPS 1-1/2 may be Schedule 10.

B. Steel Pipe Fittings:


5. Steel Threaded Couplings: ASTM A 865.

6. Locking-Lug Fittings: UL 213, ductile-iron body with retainer lugs that require one-quarter turn to secure pipe in fitting.


C. Grooved-Joint Piping Systems:

1. Grooved-End Fittings: UL-listed, ASTM A 536, ductile-iron casting with OD matching steel-pipe OD.

2. Grooved-End-Pipe Couplings: UL 213 and AWWA C606, rigid pattern, unless otherwise indicated; gasketed fitting matching steel-pipe OD. Include ductile-iron housing with keys.
2.3 STEEL PIPE AND FITTINGS

2.4 COPPER TUBE AND FITTINGS

2.5 CPVC PIPE AND FITTINGS

2.6 PIPING JOINING MATERIALS

2.7 COVER SYSTEM FOR SPRINKLER PIPING

2.8 LISTED FIRE-PROTECTION VALVES

A. General Requirements:
   1. Valves shall be UL listed or FM approved.
   3. Minimum Pressure Rating for High-Pressure Piping: [250 psig] [300 psig].

B. Ball Valves:
   2. Valves NPS 1-1/2 and Smaller: Bronze body with threaded ends.
   3. Valves NPS 2 and NPS 2-1/2: Bronze body with threaded ends or ductile-iron body with grooved ends.
   4. Valves NPS 3: Ductile-iron body with grooved ends.

C. Bronze Butterfly Valves:
   4. End Connections: Threaded.

D. Iron Butterfly Valves:
   3. Body Material: Cast or ductile iron.
   4. Style: Lug or wafer.
   5. End Connections: Grooved, threaded, or flanged.
E. Check Valves:
   2. Pressure Rating: [250 psig minimum] [300 psig].
   3. Type: Swing check.
   5. End Connections: Flanged or grooved.

F. Bronze OS&Y Gate Valves:
   4. End Connections: Threaded.

G. Iron OS&Y Gate Valves:
   2. Pressure Rating: [250 psig minimum] [300 psig].
   3. Body Material: Cast or ductile iron.
   4. End Connections: Flanged or grooved.

H. Indicating-Type Butterfly Valves:
   2. Pressure Rating: 175 psig minimum.
   3. Valves NPS 2 and Smaller:
      a. Valve Type: Ball or butterfly.
      b. Body Material: Bronze.
      c. End Connections: Threaded.
   4. Valves NPS 2-1/2 and Larger:
      a. Valve Type: Butterfly.
      b. Body Material: Cast or ductile iron.
      c. End Connections: Flanged, grooved, or wafer.
   5. Valve Operation: Integral electrical, 115-V ac, prewired, single-circuit or two-circuit supervisory switch. Coordinate with fire alarm system.
   6. Valve Operation: Integral [electrical, 115-V ac, prewired, single-circuit, supervisory switch] [electrical, 115-V ac, prewired, two-circuit, supervisory switch] [visual] indicating device.

I. NRS Gate Valves with Indicator Post:
   2. Body Material: Cast iron with indicator post flange.
   4. End Connections: Flanged or grooved.
   5. Indicator Posts:
b. Type: Horizontal for wall mounting.
c. Body Material: Cast iron with extension rod and locking device.
d. Operation: [Wrench] [Hand wheel].

J. NRS Gate Valves:
2. Pressure Rating: [250 psig minimum] [300 psig].
5. End Connections: Flanged or grooved.

K. Indicator Posts:
2. Type: Horizontal for wall mounting.
3. Body Material: Cast iron with extension rod and locking device.
4. Operation: [Wrench] [Hand wheel].

2.9 TRIM AND DRAIN VALVES
A. General Requirements:
2. Pressure Rating: 175 psig minimum.

B. Angle Valves:
C. Ball Valves:
D. Globe Valves:
E. Plug Valves:

2.10 SPECIALTY VALVES
A. General Requirements:
2. Pressure Rating:
   a. Standard-Pressure Piping Specialty Valves: 175 psig minimum.
   b. High-Pressure Piping Specialty Valves: [250 psig minimum] [300 psig].
3. Body Material: Cast or ductile iron.
4. Size: Same as connected piping.
5. End Connections: Flanged or grooved.
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B. Alarm Valves:

2. Design: For horizontal or vertical installation.
3. Include trim sets for bypass, drain, electrical sprinkler alarm switch, pressure gauges, retarding chamber (if required), and fill-line attachment with strainer.
4. Include trim sets for bypass, drain, electrical sprinkler alarm switch, pressure gauges, [retarding chamber,] and fill-line attachment with strainer.
5. Drip Cup Assembly: Pipe drain without valves and separate from main drain piping or pipe drain with check valve to main drain piping as required.
6. Drip Cup Assembly: Pipe drain without valves and separate from main drain piping.
7. Drip Cup Assembly: Pipe drain with check valve to main drain piping.

C. Deluge Valves:

2. Design: Hydraulically operated, differential-pressure type.
3. Include trim sets for bypass, drain, electrical sprinkler alarm switch, pressure gauges, drip cup assembly piped without valves and separate from main drain line, fill-line attachment with strainer, and push-rod chamber supply connection.
   a. Include wet, pilot-line trim set as required.

D. Automatic (Ball Drip) Drain Valves:

2. Pressure Rating: 175 psig minimum.
3. Type: Automatic draining, ball check.
5. End Connections: Threaded.

2.11 FIRE-DEPARTMENT CONNECTIONS

A. Exposed-Type, Fire-Department Connection:

2. Type: Exposed, projecting, for wall mounting.
5. Inlets: Brass with threads according to NFPA 1963 and matching local fire-department sizes and threads. Include extension pipe nipples, brass lugged swivel connections, and check devices or clappers.
6. Caps: Brass, lugged type, with gasket and chain.
7. Escutcheon Plate: Round, brass, wall type.
8. Outlet: Back, with pipe threads.
9. Number of Inlets: [Two] [Three].
10. Escutcheon Plate Marking: Similar to "[AUTO SPKR & STANPIPE] [AUTO SPKR]."
11. Finish: [Polished chrome plated] [Rough brass or bronze] [Rough chrome plated].
12. Outlet Size: [NPS 4] [NPS 5] [NPS 6].
B. Flush-Type, Fire-Department Connection:

2. Type: Flush, for wall mounting.
5. Inlets: Brass with threads according to NFPA 1963 and matching local fire-department sizes and threads. Include extension pipe nipples, brass lugged swivel connections, and check devices or clappers.
6. Caps: Brass, lugged type, with gasket and chain.
7. Escutcheon Plate: Rectangular, brass, wall type.
10. Body Style: [Horizontal] [Square] [Vertical].
11. Number of Inlets: Two.
12. Number of Inlets: [Two] [Three] [Four] [Six].
13. Outlet Location: Side by side.
14. Outlet Location: [Back] [Bottom] [Left side] [Right side] [Top].
15. Escutcheon Plate Marking: Similar to "AUTO SPKR & STANDPIPE" or "AUTO SPKR" as required.
16. Escutcheon Plate Marking: Similar to "[AUTO SPKR & STANDPIPE] [AUTO SPKR]."
17. Finish: Rough chrome plated.
18. Finish: [Polished chrome plated] [Rough brass or bronze] [Rough chrome plated].
20. Outlet Size: [NPS 4] [NPS 5] [NPS 6] [NPS 8].

C. Flush-Type, Fire-Department Connection:

2. Type: Flush, for wall mounting.
5. Inlets: Brass with threads according to NFPA 1963 and matching local fire-department sizes and threads. Include extension pipe nipples, brass lugged swivel connections, and check devices or clappers.
6. Caps: Brass, lugged type, with gasket and chain.
7. Escutcheon Plate: Rectangular, brass, wall type.
9. Body Style: [Horizontal] [Square] [Vertical].
10. Number of Inlets: [Two] [Three] [Four] [Six].
11. Outlet Location: [Back] [Bottom] [Left side] [Right side] [Top].
12. Escutcheon Plate Marking: Similar to "[AUTO SPKR & STANDPIPE] [AUTO SPKR]."
13. Finish: [Polished chrome plated] [Rough brass or bronze] [Rough chrome plated].
14. Outlet Size: [NPS 4] [NPS 5] [NPS 6] [NPS 8].

D. Yard-Type, Fire-Department Connection:

2. Type: Exposed, freestanding.
3. Pressure Rating: 175 psig minimum [300 psig].
5. Inlets: Brass with threads according to NFPA 1963 and matching local fire-department sizes and threads. Include extension pipe nipples, brass lugged swivel connections, and check devices or clappers.
6. Caps: Brass, lugged type, with gasket and chain.
8. Outlet: Bottom, with pipe threads.
9. Number of Inlets: [Two] [Three] [Four].
10. Sleeve: [Brass] [Not required].
11. Sleeve Height: 18 inches.
12. Escutcheon Plate Marking: Similar to "[AUTO SPKR & STANDPIPE] [AUTO SPKR]."
13. Finish[, Including Sleeve]: [Polished chrome plated] [Rough brass or bronze] [Rough chrome plated].
14. Outlet Size: [NPS 4] [NPS 5] [NPS 6].

2.12 SPRINKLER SPECIALTY PIPE FITTINGS

A. Branch Outlet Fittings:

2. Pressure Rating: 175 psig minimum.
3. Pressure Rating: [175 psig minimum] [300 psig].
5. Type: Mechanical-T and -cross fittings.
6. Configurations: Snap-on and strapless, ductile-iron housing with branch outlets.
7. Size: Of dimension to fit onto sprinkler main and with outlet connections as required to match connected branch piping.
8. Branch Outlets: Grooved, plain-end pipe, or threaded.

B. Flow Detection and Test Assemblies:

2. Pressure Rating: 175 psig minimum.
3. Pressure Rating: [175 psig minimum] [300 psig].
4. Body Material: Cast- or ductile-iron housing with orifice, sight glass, and integral test valve.
5. Size: Same as connected piping.
6. Inlet and Outlet: Threaded.

C. Branch Line Testers:

4. Size: Same as connected piping.
5. Inlet: Threaded.
6. Drain Outlet: Threaded and capped.
7. Branch Outlet: Threaded, for sprinkler.

D. Sprinkler Inspector's Test Fittings:
2. Pressure Rating: 175 psig minimum.
3. Pressure Rating: [175 psig minimum] [300 psig].
4. Body Material: Cast- or ductile-iron housing with sight glass.
5. Size: Same as connected piping.
6. Inlet and Outlet: Threaded.

E. Adjustable Drop Nipples:

2. Pressure Rating: 250 psig minimum.
3. Pressure Rating: [250 psig minimum] [300 psig].
5. Size: Same as connected piping.
7. Inlet and Outlet: Threaded.

F. Flexible, Sprinkler Hose Fittings:

2. Type: Flexible hose for connection to sprinkler, and with bracket for connection to ceiling grid.
4. Pressure Rating: [175 psig minimum] [300 psig].
5. Size: Same as connected piping, for sprinkler.

2.13 SPRINKLERS

A. Manufacturers: Subject to compliance with requirements, provide products by[ one] of the following:

1. AFAC Inc.
3. Reliable Automatic Sprinkler Co., Inc.
4. Tyco Fire & Building Products LP.
5. Venus Fire Protection Ltd.

B. General Requirements:

4. Pressure Rating for High-Pressure Automatic Sprinklers: [250 psig minimum] [300 psig].

C. Automatic Sprinklers with Heat-Responsive Element:

2. Nonresidential Applications: UL 199.
3. Residential Applications: UL 1626.
4. Characteristics: Nominal 1/2-inch orifice with Discharge Coefficient $K$ of 5.6, and for "Ordinary" temperature classification rating unless otherwise indicated or required by application.

D. Sprinkler Finishes:
1. Chrome plated.
2. Bronze.
3. Painted.
4. Coated.

E. Sprinkler Escutcheons: Materials, types, and finishes for the following sprinkler mounting applications for sprinklers not furnished with escutcheons.

F. Sprinkler Escutcheons: Materials, types, and finishes for the following sprinkler mounting applications. Escutcheons for concealed, flush, and recessed-type sprinklers are specified with sprinklers.
1. Ceiling Mounting: Chrome-plated steel, two piece, with 1-inch vertical adjustment.
2. Ceiling Mounting: [Chrome-plated steel, one piece, flat] [Chrome-plated steel, two piece, with 1-inch vertical adjustment] [Plastic, white finish, one piece, flat].
3. Sidewall Mounting: Chrome-plated steel, one piece, flat.
4. Sidewall Mounting: [Chrome-plated steel] [Plastic, white finish], one piece, flat.

G. Sprinkler Guards:
2. Type: Wire cage with fastening device for attaching to sprinkler.

2.14 ALARM DEVICES

A. Alarm-device types shall match piping and equipment connections.

B. Horn Strobe Alarm:
1. The horn strobe shall be listed to UL 1971 and UL 464 suitable for outdoor mounting and shall be approved for fire protective service. The horn strobe shall be wired as a primary-signaling notification appliance and comply with the Americans with Disabilities Act requirements for visible signaling appliances, flashing at 1Hz over the strobe’s entire operating voltage range.
2. The horn strobe shall mount to a standard back box with a universal mounting plate. The notification appliance circuit wiring shall terminate at the universal mounting plate.

C. Water-Motor-Operated Alarm:
2. Type: Mechanically operated, with Pelton wheel.
3. Alarm Gong: Cast aluminum with red-enamel factory finish.
4. Size: 10-inch diameter.
5. Components: Shaft length, bearings, and sleeve to suit wall construction.
7. Outlet: NPS 1 drain connection.

D. Electrically Operated Alarm Bell:
   2. Type: Vibrating, metal alarm bell.

E. Water-Flow Indicators:
   3. Components: Two single-pole, double-throw circuit switches for isolated alarm and auxiliary contacts, 7 A, 125-V ac and 0.25 A, 24-V dc; complete with factory-set, field-adjustable retard element to prevent false signals and tamperproof cover that sends signal if removed.
   4. Type: Paddle operated.
   6. Design Installation: Horizontal or vertical.

F. Pressure Switches:
   2. Type: Electrically supervised water-flow switch with retard feature.
   4. Design Operation: Rising pressure signals water flow.

G. Valve Supervisory Switches:
   2. Type: Electrically supervised.
   4. Design: Signals that controlled valve is in other than fully open position.

H. Indicator-Post Supervisory Switches:
   2. Type: Electrically supervised.
   4. Design: Signals that controlled indicator-post valve is in other than fully open position.

2.15 PRESSURE GAGES

A. Standard: UL 393.

B. Dial Size: 3-1/2- to 4-1/2-inch diameter.

C. Pressure Gage Range: 0 to 250 psig minimum.
D. Pressure Gage Range: [0 to 250 psig minimum] [0 to 300 psig].
E. Water System Piping Gage: Include "WATER" or "AIR/WATER" label on dial face.
F. Air System Piping Gage: Include [retard feature and] "AIR" or "AIR/WATER" label on dial face.

2.16 ELEVATOR VALVE RECESSED WALL BOXES
A. Cabinet: Suitable for shut-off valve with supervisory switch.
   1. Cabinet Construction: Fire-rated with rating equal to wall installed in.
      a. Non-rated Wall: Non-rated construction
      b. Rated Wall: Fire-rated with rating equal to wall installed in
   3. Recessed Cabinet: Cabinet box recessed in walls of sufficient depth to suit shut-off valve.
      a. Exposed Flat Trim: One-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend).
   4. Semirecessed Cabinet: Cabinet box partially recessed in walls of sufficient depth to suit style of trim indicated; with one-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend). Provide where walls are of insufficient depth for recessed cabinets but are of sufficient depth to accommodate semirecessed cabinet installation.
      a. Rolled-Edge Trim: 2-1/2-inch backbend depth.
   5. Cabinet Trim Material: Same material and finish as door.
   7. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material.
      a. Provide projecting door pull and friction latch.
      b. Provide concealed hinge permitting door to open 180 degrees.
   8. Accessories:
      a. Door Lock: [Cam lock that allows door to be opened during emergency by pulling sharply on door handle] [Cylinder lock, keyed alike to other cabinets].
      b. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location.
         1) Identify valve located in cabinet.
PART 3 - EXECUTION

3.1 PREPARATION

A. If a flow test at the nearest outside fire hydrant is older than two (2) years from the date of the calculations, perform a new fire-hydrant flow test according to NFPA 13 and NFPA 291.

B. Report test results promptly and in writing.

3.2 SERVICE-ENTRANCE PIPING

A. Connect sprinkler piping to water-service piping at service entrance to building.

B. Connect sprinkler piping to water-service piping for service entrance to building. Comply with requirements for exterior piping in Section 21 1100 "Facility Fire-Suppression Water-Service Piping."

C. Install shutoff valve, backflow preventer, pressure gage, drain, and other accessories as required by authorities having jurisdiction at connection to water-service piping.

D. Install shutoff valve, backflow preventer, pressure gage, drain, and other accessories indicated at connection to water-service piping. Comply with requirements for backflow preventers in Section 21 1100 "Facility Fire-Suppression Water-Service Piping."

E. Install shutoff valve, check valve, pressure gage, and drain at connection to water service.

3.3 [WATER-SUPPLY CONNECTIONS]

3.4 PIPING INSTALLATION

A. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated, as far as practical.

1. Deviations from approved working plans for piping require written approval from authorities having jurisdiction. File written approval with Architect before deviating from approved working plans.

B. Piping Standard: Comply with requirements for installation of sprinkler piping in NFPA 13.

C. Install seismic restraints on piping. Comply with requirements for seismic-restraint device materials and installation in NFPA 13.

D. Use listed fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.

E. Install unions adjacent to each valve in pipes NPS 2 and smaller.
F. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.

G. Install "Inspector's Test Connections" in sprinkler system piping, complete with shutoff valve, and sized and located according to NFPA 13.

H. Install sprinkler piping with drains for complete system drainage.

I. Install sprinkler zone control valves, test assemblies, and drain risers in accessible locations.

J. Install sprinkler control valves, test assemblies, and drain risers adjacent to standpipes [when sprinkler piping is connected to standpipes].

K. Install automatic (ball drip) drain valve at each check valve for fire-department connection, to drain piping between fire-department connection and check valve. Install drain piping to and spill over floor drain or to outside building.

L. Install alarm devices in piping systems.

M. Install hangers and supports for sprinkler system piping according to NFPA 13. Comply with requirements for hanger materials in NFPA 13.

N. Install pressure gages on riser or feed main, at each sprinkler test connection. Include pressure gages with connection not less than NPS 1/4 and with soft metal seated globe valve, arranged for draining pipe between gage and valve. Install gages to permit removal, and install where they will not be subject to freezing.

O. Install pressure gages on riser or feed main, at each sprinkler test connection, [and at top of each standpipe]. Include pressure gages with connection not less than NPS 1/4 and with soft metal seated globe valve, arranged for draining pipe between gage and valve. Install gages to permit removal, and install where they will not be subject to freezing.

P. Fill sprinkler system piping with water.

Q. Install electric heating cables and pipe insulation on sprinkler piping in areas subject to freezing. Comply with requirements for heating cables in Section 21 0533 "Heat Tracing for Fire-Suppression Piping" and for piping insulation in Section 21 0700 "Fire-Suppression Systems Insulation."

R. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 21 0500 "Common Work Results for Fire-Suppression."

S. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in [Section 21 0517 "Sleeves and Sleeve Seals for Fire-Suppression Piping."]

T. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 21 0500 "Common Work Results for Fire-Suppression."
U. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 21 0518 "Escutcheons for Fire-Suppression Piping."

3.5 JOINT CONSTRUCTION

A. Install couplings, flanges, flanged fittings, unions, nipples, and transition and special fittings that have finish and pressure ratings same as or higher than system's pressure rating for aboveground applications unless otherwise indicated.

B. Install unions adjacent to each valve in pipes NPS 2 and smaller.

C. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.

D. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

E. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

F. Flanged Joints: Select appropriate gasket material in size, type, and thickness suitable for water service. Join flanges with gasket and bolts according to ASME B31.9.

G. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

H. Twist-Locked Joints: Insert plain end of steel pipe into plain-end-pipe fitting. Rotate retainer lugs one-quarter turn or tighten retainer pin.

I. [Steel-Piping, Pressure-Sealed Joints: Join lightwall steel pipe and steel pressure-seal fittings with tools recommended by fitting manufacturer.]

J. Welded Joints: Construct joints according to AWS D10.12M/D10.12, using qualified processes and welding operators according to "Quality Assurance" Article.

1. Shop weld pipe joints where welded piping is indicated. Do not use welded joints for galvanized-steel pipe.

K. Steel-Piping, Cut-Grooved Joints: Cut square-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe joints.

L. Steel-Piping, Roll-Grooved Joints: Roll rounded-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe grooved joints.
M. Steel-Piping, Pressure-Sealed Joints: Join Schedule 5 steel pipe and steel pressure-seal fittings with tools recommended by fitting manufacturer.

N. Brazed Joints: Join copper tube and fittings according to CDA's "Copper Tube Handbook," "Brazed Joints" Chapter.

O. Copper-Tubing Grooved Joints: Roll rounded-edge groove in end of tube according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join copper tube and grooved-end fittings according to AWWA C606 for steel-pipe grooved joints.

P. Copper-Tubing, Pressure-Sealed Joints: Join copper tube and copper pressure-seal fittings with tools recommended by fitting manufacturer.

Q. Extruded-Tee Connections: Form tee in copper tube according to ASTM F 2014. Use tool designed for copper tube; drill pilot hole, form collar for outlet, dimple tube to form seating stop, and braze branch tube into collar.

R. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

S. Plastic-Piping, Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

2. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.

3.6 INSTALLATION OF COVER SYSTEM FOR SPRINKLER PIPING

A. Install cover system, brackets, and cover components for sprinkler piping according to manufacturer's "Installation Manual" and with NFPA 13 or NFPA 13R for supports.

3.7 VALVE AND SPECIALTIES INSTALLATION

A. Install listed fire-protection valves, trim and drain valves, specialty valves and trim, controls, and specialties according to NFPA 13 and authorities having jurisdiction.

B. Install listed fire-protection shutoff valves supervised open, located to control sources of water supply except from fire-department connections. Install permanent identification signs indicating portion of system controlled by each valve.

C. Install check valve in each water-supply connection.

D. Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water-supply sources.

E. Specialty Valves:

1. General Requirements: Install in vertical position for proper direction of flow, in main supply to system.
3. Deluge Valves: Install in vertical position, in proper direction of flow, and in main supply to deluge system. Install trim sets for drain, priming level, alarm connections, ball drip valves, pressure gages, priming chamber attachment, and fill-line attachment.

3.8 SPRINKLER INSTALLATION

A. Install sprinklers in suspended ceilings in center of narrow dimension of acoustical ceiling panels.

B. Install [dry-type sprinklers] with water supply from heated space. Do not install pendent or sidewall, wet-type sprinklers in areas subject to freezing.

C. Install sprinklers into flexible, sprinkler hose fittings and install hose into bracket on ceiling grid.

D. Install institutional sprinklers with retaining flange.

3.9 FIRE-DEPARTMENT CONNECTION INSTALLATION

A. Install wall-type, fire-department connections.

B. Install yard-type, fire-department connections in concrete slab support. Comply with requirements for concrete in Section 03 3000 "Cast-in-Place Concrete."

1. Install [two] [three] <Insert number> protective pipe bollards [around] [on sides of] each fire-department connection. Comply with requirements for bollards in Section 05 5000 "Metal Fabrications."

C. Install automatic (ball drip) drain valve at each check valve for fire-department connection.

3.10 IDENTIFICATION

A. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 13.

B. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 26 0553 "Identification for Electrical Systems."

3.11 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Leak Test: After installation, charge systems and test for leaks. Repair leaks and retest until no leaks exist.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
4. Energize circuits to electrical equipment and devices.
5. Coordinate with fire-alarm tests. Operate as required.
6. Coordinate with [fire-pump tests]. Operate as required.
7. Verify that equipment hose threads are same as local fire-department equipment.

C. Sprinkler piping system will be considered defective if it does not pass tests and inspections.
D. Prepare test and inspection reports.

3.12 CLEANING
A. Clean dirt and debris from sprinklers.
B. Remove and replace sprinklers with paint other than factory finish.

3.13 DEMONSTRATION
A. Train Owner’s maintenance personnel to adjust, operate, and maintain system.
B. [Engage a factory-authorized service representative to train] [Train] Owner’s maintenance personnel to adjust, operate, and maintain [specialty valves] [and] [pressure-maintenance pumps].

3.14 PIPING SCHEDULE
A. Piping between Fire-Department Connections and Check Valves: Galvanized, standard-weight steel pipe with threaded ends; cast-iron threaded fittings; and threaded or grooved ends; grooved-end fittings; grooved-end-pipe couplings; and grooved joints.
B. Sprinkler specialty fittings may be used, downstream of control valves, instead of specified fittings.
C. Standard-pressure, wet-pipe sprinkler system shall be the following:
   1. Main and line piping NPS 2 and larger to be Schedule 10 grooved.
   2. Line piping NPS 1-1/2 and smaller to be Schedule 40 threaded.
      a. If hydraulically proven, NPS 1-1/4 and NPS 1-1/2 may be Schedule 10.
D. Underground Service-Entrance Piping: Ductile-iron, mechanical-joint pipe and fittings and restrained joints.
3.15 SPRINKLER SCHEDULE

A. Use sprinkler types in subparagraphs below for the following applications:

1. Rooms without Ceilings: Upright sprinklers.
2. Rooms without Ceilings: [Upright sprinklers] <Insert type>.
3. Rooms with Suspended Ceilings: Concealed sprinklers.
4. Rooms with Suspended Ceilings: [Pendent sprinklers] [Recessed sprinklers] [Flush sprinklers] [Concealed sprinklers] [Pendent, recessed, flush, and concealed sprinklers as indicated].
5. Rooms with Hard Ceilings: Concealed sprinklers.
6. Rooms with Ceiling Clouds: Extended coverage sidewall sprinklers to cover under the fabric ceiling clouds without poking down thru or be mounted under them.
8. Spaces Subject to Freezing: Upright, pendent, and sidewall, dry sprinklers.
9. Spaces Subject to Freezing: [Upright sprinklers] [Pendent, dry sprinklers] [Sidewall, dry sprinklers] [Upright, pendent, dry sprinklers; and sidewall, dry sprinklers as indicated] <Insert type>.
10. Deluge-Sprinkler Systems: [Upright] [and] [pendent], open sprinklers.
11. Special Applications: [Extended-coverage, flow-control, and quick-response sprinklers where indicated] <Insert type>.

B. Provide sprinkler types in subparagraphs below with finishes indicated.

1. Concealed Sprinklers: Rough brass, with factory-painted white cover plate, or colored to match ceiling material.
2. Flush Sprinklers: Bright chrome, with painted white escutcheon.
3. Recessed Sprinklers: White, with white escutcheon.
4. Residential Sprinklers: Dull chrome.
5. Upright, Pendent, and Sidewall Sprinklers:
   a. Chrome plated in finished spaces exposed to view
   b. Rough bronze in unfinished spaces not exposed to view
   c. Painted black in exposed black painted ceilings.
   d. Painted white in exposed white painted ceilings.
   e. Wax coated where exposed to acids, chemicals, or other corrosive fumes.

END OF SECTION 21 1000
WMU Design Guidelines

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SECTION 21 3113 – ELECTRIC DRIVE, CENTRIFUGAL FIRE PUMPS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Split-case fire pumps.
   2. In-line fire pumps.
   3. Fire-pump accessories and specialties.
   4. [Flowmeter systems].

1.2 PERFORMANCE REQUIREMENTS

A. Pump Equipment, Accessory, and Specialty Pressure Rating: 175 psig minimum unless higher pressure rating is indicated.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, performance curves, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: For fire pumps, motor drivers, and fire-pump accessories and specialties. Include plans, elevations, sections, details, and attachments to other work.

   1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
   2. Wiring Diagrams: For power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each fire pump, from manufacturer.

B. Source quality-control reports.

C. Field quality-control reports.
1.5 CLOSEOUT SUBMITTALS
   A. Alignment Certificate: Include signed certificate verifying based mounted pump alignment procedures have been completed.
   B. Operation and maintenance data.

1.6 QUALITY ASSURANCE
   A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
   B. NFPA Compliance: Comply with NFPA 20, "Installation of Stationary Pumps for Fire Protection."

1.7 COORDINATION
   A. Coordinate sizes and locations of concrete bases with actual equipment provided.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR CENTRIFUGAL FIRE PUMPS
   A. Description: Factory-assembled and -tested fire-pump and driver unit.
   B. Base: Fabricated and attached to fire-pump and driver unit with reinforcement to resist movement of pump during seismic events when base is anchored to building substrate.
   C. Finish: Red paint applied to factory-assembled and -tested unit before shipping.

2.2 HORIZONTALLY MOUNTED, SINGLE-STAGE, SPLIT-CASE FIRE PUMPS
   A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      3. Peerless Pump, Inc.
   B. Pump:
      1. Standard: UL 448, for split-case pumps for fire service.
      3. Impeller: Cast bronze, statically and dynamically balanced, and keyed to shaft.
      5. Shaft and Sleeve: Steel shaft with bronze sleeve.
a. Shaft Bearings: Grease-lubricated ball bearings in cast-iron housing.
b. Seals: Stuffing box with minimum of four rings of graphite-impregnated braided yarn and bronze packing gland.

6. Mounting: Pump and driver shafts are horizontal, with pump and driver on same base.

C. Coupling: Flexible and capable of absorbing torsional vibration and shaft misalignment. Include metal coupling guard.

D. Driver:
1. Standard: UL 1004A.
2. Type: Electric motor; NEMA MG 1, polyphase Design B.

E. Capacities and Characteristics:
2. Total Rated Head: <Insert feet or psig>.
3. Inlet Flange: [Class 125] [Class 250].
4. Outlet Flange: [Class 125] [Class 250] <Insert class>.
5. Suction Head Available at Pump: <Insert feet>.
8. Electrical Characteristics:
   a. Volts: [208] [230] [460] <Insert value>.
   b. Phase: Three.
   c. Hertz: 60.
   d. Full-Load Amperes: <Insert value>.
   e. Minimum Circuit Ampacity: <Insert value>.
   f. Maximum Overcurrent Protection: <Insert amperage>.


2.3 FIRE-PUMP ACCESSORIES AND SPECIALTIES

A. Automatic Air-Release Valves: Comply with NFPA 20 for installation in fire-pump casing.

B. Circulation Relief Valves: UL 1478, brass, spring loaded; for installation in pump discharge piping.

C. Relief Valves:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. BERMAD Control Valves.
   b. CLA-VAL Automatic Control Valves.
   c. Kunkle Valve; a part of Tyco International Ltd.
   d. OCV Control Valves.
   e. Watts Regulator Company; a division of Watts Water Technologies, Inc.
f. Zurn Plumbing Products Group; Wilkins Water Control Products.

2. Description: UL 1478, bronze or cast iron, spring loaded; for installation in fire-suppression water-supply piping.

D. Inlet Fitting: Eccentric tapered reducer at pump suction inlet.

E. Outlet Fitting: Concentric tapered reducer at pump discharge outlet.

F. Discharge Cone: [Closed] [Open] [Closed or open] type.

G. Hose Valve Manifold Assembly:

5. Manifold:
   a. Test Connections: Comply with UL 405 except provide outlets without clappers instead of inlets.
   b. Body: Flush type, brass or ductile iron, with number of outlets required by NFPA 20.
   d. Adapters and Caps with Chain: Brass or bronze, with outlet threaded according to NFPA 1963 and matching local fire-department threads.
   e. Escutcheon Plate: Brass or bronze; rectangular.
   f. Hose Valves: UL 668, bronze, with outlet threaded according to NFPA 1963 and matching local fire-department threads.
   g. Exposed Parts Finish: Rough brass.
   h. Exposed Parts Finish: [Polished] [Rough] [brass] [, chrome plated].
   i. Escutcheon Plate Marking: Equivalent to "FIRE PUMP TEST."

6. Manifold:
   a. Test Connections: Comply with UL 405 except provide outlets without clappers instead of inlets.
   b. Body: Exposed type, brass, with number of outlets required by NFPA 20.
   c. Escutcheon Plate: Brass or bronze; round.
   d. Hose Valves: UL 668, bronze, with outlet threaded according to NFPA 1963 and matching local fire-department threads. Include caps and chains.
   e. Exposed Parts Finish: [Polished] [Rough] [brass] [, chrome plated].
   f. Escutcheon Plate Marking: Equivalent to "FIRE PUMP TEST."
2.5 GROUT


B. Characteristics: Nonshrink and recommended for interior and exterior applications.

C. Design Mix: 5000-psi, 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

2.6 SOURCE QUALITY CONTROL

A. Testing: Test and inspect fire pumps according to UL 448 requirements for "Operation Test" and "Manufacturing and Production Tests."

   1. Verification of Performance: Rate fire pumps according to UL 448.

B. Fire pumps will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine equipment bases and anchorage provisions, with Installer present, for compliance with requirements and for conditions affecting performance of fire pumps.

B. Examine roughing-in for fire-suppression piping systems to verify actual locations of piping connections before fire-pump installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Fire-Pump Installation Standard: Comply with NFPA 20 for installation of fire pumps, relief valves, and related components.

B. Equipment Mounting:

   1. Install fire pumps on cast-in-place concrete equipment bases. Comply with requirements for equipment bases and foundations specified in Section 03 3000 "Cast-in-Place Concrete."
2. Install fire pumps on cast-in-place concrete equipment bases. Comply with requirements for equipment bases and foundations specified in [Section 03 3000 "Cast-in-Place Concrete."] [Section 03 3053 "Miscellaneous Cast-in-Place Concrete."]

3. Comply with requirements for vibration isolation and seismic control devices specified in Section 21 0548 "Vibration and Seismic Controls for Fire-Suppression Piping and Equipment."

4. Comply with requirements for vibration isolation devices specified in Section 21 0548.13 "Vibration Controls for Fire-Suppression Piping and Equipment."

C. For pumps located on elevated floors, set fire pumps on a concrete inertia base on top of a concrete equipment bases. Inertia base shall be fabricated from welded structural steel with the height of the base being 1/12th of the longest dimension. Inertia base shall be mounted on spring isolators, employing height saving clips. Disconnect coupling before setting. Do not reconnect couplings until alignment procedure is complete.

1. Support pump baseplate on rectangular metal blocks and shims, or on metal wedges with small taper, at points near foundation bolts to provide a gap of 3/4 to 1-1/2 inches between pump base and foundation for grouting.

2. Adjust metal supports or wedges until pump and driver shafts are level. Check coupling faces and suction and discharge flanges of pump to verify that they are level and plumb.

D. Install fire-pump suction and discharge piping equal to or larger than sizes required by NFPA 20.

E. Install flexible connectors at fire-pump suction and discharge piping connections to fire pump [mounted on inertia base].

F. Support piping and pumps separately so weight of piping does not rest on pumps.

G. Install valves that are same size as connecting piping. Comply with requirements for fire-protection valves specified in Division 21 fire-protection piping sections.

H. Install valves that are same size as connecting piping. Comply with requirements for fire-protection valves specified in [Division 21 Section "Fire-Suppression Standpipes."] [Division 21 Section "Wet-Pipe Sprinkler Systems."]

I. Install pressure gages on fire-pump suction and discharge flange pressure-gage tappings. Comply with requirements for pressure gages specified in Division 21 fire-protection piping sections.

J. Install pressure gages on fire-pump suction and discharge flange pressure-gage tappings. Comply with requirements for pressure gages specified in [Section 21 1200 "Fire-Suppression Standpipes."]] [Section 21 1313 "Wet-Pipe Sprinkler Systems."]

K. Install piping hangers and supports, anchors, valves, gages, and equipment supports according to NFPA 20.

L. Electrical Wiring: Install electrical devices furnished by equipment manufacturers but not factory mounted. Furnish copies of manufacturers' wiring diagram submittals to electrical Installer.

M. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.
3.3 ALIGNMENT

A. Align split-case pump and driver shafts after complete unit has been leveled on concrete base, grout has set, and anchor bolts have been tightened.

B. Align split-case pump and driver shafts after complete unit has been leveled on concrete base, grout has set, and anchor bolts have been tightened.

C. After alignment is correct, tighten anchor bolts evenly. Fill baseplate completely with grout, with metal blocks and shims or wedges in place. Tighten anchor bolts after grout has hardened. Check alignment and make required corrections.

D. Align piping connections.

E. Align pump and driver shafts for angular and parallel alignment according to HI 1.4 and to tolerances specified by manufacturer.

3.4 CONNECTIONS

A. Comply with requirements for piping and valves specified in Division 21 fire-protection piping sections.

B. Comply with requirements for piping and valves specified in [Section 21 1200 "Fire-Suppression Standpipes."] [Section 21 1313 "Wet-Pipe Sprinkler Systems."] Drawings indicate general arrangement of piping, fittings, and specialties.

C. Install piping adjacent to pumps and equipment to allow service and maintenance.

D. Connect relief-valve discharge to drainage piping or point of discharge.

E. Connect fire pumps to their controllers.

3.5 IDENTIFICATION

A. Identify system components. Comply with requirements for fire-pump marking according to NFPA 20.

3.6 FIELD QUALITY CONTROL

A. Test each fire pump with its controller as a unit. Comply with requirements for electric-motor-driver fire-pump controllers specified in Division 21 Section "Controllers for Fire-Pump Drivers."

B. Manufacturer’s Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

C. Perform tests and inspections.
1. **Manufacturer's Field Service:** Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

D. **Tests and Inspections:**

1. After installing components, assemblies, and equipment including controller, test for compliance with requirements.
2. Test according to NFPA 20 for acceptance and performance testing.
3. **Leak Test:** After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
4. **Operational Test:** After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
5. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

E. Components, assemblies, and equipment will be considered defective if they do not pass tests and inspections.

F. Prepare test and inspection reports.

G. Furnish fire hoses in number, size, and length required to reach storm drain or other acceptable location to dispose of fire-pump test water. Hoses are for tests only and do not convey to Owner.

### 3.7 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.

### 3.8 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain fire pumps.

END OF SECTION 21 3113
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SECTION 21 3400 – PRESSURE MAINTENANCE PUMPS

PART 1 - GENERAL

1.1 SUMMARY
   A. Section Includes:
      1. Vertical turbine, pressure maintenance pumps.
   B. Related Section:
      1. Division 21 Section "Controllers for Fire-Pump Drivers" for pressure-maintenance-pump controllers.

1.2 PERFORMANCE REQUIREMENTS
   A. Pump Equipment, Accessory, and Specialty Pressure Rating: 175 psig minimum unless higher pressure rating is indicated.

1.3 ACTION SUBMITTALS
   A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, performance curves, electrical characteristics, and furnished specialties and accessories.
   B. Shop Drawings: For pumps, accessories, and specialties. Include plans, elevations, sections, details, and attachments to other work.
      1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
      2. Wiring Diagrams: For power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS
   A. Field quality-control reports.
1.5 CLOSEOUT SUBMITTALS
   A. Operation and maintenance data.

1.6 QUALITY ASSURANCE
   A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.7 COORDINATION
   A. Coordinate sizes and locations of concrete bases with actual equipment provided.

PART 2 - PRODUCTS

2.1 VERTICAL TURBINE, PRESSURE MAINTENANCE PUMPS
   A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      3. Peerless Pump, Inc.
   B. Description: Factory-assembled and -tested, vertical, multistage, open-line-shaft turbine pump as defined in HI 2.1-2.2 and HI 2.3; with pump motor mounted above pump head.
   C. Pump Construction:
      1. Pump Head: Cast iron, for surface discharge, with flange except connections may be threaded in sizes in which flanges are not available.
      2. Pump Head Seal: Stuffing box and stuffing.
      3. Line Shaft: Stainless steel or steel, with corrosion-resistant shaft sleeves.
      4. Line Shaft Bearings: Rubber sleeve, water lubricated.
      5. Line Shaft: Steel.
      7. Impeller Shaft: Monel metal or stainless steel.
      8. Bowl Section: Multiple cast-iron bowls with closed-type bronze or stainless-steel impellers.
      9. Column Pipe: ASTM A 53/A 53M, Schedule 40, galvanized-steel pipe with threaded ends and cast-iron or steel fittings, in sections 10 feet or less, with strainer of cast or fabricated bronze or stainless steel at bottom.
   D. Motor: Single speed with permanently lubricated ball bearings. Comply with requirements in Division 21 Section "Common Motor Requirements for Fire Suppression Equipment."
      1. Power Cord: Factory-connected to motor for field connection to controller and at least [10 feet] <Insert dimension> long.
E. Base: Cast iron or steel with hole for electrical cable.

F. Nameplate: Permanently attached to pump and indicating capacity and characteristics.

G. Capacities and Characteristics:

2. Total Dynamic Head: <Insert feet>.
4. Inlet Column Size: <Insert NPS>.
5. Pump Column Length: <Insert feet>.
6. Outlet Size: <Insert NPS>.
7. Flange: [Class 125] <Insert class>.
8. Suction Head Available at Pump: <Insert feet>.
11. Electrical Characteristics:
   a. Volts: [120] [240] <Insert value>.
   b. Phases: [Single] [Three].
   c. Hertz: [60] <Insert value>.
   d. Full-Load Amperes: <Insert value>.
   e. Minimum Circuit Ampacity: <Insert value>.
   f. Maximum Overcurrent Protection: <Insert amperage>.


2.2 MOTORS

A. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Division 21 Section "Common Motor Requirements for Fire Suppression Equipment."

1. Motor Sizes: Minimum size as indicated; if not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
2. Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Division 26 Sections.

PART 3 - EXECUTION

3.1 EQUIPMENT INSTALLATION

A. NFPA Standard: Comply with NFPA 20 for installation of pressure-maintenance pumps.

B. Base-Mounted Pump Mounting: Install pumps on concrete bases. Comply with requirements for concrete bases specified in Division 03 concrete section.
1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
2. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
4. Install anchor bolts to elevations required for proper attachment to supported equipment.
5. Attach pumps to equipment base using anchor bolts.

C. Install vertical-turbine, pressure-maintenance pumps according to HI 2.4.

3.2 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

B. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

C. Tests and Inspections:

1. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
2. Test and adjust controls and safety. Replace damaged and malfunctioning controls and equipment.

D. Pressure-maintenance pumps will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports.

3.3 ADJUSTING

A. Lubricate pumps as recommended by manufacturer.

B. Set field-adjustable pressure-switch ranges as indicated.
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WMU Design Guidelines Instructions: These guidelines are to be used by the Design Professional to inform the design process and outline WMU-specific desires for all University projects. These guidelines have been edited to reflect WMU preferences, and the intent is for the Design Professional to use this information to guide their normal specifications-writing process. Straying from what is indicated in the guidelines is not prohibited, but shall be discussed with WMU during the development of the project.

SECTION 21 3900 - CONTROLLERS FOR FIRE-PUMP DRIVERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Full-service, reduced-voltage controllers rated 600 V and less.
2. Full-service, [full] [reduced]-voltage controllers rated 600 V and less.
3. Limited-service controllers rated 600 V and less.
4. Controllers for diesel-drive fire pumps.
5. Controllers for pressure-maintenance pumps.
7. Low-suction-shutdown panels.

1.2 DEFINITIONS

A. ATS: Automatic transfer switch(es).
B. ECM: Electronic control module.
C. MCCB: Molded-case circuit breaker.
D. NO: Normally open.
E. PID: Proportional integral derivative.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: For each type of product indicated.

1. Include plans, elevations, sections, and attachment details.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Show tabulations of the following:

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a. Each installed unit's type and details.
b. Enclosure types and details for types other than NEMA 250, Type 2.
c. Factory-installed devices.
d. Nameplate legends.
e. Short-circuit current (withstand) rating of integrated unit.
f. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices.
g. Specified modifications.

4. Include diagrams for power, signal, alarm, control wiring, and pressure-sensing tubing.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified testing agency.

B. Seismic Qualification Certificates: For each type of product indicated, from manufacturer.
   1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
   2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
   3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

C. Product Certificates: For each type of product indicated, from manufacturer.

D. Source quality-control reports.

E. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

B. Operation and Maintenance Data: For each type of product indicated to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 01 7823 "Operation and Maintenance Data," include the following:
   1. Manufacturer's written instructions for setting field-adjustable timers, controls, and status and alarm points.
   2. Manufacturer's written instructions for testing, adjusting, and reprogramming microprocessor-based logic controls.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Indicating Lights: [Two] <Insert number> of each type and color of lens installed; [two] <Insert number> of each type and size of lamp installed.
2. Auxiliary Contacts: [One] <Insert number> for each size and type of magnetic contactor installed.
3. Power Contacts: [Three] <Insert number> for each size and type of magnetic contactor installed.
4. Contactor Coils: [One] <Insert number> for each size and type of magnetic controller installed.
5. Relay Boards: [One] <Insert number> for each size and type of relay board installed.
6. Operator Interface: [One] <Insert number> microprocessor board(s), complete with display and membrane keypad.
7. <Insert extra materials>.

1.7 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of an NRTL.
B. Source Limitations: Obtain fire-pump controllers and all associated equipment from single source or producer.

1.8 FIELD CONDITIONS

A. Environmental Limitations:
   1. Ambient Temperature Rating: Not less than 40 deg F and not exceeding 122 deg F unless otherwise indicated.
   2. Altitude Rating: Not exceeding 6600 feet unless otherwise indicated.

B. Interruption of Existing Electric Service: Notify [Architect] [Construction Manager] [Owner] no fewer than [seven] <Insert number> days in advance of proposed interruption of electric service, and comply with NFPA 70E.

1.9 COORDINATION

A. Coordinate layout and installation of controllers with other construction including conduit, piping, fire-pump equipment, and adjacent surfaces. Maintain required clearances for workspace and equipment access doors and panels. Ensure that controllers are within sight of fire-pump drivers.

B. Coordinate sizes and locations of concrete bases, if needed, with actual equipment provided.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Comply with NFPA 20 and NFPA 70.
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B. IEEE Compliance: Fabricate and test enclosed controllers according to IEEE 344 to withstand seismic forces defined in Section 26 0548.16 "Seismic Controls for Electrical Systems."

C. Seismic Performance: Fire-pump controllers and alarm panels shall withstand the effects of earthquake motions determined according to [ASCE/SEI 7] <Insert requirement>.
   1. The term "withstand" means "the unit will remain in place without separation of any parts when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.2 FULL-SERVICE CONTROLLERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. ASCO Power Technologies, LP; Firetrol Products.

B. General Requirements for Full-Service Controllers:
   1. Comply with NFPA 20 and UL 218.
   2. Comply with NFPA 20 and [UL 218] <Insert standard>.
   3. Combined automatic and nonautomatic operation.
   4. [Combined automatic and nonautomatic] [Nonautomatic] operation.
   5. Factory assembled, wired, and tested; continuous-duty rated.

C. Method of Starting:
   1. [Pressure] [Nonpressure]-switch actuated.
   2. Pressure-switch actuated.
      a. Water-pressure-actuated switch and pressure transducer with independent high- and low-calibrated adjustments responsive to water pressure in fire-suppression piping.
      b. System pressure recorder, electric ac driven, with spring backup.
      c. Programmable minimum-run-time relay to prevent short cycling.
      d. Programmable timer for weekly tests.
   4. Solid-State Controller: Reduced-voltage type.
   5. Emergency Start: Mechanically operated start handle that closes and retains the motor RUN contactor independent of all electric or pressure actuators.

D. Method of Stopping: Automatic and nonautomatic shutdown after automatic starting.

E. Method of Stopping: [Automatic and nonautomatic shutdown after automatic starting] [Nonautomatic].
F. Capacity: Rated for fire-pump-driver horsepower and short-circuit-current (withstand) rating equal to or greater than short-circuit current available at controller location.

G. Method of Isolation and Overcurrent Protection: Interlocked isolating switch and nonthermal MCCB; with a common, externally mounted operating handle, and providing locked-rotor protection.

H. Door-Mounted Operator Interface and Controls:

1. Monitor, display, and control the devices, alarms, functions, and operations listed in NFPA 20 as required for drivers and controller types used.
2. Method of Control and Indication:
   a. Microprocessor-based logic controller, with multiline digital readout.
   b. [Microprocessor-based logic] <Insert logic type> controller, with multiline digital readout.
   c. Membrane keypad.
   d. [Membrane] <Insert keypad type> keypad.
   e. LED alarm and status indicating lights.
   f. [LED] <Insert lamp type> alarm and status indicating lights.

3. Local and Remote Alarm and Status Indications:
   a. Controller power on.
   b. Motor running condition.
   c. Loss-of-line power.
   d. Line-power phase reversal.
   e. Line-power single-phase condition.
   f. <Insert indication>.

4. Audible alarm, with silence push button.
5. Nonautomatic START and STOP push buttons or switches.
6. <Insert function>.

I. Optional Features:

1. Extra Output Contacts:
   a. One NO contact for motor running condition.
   b. [One] <Insert number> NO contact(s) for motor running condition.
   c. One set of contacts for loss-of-line power.
   d. [One] <Insert number> set(s) of contacts for loss-of-line power.
   e. [One] <Insert number> each, Form C contacts for high and low reservoir level.
   f. <Insert contact type>.

2. Local alarm bell.
3. Door-mounted thermal or impact printer for alarm and status logs.
5. <Insert optional feature>.

J. ATS:
1. Complies with NFPA 20, UL 218, and UL 1008.
2. Complies with NFPA 20, [UL 218] <Insert standard>, and [UL 1008] <Insert standard>.
3. Integral with controller as a listed combination fire-pump controller and power transfer switch.
4. Automatically transfers fire-pump controller from normal power supply to alternate power supply in event of power failure.
5. Allows manual transfer from one source to the other.
6. Alternate-Source Isolating and Disconnecting Means: Integral molded-case switch, with an externally mounted operating handle.
7. Alternate-Source Isolating and Disconnecting Means: Mechanically interlocked isolation switch and circuit breaker rated at a minimum of 115 percent of rated motor full-load current, with an externally mounted operating handle; circuit breaker shall be provided with nonthermal sensing, instantaneous-only short-circuit overcurrent protection to comply with available fault currents.
8. Local and Remote Alarm and Status Indications:
   a. Normal source available.
   b. Alternate source available.
   c. In normal position.
   d. In alternate position.
   e. Isolating means open.
   f. <Insert indication>.
9. Audible alarm, with silence push button.
11. Engine test push button.
12. Start generator output contacts.
13. Timer for weekly generator tests.

2.3 LIMITED-SERVICE CONTROLLERS

2.4 STANDALONE ATS

2.5 CONTROLLERS FOR DIESEL-DRIVE FIRE PUMPS

2.6 CONTROLLERS FOR PRESSURE-MAINTENANCE PUMPS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. ASCO Power Technologies, LP; Firetrol Products.

B. General Requirements for Pressure-Maintenance-Pump Controllers:

1. Type: UL 508, factory-assembled, -wired, and -tested, across-the-line controller; for combined automatic and manual operation.
2. Enclosure: UL 508 and NEMA 250, Type 2 for wall-mounting.
3. Factory assembled, wired, and tested.
4. Finish: Manufacturer's standard color paint.

C. Rate controller for scheduled horsepower and include the following:
   1. Fusible disconnect switch.
   2. Pressure switch.
   4. Pilot light.
   5. Running period timer.

2.7 REMOTE ALARM PANELS
A. General Requirements for Remote Alarm Panels: Factory assembled, wired, and tested; and complying with NFPA 20 and UL 218.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. ASCO Power Technologies, LP; Firetrol Products.

C. Supervisory [and Normal] Control Voltage: [120-V ac] [240-V ac] <Insert voltage>; [single] [dual] source.

D. Audible and Visual Alarm and Status Indications:
   1. Driver running.
   2. Loss of phase.
   3. Phase reversal.
   4. Supervised power on.
   5. Common trouble on the controller.
   6. [Common] [Separate] trouble on the controller.
a. <Insert alarm>.
   7. Controller connected to alternate power source.
   8. <Insert indication>.

E. Audible and Visual Alarm and Status Indications: Manufacturer's standard indicating lights; push-to-test.

F. Audible and Visual Alarm and Status Indications: Manufacturer's standard indicating lights; [push-to-test] [non-push-to-test, with separate test push button].
   1. Engine running.
   2. Controller main switch turned to the off or manual position.
   3. Supervised power on.
   4. Common trouble on the controller or engine.
   5. [Common] [Separate] trouble on the controller or engine.
a. <Insert alarm>. 
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7. Controller connected to alternate power source.
8. <Insert indication>.

G. Audible alarm, with silence push button.
H. Pump REMOTE START push button.

2.8 LOW-SUCTION-SHUTDOWN PANELS

2.9 ENCLOSURES

A. Fire-Pump Controllers, ATS, Remote Alarm Panels, and Low-Suction-Shutdown Panels: NEMA 250, to comply with environmental conditions at installed locations and NFPA 20.

1. Indoor, Dry and Clean Locations: Type 1 (IEC IP10).
2. Indoor Locations Subject to Dripping Noncorrosive Liquids: Type 2 (IEC IP11).
3. Outdoor Locations: [Type 3R (IEC IP14)] [Type 4 (IEC IP56)] [Type 4X (IEC IP56)] <Insert type>.
4. Other Wet or Damp, Indoor Locations: [Type 4 (IEC IP56)] [Type 4X (IEC IP56)] <Insert type>.
5. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: Type 12 (IEC IP12).

B. Enclosure Color: Manufacturer’s standard “fire-pump-controller red”.

C. Nameplates: Comply with NFPA 20; complete with capacity, characteristics, approvals, listings, and other pertinent data.

D. Optional Features:

1. Floor stands, 12 inches high, for floor-mounted controllers.
2. Space heater, [120-V ac] [240-V ac] [, with humidistat] [, with thermostat].
3. Tropicalization.
4. <Insert optional feature>.

2.10 SOURCE QUALITY CONTROL

A. Testing: Test and inspect fire-pump controllers according to requirements in NFPA 20 and UL 218.

1. Verification of Performance: Rate controllers according to operation of functions and features specified.

B. Fire-pump controllers will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.
PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and surfaces to receive equipment, with Installer present, for compliance with requirements and other conditions affecting performance.

B. Examine equipment before installation. Reject equipment that is wet or damaged by moisture or mold.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 CONTROLLER INSTALLATION

A. Coordinate installation of controllers with other construction including conduit, piping, fire-pump equipment, and adjacent surfaces. Maintain required clearances for workspace and equipment access doors and panels. Ensure that controllers are within sight of fire-pump drivers.

B. Coordinate sizes and locations of concrete bases with actual equipment provided.

C. Install controllers within sight of their respective drivers.

D. Connect controllers to their dedicated pressure-sensing lines.

E. Wall-Mounting Controllers: Install controllers on walls with disconnect operating handles not higher than 79 inches above finished floor, and bottom of enclosure not less than 12 inches above finished floor unless otherwise indicated. Bolt units to wall or mount on lightweight structural-steel channels bolted to wall. For controllers not on walls, provide freestanding racks complying with Section 26 0529 “Hangers and Supports for Electrical Systems.”

F. Floor-Mounting Controllers: Install controllers on concrete base(s), using floor stands high enough so that the bottom of enclosure cabinet is not less than 12 inches above finished floor. Comply with requirements for concrete bases specified in Section 03 3053 “Miscellaneous Cast-in-Place Concrete.”

1. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base, and anchor into structural concrete floor.
2. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
3. Install anchor bolts to elevations required for proper attachment to supported equipment.

G. Seismic Bracing: Comply with requirements specified in Section 26 0548.16 “Seismic Controls for Electrical Systems.”

H. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

I. Comply with NEMA ICS 15.
3.3 STANDALONE ATS INSTALLATION

3.4 REMOTE ALARM PANEL INSTALLATION

3.5 REMOTE ALARM[ AND LOW-SUCTION-SHUTDOWN] PANEL INSTALLATION
   A. Install panels on walls with tops not higher than 72 inches above finished floor unless otherwise indicated. Bolt units to wall or mount on lightweight structural-steel channels bolted to wall. For ATS not on walls, provide freestanding racks using lightweight structural-steel channels bolted to floor.
   B. Install panels on walls with tops not higher than [72 inches] <Insert height> above finished floor unless otherwise indicated. Bolt units to wall or mount on lightweight structural-steel channels bolted to wall. For ATS not on walls, provide freestanding racks complying with Section 26 0529 “Hangers and Supports for Electrical Systems.”

3.6 POWER WIRING INSTALLATION
   A. Install power wiring between controllers and their services or sources, and between controllers and their drivers. Comply with requirements in NFPA 20, NFPA 70, and Section 26 0519 “Low-Voltage Electrical Power Conductors and Cables.”

3.7 CONTROL AND ALARM WIRING INSTALLATION
   A. Install wiring between controllers and remote devices and facility’s central monitoring system. Comply with requirements in NFPA 20, NFPA 70.
   B. Install wiring between controllers and remote devices[ and facility’s central monitoring system]. Comply with requirements in NFPA 20, NFPA 70, and Section 26 0523 "Control-Voltage Electrical Power Cables."
   C. Install wiring between remote alarm panels and controllers. Comply with requirements in NFPA 20, NFPA 70, and Section 26 0523 "Control-Voltage Electrical Power Cables."
   D. Install wiring between remote alarm[ and low-suction-shutdown] panels and controllers. Comply with requirements in NFPA 20, NFPA 70, and Section 26 0523 "Control-Voltage Electrical Power Cables."
   E. Install wiring between controllers and the building’s fire-alarm system. Comply with requirements specified in Section 28 3111 "Digital, Addressable Fire-Alarm System."
   F. Bundle, train, and support wiring in enclosures.
   G. Connect remote manual and automatic activation devices where applicable.
3.8 IDENTIFICATION

A. Comply with requirements in NFPA 20 for marking fire-pump controllers.

B. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification in NFPA 20 and as specified in Section 26 0553 "Identification for Electrical Systems."

3.9 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Testing Agency: [Owner will engage] [Engage] a qualified testing agency to perform tests and inspections.

C. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

D. Perform the following tests and inspections[ with the assistance of a factory-authorized service representative]:

E. Acceptance Testing Preparation:

1. Inspect and Test Each Component:
   a. Inspect wiring, components, connections, and equipment installations. Test and adjust components and equipment.
   b. Test insulation resistance for each element, component, connecting supply, feeder, and control circuits.
   c. Test continuity of each circuit.

2. Verify and Test Each Electric-Drive Controller:
   a. Verify that voltages at controller locations are within plus 10 or minus 1 percent of motor nameplate rated voltages, with motors off. If outside this range for any motor, notify Engineer and Owner before starting the motor(s).
   b. Verify that voltages at controller locations are within plus 10 or minus 1 percent of motor nameplate rated voltages, with motors off. If outside this range for any motor, notify [Architect] [Construction Manager] [Owner] before starting the motor(s).
   c. Test each motor for proper phase rotation.

3. Operational Test: After electrical circuitry has been energized, start units to confirm proper unit operation.

4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

F. Field Acceptance Tests:
1. Do not begin field acceptance testing until suction piping has been flushed and hydrostatically tested and the certificate for flushing and testing has been submitted to Engineer, Owner and authorities having jurisdiction.

2. Do not begin field acceptance testing until suction piping has been flushed and hydrostatically tested and the certificate for flushing and testing has been submitted to [Architect] [Construction Manager] [Owner] and authorities having jurisdiction.

3. Prior to starting, notify authorities having jurisdiction of the time and place of the acceptance testing.

4. Engage manufacturer's factory-authorized service representative to be present during the testing.

5. Perform field acceptance tests as outlined in NFPA 20.

G. Controllers will be considered defective if they do not pass tests and inspections.

H. Prepare test and inspection reports.

3.10 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

B. [Engage a factory-authorized service representative to perform] [Perform] startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.

2. <Insert startup steps if any>.

3.11 ADJUSTING

A. Adjust controllers to function smoothly and as recommended by manufacturer.

B. Set field-adjustable switches, auxiliary relays, time-delay relays, and timers.

C. Program microprocessors for required operational sequences, status indications, alarms, event recording, and display features. Clear events memory after final acceptance testing and prior to Substantial Completion.

D. Set field-adjustable pressure switches.

3.12 PROTECTION

A. Temporary Heating: Apply temporary heat to maintain temperature according to manufacturer's written instructions until enclosed controllers are ready to be energized and placed into service.

B. Replace controllers whose interiors have been exposed to water or other liquids prior to Substantial Completion.
3.13 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner’s maintenance personnel to adjust, operate, and maintain controllers, remote alarm panels, and to use and reprogram microprocessor-based controls within this equipment.

END OF SECTION 21 3900