



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.
6. Remote alarm panels.
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.
 - 2. Joslyn Clark Corporation.
- 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.
 - 3. Magnetic Controller: Across-the-line, Wye-delta (open transition).
 - 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.
 - 4. Operator Interface Communications Ports: USB, Ethernet, and RS485.
 - 5. <Insert optional feature>.
- J. ATS:



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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.
10. Nonautomatic (manual, nonelectric) means of transfer.
11. Engine test push button.
12. Start generator output contacts.
13. Timer for weekly generator tests.
14. <Insert function>.

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.
 2. Joslyn Clark Corporation.
- 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.
3. Hand-off-auto selector 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.
2. Joslyn Clark Corporation.

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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6. Common pump room trouble.
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.



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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:



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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