SECTION 213900 - CONTROLLERS FOR FIRE-PUMP DRIVERS

Revise this Section by deleting and inserting text to meet Project-specific requirements.

1. GENERAL
	* + 1. RELATED DOCUMENTS
				1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
			2. SUMMARY
				1. Section Includes:

Full-service, [**full**] [**reduced**]-voltage controllers rated 600 V and less.

Limited-service controllers rated 600 V and less.

Controllers for diesel-drive fire pumps.

Controllers for pressure-maintenance pumps.

Remote alarm panels.

Low-suction-shutdown panels.

* + - 1. DEFINITIONS

Retain definition(s) remaining after this Section has been edited.

* + - * 1. ATS: Automatic transfer switch(es).
				2. ECM: Electronic control module.
				3. MCCB: Molded-case circuit breaker.
				4. N.O.: Normally open.
			1. PERFORMANCE REQUIREMENTS

Retain paragraph below with "Seismic Qualification Certificates" Paragraph in "Informational Submittals" Article for projects requiring seismic design. Model building codes and ASCE/SEI 7 establish criteria for buildings subject to earthquake motions. Verify requirements of authorities having jurisdiction.

* + - * 1. Seismic Performance: Fire-pump controllers and alarm panels shall withstand the effects of earthquake motions determined according to [**ASCE/SEI 7**] <**Insert requirement**>.

Retain subparagraph below to define the term "withstand" as it applies to this Project. Definition varies with type of building and occupancy and is critical to valid certification. Option is used for essential facilities where equipment must operate immediately after an earthquake.

The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified [**and the unit will be fully operational after the seismic event**]."

* + - 1. SUBMITTALS
				1. Submittals for this section are subject to the re-evaluation fee identified in Article 4 of the

General Conditions.

* + - * 1. Manufacturer’s installation instructions shall be provided along with product data.
				2. Submittals shall be provided in the order in which they are specified and tabbed (for

combined submittals).

* + - * 1. Product data for each type of product: catalog sheets, specifications, and installation instruction. indicating UL or FM approved for each product.
				2. Shop Drawings: For each type of product indicated. Include dimensioned plans, elevations, sections, details, and attachments to other work, including required clearances and service spaces around controller enclosures.

Show tabulations of the following:

Each installed unit's type and details.

Enclosure types and details for types other than NEMA 250 “Enclosures for Electrical Equipment”, Type 2.

Factory-installed devices.

Nameplate legends.

Short-circuit current (withstand) rating of integrated unit.

Features, characteristics, ratings, and factory settings of individual overcurrent protective devices.

Retain first subparagraph below if specifying modifications in Part 2.

Specified modifications.

Detail equipment assemblies and indicate dimensions, weights, loads, method of field assembly, components, and location and size of each field connection.

Schematic and Connection Diagrams: For power, signal, alarm, and control wiring and for pressure-sensing tubing.

* + - * 1. Qualification Data: For qualified testing agency.

Retain first paragraph below if required by seismic criteria applicable to Project. See ASCE/SEI 7 for certification requirements for equipment and components.

* + - * 1. Seismic Qualification Certificates: For each type of product indicated, from manufacturer.

Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.

Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

Retain first paragraph below for product certificates from manufacturers.

* + - * 1. Product Certificates: For each type of product indicated, from manufacturer.

NFPA 20 requires that "all controllers shall be completely assembled, wired, and tested by the manufacturer before shipment from the factory." Retain first paragraph below for requesting copies of the test reports.

* + - * 1. Manufacturer's factory test reports of fully assembled and tested equipment.
				2. Source quality-control reports.

Retain paragraph below if Contractor is responsible for field quality-control testing and inspecting.

* + - * 1. Field quality-control reports.
			1. CLOSEOUT SUBMITTALS
				1. Operation and Maintenance Data: For each type of product indicated to include in emergency, operation, and maintenance manuals. Include the following:

Manufacturer's written instructions for setting field-adjustable timers, controls, and status and alarm points.

Retain subparagraph below if retaining microprocessor-based logic controls in Part 2.

Manufacturer's written instructions for testing, adjusting, and reprogramming microprocessor-based logic controls.

* + - 1. MAINTENANCE MATERIAL SUBMITTALS

Revise this article to include extra materials that Owner may require or that are critical to the functionality of equipment. This list does not include spare equipment mandated by NFPA 20, such as current limiters. Consult manufacturers for recommended extra materials to retain or insert.

* + - * 1. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

Indicating Lights: [**Two**] <**Insert number**> of each type and color of lens installed; [**two**] <**Insert number**> of each type and size of lamp installed.

Auxiliary Contacts: [**One**] <**Insert number**> for each size and type of magnetic contactor installed.

Power Contacts: [**Three**] <**Insert number**> for each size and type of magnetic contactor installed.

Contactor Coils: [**One**] <**Insert number**> for each size and type of magnetic controller installed.

Relay Boards: [**One**] <**Insert number**> for each size and type of relay board installed.

Operator Interface: [**One**] <**Insert number**> microprocessor board(s), complete with display and membrane keypad.

<**Insert extra materials**>.

* + - 1. QUALITY ASSURANCE

Retain first paragraph below if Contractor selects testing agency or if Contractor is required to provide services of a qualified testing agency in "Field Quality Control" Article.

* + - * 1. Testing Agency Qualifications: Member company of an NRTL.
				2. Source Limitations: Obtain fire-pump controllers and all associated equipment from single source or producer.
				3. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70 “Standard for Electrical Safety in the Workplace”, by a qualified testing agency, and marked for intended location and application.
				4. Comply with standards of authorities having jurisdiction pertaining to materials and installation.
				5. Comply with NFPA 20 “Standard for the Installation of Stationary Pumps for Fire Protection” and NFPA 70 “Standard for Electrical Safety in the Workplace”.
			1. DELIVERY, STORAGE, AND HANDLING

Retain first paragraph below for enclosed sites with conditioned storage spaces. Retain second paragraph if site conditions require supplemental heating to prevent condensation. If retaining second paragraph, retain first option for controllers that do not have factory-installed space heaters; otherwise, retain second option.

* + - * 1. Store controllers indoors in clean, dry space with uniform temperature to prevent condensation. Protect enclosed controllers from exposure to dirt, fumes, water, corrosive substances, and physical damage.
				2. If stored in areas subject to weather, protect controllers from weather, dirt, dust, corrosive substances, and physical damage. Remove loose packing and flammable materials from inside controllers; [**install temporary electric heating, with at least 250 W per controller**] [**connect factory-installed space heaters to temporary electrical service**].
			1. PROJECT CONDITIONS

NFPA 20 lists a minimum temperature for indoor electric-drive fire pumps, i.e., 40 deg F, and defers to manufacturers for temperature ranges for diesel-drive fire pumps. Specify unusual environmental or service conditions in first paragraph below; values indicated are those normally listed in manufacturers' literature for indoor controllers. For equipment installed outdoors, indicate maximum and minimum ambient temperatures and expected humidity range. For additional ambient compensation requirements for circuit breakers, see Editing Instruction No. 3 in the Evaluations.

* + - * 1. Environmental Limitations:

Ambient Temperature Rating: Not less than 40 deg F and not exceeding 122 deg F unless otherwise indicated.

Altitude Rating: Not exceeding 6600 feet unless otherwise indicated.

Retain paragraph below if interruption of existing electric service is required.

* + - * 1. Interruption of Existing Electric Service: Notify [**Director’s Representative]** no fewer than [**seven**] <**Insert number**> days in advance of proposed interruption of electric service and comply with NFPA 70E “Standard for Electrical Safety in the Workplace”.
			1. COORDINATION
				1. 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.

Retain paragraph below if required for base-supported controllers.

* + - * 1. Coordinate sizes and locations of concrete bases with actual equipment provided.
1. PRODUCTS [**Retain or delete to what is applicable**]
	* + 1. FULL-SERVICE CONTROLLERS

Show voltage, size, type, accessories, and enclosure type for each controller on Drawings if not included in the Section Text. See "Specifying Fire-Pump Controllers" Article in the Evaluations for selection considerations.

Standard features vary considerably among manufacturers of full-service, electric-motor-driver, fire-pump controllers; not all features in this article are available for every type and from every listed manufacturer. Features vary according to motor characteristics and the driven-equipment operating criteria. Verify availability and unique characteristics with manufacturers; indicate in the Section Text or show on Drawings those features that apply to each controller. See Editing Instruction No. 2 and "Peculiar Characteristics of Controllers for Electric-Drive Fire Pumps" Article in the Evaluations for additional guidance.See "General Requirements for Fire-Pump Controllers" Article in the Evaluations for restrictions on using nonautomatic controllers.

Some authorities having jurisdiction or the Owner's insurance underwriter may require specific local approvals (e.g., the New York Department of Buildings) or an FM Approvals certification and mark. Insert additional or replacement standards or approvals in first paragraph below.

* + - * 1. General Requirements for Full-Service Controllers:

Comply with NFPA 20 “Standard for the Installation of Stationary Pumps for Fire Protection” and [**UL 218**] <**Insert standard**>.

Listed by an NRTL for electric-motor driver for fire-pump service.

[**Combined automatic and nonautomatic**] [**Nonautomatic**] operation.

Factory assembled, wired, and tested; continuous-duty rated.

Retain subparagraph below for controllers used as means of disconnect and overcurrent protection for the service entrance, outside feeder, or separately derived source.

Service Equipment Label: NRTL labeled for use as service equipment.

* + - * 1. Method of Starting:

Retain first subparagraph below for controllers with automatic operation. Retain first option for controllers actuated by water flow in fire-suppression piping; retain second option for other starting means (e.g., fire-protection equipment, sequential starting), and provide details of starting method here or on Drawings.

[**Pressure**] [**Nonpressure**]-switch actuated.

Retain first two subparagraphs below for automatic operation and pressure-switch actuation.

Water-pressure-actuated switch and pressure transducer with independent high- and low-calibrated adjustments responsive to water pressure in fire-suppression piping.

System pressure recorder, electric ac driven, with spring backup.

Retain first two subparagraphs below for automatic operation.

Programmable minimum-run-time relay to prevent short cycling.

Programmable timer for weekly tests.

Retain one of first two subparagraphs below. First option in first subparagraph is full-voltage starting; remaining options are reduced-voltage starting. See "Full-Voltage Controllers" and "Reduced-Voltage Controllers" articles in the Evaluations for additional guidance.

Magnetic Controller: [**Across-the-line**] [**Autotransformer**] [**Part-winding**] [**Primary-resistor**] [**Wye-delta (open transition)**] [**Wye-delta (closed transition)**] <**Insert type**> type.

Solid-State Controller: [**Reduced-voltage**] <**Insert type**> type.

Emergency Start: Mechanically operated start handle that closes and retains the motor RUN contactor independent of all electric or pressure actuators.

NFPA 20 restricts use of automatic shutdown. Retain first option in first paragraph below if allowed and required to suit Project. See ""General Requirements for Fire-Pump Controllers" Article in the Evaluations if retaining first option.

* + - * 1. Method of Stopping: [**Automatic and nonautomatic shutdown after automatic starting**] [**Nonautomatic**].

Show controller short-circuit current (withstand) rating (or available short-circuit currents) on Drawings. Consider conductor size and distance from substation or supply transformers when calculating short-circuit currents at controllers.

* + - * 1. 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.

Functions in first two paragraphs below are the minimum required by NFPA 20; however, standard features and optional modifications vary considerably among manufacturers of fire-pump controllers; they must be closely coordinated with "General Requirements for Full-Service Controllers," "Method of Starting," and "Method of Stopping" paragraphs in this article. Verify availability and unique characteristics with manufacturers; include in first two paragraphs below or show on Drawings those features that apply to the controllers.

* + - * 1. Method of Isolation and Overcurrent Protection: Interlocked isolating switch and nonthermal MCCB; with a common, externally mounted operating handle, and providing locked-rotor protection.
				2. Door-Mounted Operator Interface and Controls:

Monitor, display, and control the devices, alarms, functions, and operations listed in NFPA 20 “Standard for the Installation of Stationary Pumps for Fire Protection” as required for drivers and controller types used.

Method of Control and Indication:

[**Microprocessor-based logic**] <**Insert logic type**> controller, with multiline digital readout.

[**Membrane**] <**Insert keypad type**> keypad.

[**LED**] <**Insert lamp type**> alarm and status indicating lights.

Local[**and Remote**] Alarm and Status Indications:

Manufacturers offer numerous alarm and status indications and interfaces. Consult manufacturers for availability and types.

Controller power on.

Motor running condition.

Loss-of-line power.

Line-power phase reversal.

Line-power single-phase condition.

<**Insert indication**>.

Audible alarm, with silence push button.

Nonautomatic START and STOP push buttons or switches.

<**Insert function**>.

* + - * 1. Optional Features:

Manufacturers offer numerous optional features for fire-pump controllers. Consult manufacturers for availability and limitations. Retain applicable features in first subparagraph below; insert others to suit Project. Indicate requirements for and quantities of optional features on Drawings if not included here. These features are normally added-cost items.

Extra Output Contacts:

[**One**] <**Insert number**> N.O. contact(s) for motor running condition.

[**One**] <**Insert number**> set(s) of contacts for loss-of-line power.

[**One**] <**Insert number**> each, Form C contacts for high and low reservoir level.

<**Insert contact type**>.

Local alarm bell.

Door-mounted thermal or impact printer for alarm and status logs.

Operator Interface Communications Ports: USB, Ethernet, and RS485.

<**Insert optional feature**>.

Retain paragraph below if an ATS ahead of the fire-pump controller is required and the ATS is integral with the controller. See Editing Instruction No. 4 and "Automatic Transfer Switches" Article in the Evaluations for additional guidance.

* + - * 1. ATS:

Complies with NFPA 20 “Standard for the Installation of Stationary Pumps for Fire Protection”, [**UL 218**] <**Insert standard**>, and [**UL 1008**] <**Insert standard**>.

Integral with controller as a listed combination fire-pump controller and power transfer switch.

Automatically transfers fire-pump controller from normal power supply to alternate power supply in event of power failure.

Allows manual transfer from one source to the other.

Retain one of first two subparagraphs below. Retain first subparagraph if the alternate source is a standby generator with a capacity of less than 225 percent of the motor's full-load current rating. Coordinate with upstream external overcurrent protection.

Alternate-Source Isolating and Disconnecting Means: Integral molded-case switch, with an externally mounted operating handle.

NFPA 20 has separate, more stringent, requirements for an integral ATS if the alternate source is a second utility service, an upstream ATS, or an emergency generator with a capacity exceeding 225 percent of the fire-pump motor's full-load current rating. Retain first subparagraph below if any of these situations apply.

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.

Local[**and Remote**] Alarm and Status Indications:

Manufacturers offer additional local and remote alarm and status indications and interfaces. Consult manufacturers for availability and types.

Normal source available.

Alternate source available.

In normal position.

In alternate position.

Isolating means open.

<**Insert indication**>.

Audible alarm, with silence push button.

Nonautomatic (manual, nonelectric) means of transfer.

Retain first three subparagraphs below if alternate power is from a standby generator.

Engine test push button.

Start generator output contacts.

Timer for weekly generator tests.

<**Insert function**>.

* + - 1. LIMITED-SERVICE CONTROLLERS

Show voltage, size, type, accessories, and enclosure type for each controller on Drawings if not included in the Section Text. See "Specifying Fire-Pump Controllers" Article in the Evaluations for selection considerations.

Standard features vary considerably among manufacturers of limited-service, electric-motor-driver, fire-pump controllers; not all features in this article are available for every type and from every listed manufacturer. Features depend on motor characteristics and driven-equipment operating criteria. Verify availability and unique characteristics with manufacturers; include in the Section Text or show on Drawings those features that apply to each controller. See Editing Instruction No. 2 and "Peculiar Characteristics of Controllers for Electric-Drive Fire Pumps" and "Limited-Service Controllers" articles in the Evaluations for additional guidance.

See "General Requirements for Fire-Pump Controllers" Article in the Evaluations for restrictions on using nonautomatic controllers.

Some authorities having jurisdiction or the Owner's insurance underwriter may require specific local approvals (e.g., the New York Department of Buildings) or an FM Approvals certification and mark. Insert additional or replacement standards or approvals in first paragraph below.

* + - * 1. General Requirements for Limited-Service Controllers:

Comply with NFPA 20 “Standard for the Installation of Stationary Pumps for Fire Protection” and [**UL 218**] <**Insert standard**>.

Listed by an NRTL for electric-motor driver for fire-pump service.

[**Combined automatic and nonautomatic**] [**Nonautomatic**] operation.

Factory assembled, wired, and tested; continuous-duty rated.

Retain subparagraph below for controllers used as means of disconnect and overcurrent protection for the service entrance, outside feeder, or separately derived source.

Service Equipment Label: NRTL labeled for use as service equipment.

* + - * 1. Method of Starting:

Retain first subparagraph below for controllers with automatic operation. Retain first option for controllers actuated by water flow in fire-suppression piping; retain second option for other starting means (e.g., fire-protection equipment, sequential starting), and provide details of starting method here or on Drawings.

[**Pressure**] [**Nonpressure**]-switch actuated.

Retain first two subparagraphs below for automatic operation and pressure-switch actuation.

Water-pressure-actuated switch and pressure transducer with independent high- and low-calibrated adjustments responsive to water pressure in fire-suppression piping.

System pressure recorder, electric ac driven, with spring backup.

Retain first two subparagraphs below for automatic operation.

Programmable minimum-run-time relay to prevent short cycling.

Programmable timer for weekly tests.

Full-voltage, across-the-line starting is the only starting method allowed by NFPA 20 for limited-service controllers.

Across-the-line magnetic controller.

Emergency Start: Mechanically operated start handle that closes and retains the motor RUN contactor independent of all electric or pressure actuators.

NFPA 20 restricts use of automatic shutdown. Retain first option in first paragraph below if allowed and required to suit Project. See "General Requirements for Fire-Pump Controllers" Article in the Evaluations if retaining first option.

* + - * 1. Method of Stopping: [**Automatic and nonautomatic shutdown after automatic starting**] [**Nonautomatic**].

Show controller short-circuit current (withstand) rating (or available short-circuit currents) on Drawings. Consider conductor size and distance from substation or supply transformers when calculating short-circuit currents at controllers.

* + - * 1. 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.

Functions in first two paragraphs below are the minimum required by NFPA 20; however, standard features and optional modifications vary considerably among manufacturers of fire-pump controllers; they must be closely coordinated with "General Requirements for Limited-Service Controllers," "Method of Starting," and "Method of Stopping" paragraphs in this article. Verify availability and unique characteristics with manufacturers; include in first two paragraphs below or show on Drawings those features that apply to the controllers.

* + - * 1. Method of Isolation and Overcurrent Protection: Inverse-time, nonadjustable MCCB, with an externally mounted operating handle.
				2. Door-Mounted Operator Interface and Controls:

Monitor, display, and control the devices, alarms, functions, and operations listed in NFPA 20 “Standard for the Installation of Stationary Pumps for Fire Protection” as required for drivers and controller types used.

Method of Control and Indication:

[**Microprocessor-based logic**] <**Insert logic type**> controller, with multiline [**LCD**] <**Insert display type**> digital readout.

[**Membrane**] <**Insert keypad type**> keypad.

[**LED**] <**Insert lamp type**> alarm and status indicating lights.

Local[**and Remote**] Alarm and Status Indications:

Manufacturers offer numerous alarm and status indications and interfaces. Consult manufacturers for availability and types.

Controller power on.

Motor running condition.

Loss-of-line power.

Line-power phase reversal.

Line-power single-phase condition.

<**Insert indication**>.

Audible alarm, with silence push button.

Nonautomatic START and STOP push buttons.

<**Insert function**>.

* + - * 1. Optional Features:

Manufacturers offer numerous optional features for fire-pump controllers. Consult manufacturers for availability and limitations. Retain applicable features in first subparagraph below; insert others to suit Project. Indicate requirements for and quantities of optional features on Drawings if not included here. These features are normally added-cost items.

Extra Output Contacts:

[**One**] <**Insert number**> N.O. contact(s) for motor running condition.

[**One**] <**Insert number**> set(s) of contacts for loss-of-line power.

[**One**] <**Insert number**> each, Form C contacts for high and low reservoir level.

<**Insert contact type**>.

Local alarm bell.

Door-mounted thermal or impact printer for alarm and status logs.

Operator Interface Communications Ports: USB, Ethernet, and RS485.

<**Insert optional feature**>.

Retain paragraph below if an ATS ahead of the fire-pump controller is required and the ATS is integral with the controller. See Editing Instruction No. 4 and "Automatic Transfer Switches" Article in the Evaluations for additional guidance.

* + - * 1. ATS:

Complies with NFPA 20 “Standard for the Installation of Stationary Pumps for Fire Protection”, [**UL 218**] <**Insert standard**>, and [**UL 1008**] <**Insert standard**>.

Integral with controller as a listed combination fire-pump controller and power transfer switch.

Automatically transfers fire-pump controller from normal power supply to alternate power supply in event of power failure.

Allows manual transfer from one source to the other.

Retain one of first two subparagraphs below. Retain first subparagraph if the alternate source is a standby generator with a capacity of less than 225 percent of the motor's full-load current rating. Coordinate with upstream external overcurrent protection.

Alternate-Source Isolating and Disconnecting Means: Integral molded-case switch, with an externally mounted operating handle.

NFPA 20 has separate, more stringent, requirements for an integral ATS if the alternate source is a second utility service, an upstream ATS, or an emergency generator with a capacity exceeding 225 percent of the fire-pump motor's full-load current rating. Retain first subparagraph below if any of these situations apply.

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.

Local[**and Remote**] Alarm and Status Indications:

Manufacturers offer additional local and remote alarm and status indications and interfaces. Consult manufacturers for availability and types.

Normal source available.

Alternate source available.

In normal position.

In alternate position.

Isolating means open.

<**Insert indication**>.

Audible alarm, with silence push button.

Nonautomatic (manual, nonelectric) means of transfer.

Retain one of first three subparagraphs below if alternate power is from a standby generator.

Engine test push button.

Start generator output contacts.

Timer for weekly generator tests.

<**Insert function**>.

* + - 1. STANDALONE ATS

Retain this article if an ATS ahead of the fire-pump controller is required, and the ATS is external to the controller. Show voltage, size, type, accessories, and enclosure type for each ATS on Drawings if not included in the Section Text. See Editing Instruction No. 4 and "Automatic Transfer Switches" Article in the Evaluations for additional guidance.

Standard features vary considerably among manufacturers of ATS for electric-motor-driver, fire-pump controllers; not all features in this article are available for every type and from every listed manufacturer. Features depend on controller characteristics and driven-equipment operating criteria; they may not be compatible with controllers other than those of same manufacturer. Verify availability, suitability with the specified or existing controller, and unique characteristics with manufacturer; include in the Section Text or show on Drawings those features that apply to each ATS.

Some authorities having jurisdiction or the Owner's insurance underwriter may require specific local approvals (e.g., the New York Department of Buildings) or an FM Approvals certification and mark. Insert additional or replacement standards or approvals in first paragraph below.

NFPA 20 does not allow nonautomatic-only operation for fire-pump controller transfer switches.

* + - * 1. General Requirements for Standalone ATS:

Complies with NFPA 20 “Standard for the Installation of Stationary Pumps for Fire Protection”, [**UL 218**] <**Insert standard**>, and [**UL 1008**] <**Insert standard**>.

Listed by an NRTL for fire-pump service.

Automatic and nonautomatic operation.

Separate from controller and individually listed as a fire-pump-controller power transfer switch.

Automatically transfers fire-pump controller from normal power supply to alternate power supply in event of power failure.

Allows manual transfer from one source to the other; factory assembled, wired, and tested.

Indicate ATS short-circuit current (withstand) rating (or available short-circuit currents) on Drawings. Consider conductor size and distance from substation or supply transformers when calculating short-circuit currents at the ATS.

* + - * 1. Capacity: Rated for fire-pump-driver horsepower and short-circuit-current (withstand) rating equal to or greater than short-circuit current available at ATS location.

Functions in this article are the minimum required by NFPA 20; however, standard features and optional features vary considerably among manufacturers of ATS for fire-pump controllers; they must be closely coordinated with "General Requirements for Full-Service Controllers," "General Requirements for Limited-Service Controllers," "Method of Starting," and "Method of Stopping" paragraphs in electric controller articles. Verify availability and unique characteristics with manufacturers; include in first three paragraphs below or show on Drawings those features that apply to the ATS.

Retain one of first two paragraphs below. Retain first paragraph if the alternate power source is supplied from a standby generator, and coordinate with upstream external overcurrent protection; retain second paragraph for an alternate power source from a second utility. NFPA 20 allows the isolating and overcurrent protection means to be external and upstream of standalone ATS; however, listed manufacturers incorporate the isolating means for alternate power from a standby generator or second utility service.

* + - * 1. Alternate-Source Isolating and Disconnecting Means: Integral molded-case switch, with an externally mounted operating handle.
				2. 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.

Externally mounted operating handle.

Circuit breaker provided with nonthermal sensing, instantaneous-only, short-circuit overcurrent protection.

Equipped with a voltage surge arrester.

* + - * 1. Door-Mounted Operator Interface and Controls:

Monitor, display, and control devices, alarms, functions, and operations listed in NFPA 20 “Standard for the Installation of Stationary Pumps for Fire Protection” as required for drivers and controller types used.

Method of Control and Indication:

[**Microprocessor-based logic**] <**Insert logic type**> controller, with multiline [**LCD**] <**Insert display type**> readout.

[**Membrane**] <**Insert keypad type**> keypad.

[**LED**] <**Insert lamp type**> alarm and status indicating lights.

Local[**and Remote**] Alarm and Status Indications:

Manufacturers offer additional local and remote alarm and status indications and interfaces. Consult manufacturers for availability and types.

Normal source available.

Alternate source available.

In normal position.

In alternate position.

Isolating means open.

<**Insert indication**>.

Audible alarm, with silence push button.

Nonautomatic (manual, nonelectric) means of transfer.

Retain first three subparagraphs below if alternate power is from a standby generator.

Engine test push button.

Start generator output contacts.

Timer for weekly generator tests

<**Insert function**>.

* + - * 1. Optional Features:

Manufacturers offer optional features and enhancements for ATS. Consult manufacturers for availability and limitations. Retain applicable features in first subparagraph below; insert others to suit Project. Indicate requirements for and quantities of optional features on Drawings if not included here. These features are normally added-cost items.

Extra Output Contacts:

[**One**] <**Insert number**> each, Form A; isolating means open.

[**One**] <**Insert number**> each, Form C; in normal or alternate position

<**Insert contact type**>.

Door-mounted thermal or impact printer for alarm and status logs.

Operator Interface Communications Ports: USB, Ethernet, and RS485.

<**Insert optional feature**>.

* + - 1. CONTROLLERS FOR DIESEL-DRIVE FIRE PUMPS

Show voltage, size, type, accessories, and enclosure type for each controller on Drawings if not included in the Section Text. See "Specifying Fire-Pump Controllers" Article in the Evaluations for selection considerations.

Standard features vary considerably among manufacturers of diesel-engine-driver, fire-pump controllers; not all features in this article are available for every type and from every listed manufacturer. Features depend on motor characteristics and driven-equipment operating criteria. Verify availability and unique characteristics with manufacturer; include in the Section Text or show on Drawings those features that apply to each controller. See Editing Instruction No. 2 and "Peculiar Characteristics of Controllers for Diesel-Drive Fire Pumps" Article in the Evaluations for additional guidance.

Some authorities having jurisdiction or the Owner's insurance underwriter may require specific local approvals (e.g., the New York Department of Buildings) or an FM Approvals certification and mark. Insert additional or replacement standards or approvals in first paragraph below.

* + - * 1. General Requirements for Controllers:

Comply with NFPA 20 “Standard for the Installation of Stationary Pumps for Fire Protection” and [**UL 218**] <**Insert standard**>.

Listed by an NRTL for diesel-engine driver for fire-pump service.

[**Combined automatic and nonautomatic**] [**Nonautomatic**] operation.

Factory assembled, wired, and tested.

* + - * 1. Method of Starting:

Retain first subparagraph below for controllers with automatic operation. Retain first option for controllers actuated by water flow in fire-suppression piping; retain second option for other starting means (e.g., fire-protection equipment, sequential starting), and provide details of starting method here or on Drawings.

[**Pressure**] [**Nonpressure**]-switch actuated.

Retain first two subparagraphs below for automatic operation and pressure-switch actuation.

Water-pressure-actuated switch and pressure transducer with independent high- and low-calibrated adjustments responsive to water pressure in fire-suppression piping.

System pressure recorder, electric ac driven, with spring backup.

Retain first two subparagraphs below for automatic operation.

Programmable minimum-run-time relay to prevent short cycling.

Programmable timer for weekly tests.

Only a battery-powered starting method is allowed by NFPA 20 for diesel-engine controllers.

Dual, redundant dc-voltage battery units, with automatic changeover.

Emergency Control: Bypasses all automatic control circuits during manual starting and running.

Automatic engine start on loss of ac power to the controller.

NFPA 20 restricts use of automatic shutdown. Retain first option in first paragraph below if allowed and required to suit Project. See "General Requirements for Fire-Pump Controllers" Article in the Evaluations if retaining first option.

* + - * 1. Method of Stopping: [**Automatic and nonautomatic shutdown after automatic starting**] [**Nonautomatic**].

Functions in first paragraph below are the minimum required by NFPA 20; however, standard features and optional modifications vary considerably among manufacturers of fire-pump controllers; they must be closely coordinated with "General Requirements for Controllers," "Method of Starting," and "Method of Stopping" paragraphs in this article. Verify availability and unique characteristics with manufacturers; include in first paragraph or show on Drawings those features that apply to the controllers.

* + - * 1. Door-Mounted Operator Interface and Controls:

Monitor, display, and control devices, alarms, functions, and operations listed in NFPA 20 “Standard for the Installation of Stationary Pumps for Fire Protection” as required for drivers and controller types used.

Method of Control and Indication:

[**Microprocessor-based logic**] <**Insert logic type**> controller, with multiline [**LCD**] <**Insert display type**> readout.

[**Membrane**] <**Insert keypad type**> keypad.

[**LED**] <**Insert lamp type**> alarm and status indicating lights.

Local[**and Remote**] Alarm and Status Indications:

Manufacturers offer numerous local and remote alarm and status indications and interfaces. Consult manufacturers for availability and types.

Controller power on.

Engine-lubrication-system critically low oil pressure.

Engine-jacket coolant high temperature.

Engine fail-to-start.

Engine overspeed shutdown.

Low fuel level.

Missing or failed battery.

Battery charger failure.

Retain first subparagraph below for engines equipped with pressure-limiting controls.

System overpressure.

Retain first two subparagraphs below for engines equipped with ECM controls.

ECM selector switch in alternate ECM position.

Fuel injector malfunction.

<**Insert indication**>.

NFPA 20 does not allow a silence switch or push button for alarms listed in this article.

Audible alarm.

Nonautomatic START and STOP push buttons or switches.

<**Insert function**>.

* + - * 1. Optional Features:

Manufacturers offer numerous optional features for fire-pump controllers. Consult manufacturers for availability and limitations. Retain applicable optional features in first subparagraph below; insert others to suit Project. Indicate requirements for and quantities of optional features on Drawings if not included here.

Extra Output Contacts:

[**One**] <**Insert number**> Form C contacts for low pump-room temperature.

[**One**] <**Insert number**> each, Form C contacts for high and low fuel levels.

[**One**] <**Insert number**> each, Form C contacts for high and low reservoir levels.

<**Insert contact type**>.

Door-mounted thermal or impact printer for alarm and status logs.

Operator Interface Communications Ports: USB, Ethernet, and RS485.

NFPA 20 allows use of diesel-engine controllers "to supply essential and necessary ac or dc power to operate pump room dampers and engine oil heaters and other associated and required engine equipment only when provided with factory-equipped, dedicated, field terminals and overcurrent protection." Consult manufacturers for availability of optional feature in first subparagraph below; retain if required.

Powered louver contacts.

Powered engine-oil heater contacts.

<**Insert optional feature**>.

* + - * 1. Battery Charger System:

Built-in, independent, dual battery chargers with automatic changeover; [**12-V dc**] [**24-V dc**] for [**lead-acid**] [**nickel-cadmium**] batteries.

Standard: [**UL 1236**] <**Insert standard**>.

* + - 1. CONTROLLERS FOR PRESSURE-MAINTENANCE PUMPS
				1. General Requirements for Pressure-Maintenance-Pump Controllers:

Type: UL 508 “Standard for Safety for Industrial Control Equipment” factory assembled, -wired, and tested, across-the-line; for combined automatic and manual operation.

Enclosure: UL 508 “Standard for Safety for Industrial Control Equipment” and NEMA 250 “Enclosures for Electrical Equipment”, Type 2 for wall-mounting.

Factory assembled, wired, and tested.

Finish: Manufacturer's standard color paint.

* + - * 1. Rate controller for scheduled horsepower and include the following:

Fusible disconnect switch.

Pressure switch.

Hand-off-auto selector switch.

Pilot light.

Running period timer.

* + - 1. REMOTE ALARM PANELS

NFPA 20 requires use of a remote alarm panel located in an area that is constantly attended if the fire-pump controller is in a location that is not constantly attended or supervised. See Editing Instruction No. 2 and "Remote Alarm Panels" Article in the Evaluations for additional guidance.

* + - * 1. General Requirements for Remote Alarm Panels: Comply with NFPA 20 “Standard for the Installation of Stationary Pumps for Fire Protection” and [**UL 218**] <**Insert standard**>; listed by an NRTL for fire-pump service.

Not all features, accessories, and options in this article are available from every listed manufacturer. Verify availability and unique characteristics with manufacturers.

* + - * 1. General Requirements for Remote Alarm Panels: Factory assembled, wired, and tested.

Retain first and last options in first paragraph below if a separate and redundant normal power source is provided to the panel. Not all listed manufacturers offer dual voltage sources.

* + - * 1. Supervisory[**and Normal**] Control Voltage: [**120-V ac**] [**240-V ac**] <**Insert voltage**>; [**single**] [**dual**] source.

Alarms and status indications in first two paragraphs below are the minimum required by NFPA 20; however, standard and optional features vary considerably among manufacturers of remote alarm panels. Verify availability and unique characteristics with manufacturer; include in first paragraph below or show on Drawings those features that apply to each alarm panel. Retain first paragraph for electric controllers; retain second paragraph for diesel-engine controllers.

* + - * 1. Audible and Visual Alarm and Status Indications:

Driver running.

Loss of phase.

Phase reversal.

Supervised power on.

[**Common**] [**Separate**] trouble on the controller.

If retaining second option in subparagraph above, insert list of required alarms in first subparagraph below.

<**Insert alarm**>.

Retain first subparagraph below if power is supplied from multiple sources.

Controller connected to alternate power source.

<**Insert indication**>.

* + - * 1. Audible and Visual Alarm and Status Indications: Manufacturer's standard indicating lights; [**push-to-test**] [**non-push-to-test, with separate test push button**].

Engine running.

Controller main switch turned to the off or manual position.

Supervised power on.

[**Common**] [**Separate**] trouble on the controller or engine.

If retaining second option in subparagraph above, insert list of required alarms in first subparagraph below.

<**Insert alarm**>.

Common pump room trouble.

Retain first subparagraph below if power is supplied from multiple sources.

Controller connected to alternate power source.

<**Insert indication**>.

* + - * 1. Audible alarm, with silence push button.

Retain paragraph below if applicable; this is an optional feature at added cost.

* + - * 1. Pump REMOTE START push button.
			1. LOW-SUCTION-SHUTDOWN PANELS

Although prohibited by NFPA 20, some local laws or authorities having jurisdiction mandate use of low-suction-shutdown panels to inhibit starting and to activate shutdown of automatically controlled fire pumps on low-suction pressure in the municipal water supplies. Consult authorities having jurisdiction for specifics and retain this article only if required by local mandates. Some manufacturers listed in fire-pump-controller articles incorporate this feature into their microprocessor-based controllers as an alternative.

Not all features, accessories, and options in this article are available from every listed manufacturer. Verify availability and unique characteristics with manufacturers. See Editing Instruction No. 2 and "Low-Suction-Shutdown Panels" Article in the Evaluations for additional guidance.

* + - * 1. General Requirements for Low-Suction-Shutdown Panels:

Listed by an NRTL for fire-pump service.

Factory assembled, wired, and tested.

Prevents automatic start of fire pump, and shuts down automatically started fire pump, on low-suction pressure.

[**Automatic**] [**Manual**] reset.

* + - * 1. Operation: [**External contact input**] [**Integral pressure switch**] <**Insert operation**>.

Retain first and last options in first paragraph below if a separate and redundant normal power source is provided to the controller. Not all listed manufacturers offer dual voltage sources.

* + - * 1. Supervisory[**and Normal**] Control Voltage: [**120-V ac**] [**240-V ac**] <**Insert voltage**>; [**single**] [**dual**] source.

Standard and optional features vary considerably among manufacturers of low-suction-shutdown panels. Verify availability and unique characteristics with manufacturer; include in paragraph below or show on Drawings those features that apply to each controller.

* + - * 1. Include audible and visual alarms and status indications, with silence push button, for the following conditions:

Control power available.

Low-suction pressure.

Normal-suction pressure.

<**Insert optional features**>.

* + - 1. ENCLOSURES
				1. Fire-Pump Controllers, ATS, Remote Alarm Panels, and Low-Suction-Shutdown Panels: NEMA 250 “Enclosures for Electrical Equipment”, to comply with environmental conditions at installed locations and NFPA 20 “Standard for the Installation of Stationary Pumps for Fire Protection”.

See "Enclosures" Article in the Evaluations for discussion of enclosure types. Coordinate subparagraphs below with Drawings by identifying the designated areas on plans or by including the required enclosure types. Enclosure materials and finishes may be added to the Section Text. NFPA 20 requires NEMA 250, Type 2 as the minimum allowable enclosure type for indoor controllers and ATS; NEMA 250, Type 1 is allowed for alarm panels. Consult manufacturers for availability of, and limitations on, other than NEMA 250, Type 2 enclosures, especially if retaining "Basis-of-Design Product" Paragraph in other articles.

Retain first subparagraph below only if retaining remote alarm panels.

Indoor, Dry and Clean Locations: [**Type 1 (IEC IP10)**] <**Insert type**>.

Indoor Locations Subject to Dripping Noncorrosive Liquids: [**Type 2 (IEC IP11)**] <**Insert type**>.

Outdoor Locations: [**Type 3R (IEC IP14)**] [**Type 4 (IEC IP56)**] [**Type 4X (IEC IP56)**] <**Insert type**>.

Other Wet or Damp, Indoor Locations: [**Type 4 (IEC IP56)**] [**Type 4X (IEC IP56)**] <**Insert type**>.

Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: Type 12 (IEC IP12).

* + - * 1. Enclosure Color: [**Manufacturer's standard "fire-pump-controller red"**] <**Insert color**>.
				2. Nameplates: Comply with NFPA 20 “Standard for the Installation of Stationary Pumps for Fire Protection”; complete with capacity, characteristics, approvals, listings, and other pertinent data.
				3. Optional Features:

Optional features in subparagraphs below pertain mainly to enclosures for fire-pump controllers; they are also limited in application by controller, enclosure type, and manufacturer. Retain applicable optional features and indicate requirements for and quantities of accessories on Drawings. Consult manufacturers for availability and limitations.

Floor stands, 12 inches high, for floor-mounted controllers.

Space heater, [**120-V ac**] [**240-V ac**] [**, with humidistat**] [**, with thermostat**].

Tropicalization.

<**Insert optional feature**>.

* + - 1. SOURCE QUALITY CONTROL
				1. Testing: Test and inspect fire-pump controllers according to requirements in NFPA 20 “Standard for the Installation of Stationary Pumps for Fire Protection” and [**UL 218**] <**Insert standard**>.

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

* + - * 1. Fire-pump controllers will be considered defective if they do not pass tests and inspections.
				2. Prepare test and inspection reports.
1. EXECUTION
	* + 1. EXAMINATION
				1. Examine areas and surfaces to receive equipment, with Installer present, for compliance with requirements and other conditions affecting performance.
				2. Examine equipment before installation. Reject equipment that is wet or damaged by moisture or mold.
				3. Proceed with installation only after unsatisfactory conditions have been corrected.
			2. CONTROLLER INSTALLATION

NFPA 20 and NFPA 70 define specific installation requirements for fire-pump controllers. See "General Installation Requirements for Fire-Pump Controllers" Article in the Evaluations for additional information.

* + - * 1. Install controllers within sight of their respective drivers.

Retain first paragraph below for controllers actuated by water flow in fire-suppression piping.

* + - * 1. Connect controllers to their dedicated pressure-sensing lines.

Limited-service controllers and small-to-medium-sized, full-service controllers are readily suited for wall mounting. Retain first paragraph below for equipment supported by walls or freestanding racks.

* + - * 1. 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 260529 "Hangers and Supports for Electrical Systems."

Full- and limited-service controllers are available with standard or optional floor stands. Retain first paragraph below for controllers supported on slabs-on-grade.

* + - * 1. Floor-Mounting Controllers: Install controllers on 4-inch nominal-thickness concrete bases, 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 033000 "Cast-in-Place Concrete."**]

Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inchcenters around the full perimeter of concrete base.

For supported equipment, install epoxy-coated anchor bolts that extend through concrete base, and anchor into structural concrete floor.

Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

Install anchor bolts to elevations required for proper attachment to supported equipment.

* + - * 1. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

Retain paragraph below if retaining full- or limited-service, electric-drive controllers in Part 2.

* + - * 1. Comply with NEMA ICS 15.
			1. STANDALONE ATS INSTALLATION

Small-to-medium-sized ATS are readily suited for wall mounting. Retain first paragraph below for equipment supported by walls or freestanding racks.

* + - * 1. Wall-Mounting ATS: Install ATS 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 ATS not on walls, provide freestanding racks complying with Section 260529 "Hangers and Supports for Electrical Systems."

ATS are available with standard or optional floor stands. Retain first paragraph below for ATS supported on slabs-on-grade.

* + - * 1. Floor-Mounting ATS: Install ATS on 4-inch nominal-thickness concrete bases, 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 033000 "Cast-in-Place Concrete."**]

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.

For supported equipment, install epoxy-coated anchor bolts that extend through concrete base, and anchor into structural concrete floor.

Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

Install anchor bolts to elevations required for proper attachment to supported equipment.

* + - * 1. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.
			1. REMOTE ALARM[**AND LOW-SUCTION-SHUTDOWN**] PANEL INSTALLATION

Retain this article if retaining "Remote Alarm Panels" or "Low-Suction-Shutdown Panels" Article in Part 2.

* + - * 1. 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 complying with Section 260529 "Hangers and Supports for Electrical Systems."
			1. POWER WIRING INSTALLATION [**Retain or delete if applicable**]

Retain this article if retaining electric-drive controllers in Part 2. NFPA 20 and NFPA 70 have specific requirements and restrictions on wiring for electric-drive controllers; review these standards before revising this article. See "General Installation Requirements for Fire-Pump Controllers" Article in the Evaluations for restrictions on other wiring systems routed through controllers.

* + - * 1. Install power wiring between controllers and their services or sources, and between controllers and their drivers. Comply with requirements in NFPA 20 “Standard for the Installation of Stationary Pumps for Fire Protection”, NFPA 70 “Standard for Electrical Safety in the Workplace”, and Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
			1. CONTROL AND ALARM WIRING INSTALLATION [**Retain or delete if applicable**]

Retain this article if remote control or remote status indication is required. NFPA 20 and NFPA 70 have specific requirements and restrictions on control and alarm wiring for all fire-pump controllers and associated remote panels; review these standards before revising this article. See "General Installation Requirements for Fire-Pump Controllers" Article in the Evaluations for restrictions on other wiring systems routed through controllers.

* + - * 1. Install wiring between controllers and remote devices[**and facility's central monitoring system**]. Comply with requirements in NFPA 20 “Standard for the Installation of Stationary Pumps for Fire Protection”, NFPA 70 “Standard for Electrical Safety in the Workplace”, and Section 260523 "Control-Voltage Electrical Power Cables."

Retain first paragraph below if retaining remote alarm panels, low-suction-shutdown panels, or both, in Part 2. Retain second paragraph if remote indication at the fire-alarm system is required.

* + - * 1. Install wiring between remote alarm[**and low-suction-shutdown**] panels and controllers. Comply with requirements in NFPA 20 “Standard for the Installation of Stationary Pumps for Fire Protection”, NFPA 70 “Standard for Electrical Safety in the Workplace”, and Section 260523 "Control-Voltage Electrical Power Cables."
				2. Install wiring between controllers and the building's fire-alarm system.
				3. Bundle, train, and support wiring in enclosures.
				4. Connect remote manual and automatic activation devices where applicable.
			1. IDENTIFICATION
				1. Comply with requirements in NFPA 20 “Standard for the Installation of Stationary Pumps for Fire Protection” for marking fire-pump controllers.
				2. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification in NFPA 20 “Standard for the Installation of Stationary Pumps for Fire Protection” and as specified in Section 260553 "Identification for Electrical Systems."
			2. FIELD QUALITY CONTROL

NFPA 20 requires manufacturers of fire-pump controllers and ATS to be present during field acceptance testing regardless of who does the testing. Retain one of first two paragraphs below to identify who shall retain with "Field quality-control reports"

Retain first paragraph below to require a factory-authorized service representative to perform inspections, tests, and adjustments.

* + - * 1. Manufacturer's Field Service: Engage a Company Field Advisor per OGS Spec Section 014216 to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

Retain first paragraph below to require Contractor to perform tests and inspections.

* + - * 1. Perform tests and inspections.

Retain subparagraph below to require a factory-authorized service representative to assist Contractor with inspections, tests, and adjustments.

Manufacturer's Field Service: Engage a Company Field Advisor per OGS Spec Section 014216 to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

Retain first two paragraphs below to describe tests and inspections to be performed.

Field acceptance tests are part of the formal process to verify compliance with NFPA 20; therefore, all pre-acceptance testing preparation should be complete before scheduling the tests for witnessing by authorities having jurisdiction.

* + - * 1. Acceptance Testing Preparation:

Inspect and Test Each Component:

Inspect wiring, components, connections, and equipment installations. Test and adjust components and equipment.

Test insulation resistance for each element, component, connecting supply, feeder, and control circuits.

Test continuity of each circuit.

Retain first subparagraph below if retaining full- or limited-service, electric-drive controllers in Part 2.

Verify and Test Each Electric-Driver Controller:

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 Directors Representativebefore starting the motor(s).

Test each motor for proper phase rotation.

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

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

* + - * 1. Field Acceptance Tests:

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 Directors Representativeand authorities having jurisdiction.

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

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

Perform field acceptance tests as outlined in NFPA 20 “Standard for the Installation of Stationary Pumps for Fire Protection”.

* + - * 1. Controllers will be considered defective if they do not pass tests and inspections.
				2. Prepare test and inspection reports.
			1. STARTUP SERVICE
				1. [**Engage a Company Field Advisor per OGS Spec Section 014216 to perform**] [**Perform**] startup service.

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

<**Insert startup steps if any**>.

* + - 1. ADJUSTING

Retain applicable paragraphs in this article. Coordinate with selections made in Part 2.

* + - * 1. Adjust controllers [**and battery charger systems**] to function smoothly and as recommended by manufacturer.
				2. Set field-adjustable switches, auxiliary relays, time-delay relays, and timers.
				3. 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.
				4. Set field-adjustable pressure switches.
			1. PROTECTION

Retain this article if retaining "Delivery, Storage, and Handling" Article and if retaining space heaters in "Enclosures" Article.

* + - * 1. 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.
				2. Replace controllers whose interiors have been exposed to water or other liquids prior to Substantial Completion.
			1. DEMONSTRATION

Retain applicable options in paragraph below. Coordinate with selections made in Part 2.

* + - * 1. [**Engage a Company Field Advisor per OGS Spec Section 014216 to train**] [**Train**] Facility’s maintenance personnel to adjust, operate, and maintain controllers [**, remote alarm panels**] [**, low-suction-shutdown panels**] [**, and to use and reprogram microprocessor-based controls within this equipment**].

END OF SECTION 213900