SECTION 213116 - DIESEL-DRIVE, CENTRIFUGAL FIRE PUMPS

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:

Retain one of first three subInclude plans, elevations, section, and location of attachments with details incorporating sway bracing, flexibility, clearances, and anchoringparagraphs below.

End-suction fire pumps with diesel-engine drive.

Single-stage, split-case fire pumps with diesel-engine drive.

Multistage, split-case fire pumps with diesel-engine drive.

Fire-pump accessories and specialties.

Flowmeter systems.

* + - 1. SUBMITTALS
				1. Submittals for this section are subject to the re-evaluation fee identified in Article 4 of the General Conditions.
				2. Manufacturer’s installation instructions shall be provided along with product data.
				3. Submittals shall be provided in the order in which they are specified and tabbed (for combined submittals).
				4. Product data for each type of product: catalog sheets, specifications, and installation instruction. indicating UL or FM approved for each product.
				5. Product Certificates: For each type of fire pump, for manufacturer.

Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for fire pump.

Include rated capacities, operating characteristics, certified performance test curves, electrical characteristics, and furnished specialties and accessories.

* + - * 1. Shop Drawings: For each fire pump, diesel engine drives, and fire pump accessories and specialties. As per NFPA 20 “Standard for the Installation of Stationary Pumps for Fire Protection”.

 Including a complete plan and detailed data describing pump, driver, controller, power supply, fittings, suction and discharge connections, and liquid supply conditions.

Include plans, elevations, sections, and mounting and attachment details.

Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

 Detail fabrication and assemblies of fire pumps.

Include diagrams for power, signal, and control wiring.

* + - * 1. For fire pump systems indicated to comply with performance requirements and design documentation criteria. A certified NICET Level III or IV Technician certified in “Fire Pump System Layout” to perform the shop drawings and hydraulic calculations. Those shop drawings and hydraulic calculations shall be signed and stamped by a NYS Registered Professional Fire Protection Engineer to submit**,** or a NYS Registered Professional Fire Protection Engineer shall perform the shop drawings and hydraulic calculation which shall be signed and stamp to submit to the NYS Licensed Designer of Record.
				2. Supervisor’s Qualifications: Certified NICET III or IV Technician for “Fire Pump System Layout” will supervise layout, installation of the system and the testing.
				3. Installer Qualification Data: Persons engaged with the Design and the Installation of the fire pump system work. Shall have a minimum of 5 years while the employ of a company or companies engaged in the installation, inspection, and testing of fire pump systems.

Name of each person who will be performing the work.

Upon request, furnish names and addresses of the required number of similar projects that each person has worked on which meets the experience criteria.

* + - * 1. Certifications:

Welding certificates.

Certified NICET Level III or IV Technician for “Fire Pump System Layout”.

NYS registered Professional Fire Protection Engineer. (minimum 3 years of experience having the ability to assess and design fire pump systems.

* + - * 1. Fire-hydrant flow test report. As per NFPA 13 "Standard for the Installation of Sprinkler Systems”, test shall be conducted no more than 12 months prior to the working plan submittal.
				2. Field Test Reports: Test Certificates and Test Forms to be used for projects. Each report chosen to which is applicable for each project specific. [**Retain or delete if applicable**] [**NFPA 13**-**Contractor’s Material and Test Certificate for Aboveground Piping**] [**NFPA 24** **Contractor’s Material and Test Certificate for Underground Piping**] [**NFPA 20**-**Contractor’s Material and Test Certificate for Fire Pump Systems**] [**NFSA Form** **20A/Centrifugal Fire Pump Acceptance Test Form**] [**NYSDOH Form 1013 Report on Test** **and Maintenance of Backflow Prevention Device]**
				3. Seismic Submittals: [**Retain or delete if applicable] (**Seismic Shop drawings. As per NFPA 13/9.3 and related spec section 210548 “Vibration and Seismic Controls for Fire-Suppression Piping and Equipment”.

Include plans, elevations, section, and location of attachments with details incorporating sway bracing, flexibility, clearances, and anchoring.

Seismic Bracing Calculations.

* + - * 1. Vibration Controls Submittals: [**Retain or delete if applicable**] As per NFPA 13 "Standard for the Installation of Sprinkler Systems” and related spec section 210548.13 “Vibration Controls for Fire-Suppression Piping and Equipment.
				2. Submittals for this section are subject to the re-evaluation fee identified in Article 4 of the General Conditions.

Retain "Seismic Qualification Certificates" Paragraph below if required by seismic criteria applicable to Project. Coordinate with Section 210548 "Vibration and Seismic Controls for Fire-Suppression Piping and Equipment." See ASCE/SEI 7 for certification requirements for equipment and components.

* + - * 1. Seismic Qualification Certificates: For fire pumps, accessories, and components, 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.

* + - * 1. Coordination Drawings: Fire Pump System Layout, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved: Comply with requirements in Section 013350 “Computer Aided Design Coordination Drawings” **[(D & C Master Spec)].**
			1. CLOSEOUT SUBMITTALS
				1. Operation and Maintenance Data: For fire pumps to include in emergency, operation, maintenance manuals, parts list for mechanical and electrical devices, and Publication NFPA-25 Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems. Submit one (1) set of copies to the Director’s Representative and a second set of copies to be inserted into the AS Built Drawing Cabinet located in the Fire Pump Room or Building.
				2. Warranty Information: Providing one-year parts and labor warranty certificate. Submit one copy to the Director’s Representative and provide a second copy to be inserted into the AS Built Drawing Cabinet located in the Fire Pump Room or Building.
				3. As-Built Drawings and Hydraulic Calculations: After final acceptance of the system all drawings and calculations shall have the NICET level III or IV Technician stamp and a NYS Registered Professional Fire Protection Engineer seal and signature. Or a seal and signature by a NYS Registered Professional Fire Protection Engineer. Submit one (1) set of copies to the Director’s Representative as a hard copy electronically and as a .pdf and .dwg. files. Then provide a second set of hard copies to be inserted into the AS Built Drawing Cabinet located in the Fire Pump Room or Building.
				4. As per IFC follow requirements in 901.2.1 Statement of compliance. Before requesting final approval of the installation, the installing contractor shall furnish a written statement to the fire code official that the subject fire protection system has been installed in accordance with approved plans and has been tested in accordance with the manufacture’s specifications and the appropriate installation standard. Any deviation from the design standards shall be noted and copies of the approvals for such deviations shall be attached to the written statement. Submit pdf copy to the Director’s Representative and provide a second hard copy and pdf to be inserted into the AS Built Drawing Cabinet located in the Fire Pump Room or Building.
				5. Field Test Reports: Completed NFPA Test Certificates and Test Forms signed by Installing Contractor and witnessed by Director’s Representative including their signature. Submit all related test reports in pdf to the Director’s Representative and provide the same related test reports in hard copy and pdf to be inserted into the AS Built Drawing Cabinet located in the Fire Pump Room or Building.

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”, NFPA 24 “Contractor’s Material and Test Certificate for Underground Piping”, NFPA 20 “Contractor’s Material and Test Certificate for Fire Pump Systems, NFSA Form 20A/Centrifugal Fire Pump Acceptance Test Form., Manufacturer’s Fire Pump Acceptance Report, and NYSDOH Form 1013 Report on Test and Maintenance of Backflow Prevention Device.

* + - 1. MAINTENANCE MATERIAL SUBMITTALS
				1. An AS Built Drawing Cabinet shall be installed at each project that has a new Fire Pump System, alteration and fit-up which shall be located in the Fire Sprinkler Riser Room. All close out submittals for the project record documents shall be stored in the AS Built Drawing Cabinet.

AS Built Drawing Cabinet:

Rigid 16 gage steel construction/ Red powder coat finish.

Dimensions: 26.35”H x 14.25” W x 4” H.

Full-length, stainless steel piano hinge w/Boston lock

Surface mount w/ wall mount holes.

* + - 1. QUALITY ASSURANCE
				1. Contractor Qualifications:

Contractor responsibilities include layout, fabricating, installing sprinkler systems, and testing. Providing calculations using results of most current fire-hydrant flow test as per NFPA within 12 months prior to start of shop drawing preparation. If given flow test on the contract documents is outdated. Contractor shall perform a present fire-hydrant flow test as per NFPA 291 “Recommended Practice for Water Flow Testing and Marking od Hydrants”.

NICET Level III or IV Technician: Preparation of working plans, calculations, field test reports, and including a NYS Registered Professional Fire Protection Engineer seal and signature on working plans to submit.

NYS Registered Professional Fire Protection Engineer: Preparation of working plans, and calculations with seal and signature on working plans to submit.

Engineering Responsibility: Preparation working plans. Includes design calculations and details for selecting vibration isolators, seismic restraints-sway bracing, seismic separation, flexibility- couplings, clearances, and anchorage. Drawings and calculations signed and sealed by a qualified professional Director’s Representative in New York State.

* + - * 1. Welding Qualifications: Qualify procedures and operators according to 2010 ASME Boiler and Pressure Vessel Code.
			1. FIELD CONDITIONS
				1. Interruption of Existing Sprinkler Service: Do not interrupt sprinkler service to facilities occupied by Director’s Representative or others unless permitted under the following conditions and then only after arranging to provide temporary sprinkler service according to requirements indicated:

Follow the Impairment Procedures as per NFPA 25 “Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems” & NFPA 13 “Standard for the Installation of Sprinkler Systems” standards.

Notify Director’s Representative no fewer than two (2) days in advance of proposed interruption of sprinkler service as per IFC follow requirements in 901.7 Systems out of service. Approved fire watch shall be provided for all occupants left unprotected by the shutdown until the fire protection system has been returned to service.

Before shutting down the sprinkler system to perform the work, notify the Director’s Representative in writing, and the local fire department that the system is to be shut down temporarily. Give schedule which states date and time of proposed shut down and approximate length of time that the system will be out of service. Request instructions for precautions that should be taken during the shutdown period.

Do not shut down system until schedule is approved by the Director’s Representative.

Return the existing system to pre-shutdown operation immediately after Work has been completed. Give written notice to the Director’s Representative that the system has been returned to pre-shutdown operation.

1. PRODUCTS

Manufacturers and products listed in SpecAgent and MasterWorks Paragraph Builder are neither recommended nor endorsed by the AIA or Deltek. Before inserting names, verify that manufacturers and products listed there comply with requirements retained or revised in descriptions and are both available and suitable for the intended applications.

* + - 1. PERFORMANCE REQUIREMENTS
				1. NFPA Compliance: Comply with NFPA 20 “Standard for the Installation of Stationary Pumps for Fire Protection”.

Retain "Seismic Performance" Paragraph below with "Seismic Qualification Certificates" Paragraph in "Informational Submittals" Article for projects requiring seismic design. Delete paragraph if performance requirements are indicated on Drawings. Model building codes and ASCE/SEI 7 establish criteria for buildings subject to earthquake motions. Coordinate requirements with structural engineer.

* + - * 1. Seismic Performance: Fire pumps 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 when subjected to the seismic forces specified[**and the unit will be fully operational after the seismic event]**.”

Component Importance Factor: 1.5.

* + - * 1. Environmental Conditions:

This temperature range usually implies installation indoors in heated space. Coordinate with Drawings.

Ambient Temperature: [**5 to 40 deg C**] [**Minus 15 to plus 40 deg C**].

Delete "Relative Humidity" Subparagraph below for outdoor units.

Relative Humidity: Zero to 95 percent.

Altitude: Sea level to [**1000 feet**] <**Insert altitude**>.

* + - * 1. Pump Equipment, Accessory, and Specialty Pressure Rating: 175 psig minimum unless higher pressure rating is indicated.
				2. 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.
			1. ASSEMBLY DESCRIPTION
				1. Description: Factory-assembled and tested fire-pump and driver unit. The pump shall be hydrostatically tested and run tested prior to shipment. The pump shall be hydrostatically tested at a pressure of not less than one and one-half times the no flow (shut off) head of the pump’s maximum diameter impeller plus the maximum allowable suction head, but in no case not less than 250psi.

Retain "Assembly Attachment to Base" Paragraph below for projects in seismic areas.

* + - * 1. Assembly Attachment to Base: Fabricate mounting base and attachment to fire-pump assembly with reinforcement strong enough to withstand seismic forces defined in Section 230548 "Vibration and Seismic Controls for HVAC" when mounting base is anchored to building structure.
				2. Finish: Red paint applied to factory-assembled and -tested unit before shipping.
				3. NFPA Compliance: Comply with NFPA 20 “Standard for the Installation of Stationary Pumps for Fire Protection”.
			1. END-SUCTION FIRE PUMPS

* + - * 1. [Manufacturers:](http://www.specagent.com/Lookup?ulid=1629) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

[A-C Fire Pump; a Xylem brand](http://www.specagent.com/Lookup?uid=123457164154).

[Patterson Pump Company; a Gorman-Rupp company](http://www.specagent.com/Lookup?uid=123457164155).

[S.A. Armstrong Limited](http://www.specagent.com/Lookup?uid=123457164157).

Approved equivalent.

* + - * 1. Standard: [**UL 448**] <**Insert standard**>, for end-suction pumps for fire service.
				2. Casing: Radially split case, top center-line discharge self-venting cast iron with ASME B16.1 “Gray Iron Pipe Flanges and Flanges Fittings Classes 25, 125 and 250” pipe-flange connections.
				3. Impeller: Cast bronze, statically and dynamically balanced, and keyed to shaft.
				4. Wear Rings: Replaceable bronze.
				5. Shaft and Sleeve: Steel shaft with [**bronze**] [**stainless-steel**] sleeves.

Shaft Bearings: Grease-lubricated, back-to-back thrust ball bearings and one radial roller bearing.

Seals: Stuffing box with minimum of four rings of graphite-impregnated braided yarn and bronze packing gland.

* + - * 1. Mounting: Back pull-out design allowing complete rotating assembly removal without disturbing the casing piping connections. Pump and driver shafts are horizontal, with pump and driver on same base.
				2. Coupling: Flexible and capable of absorbing torsional vibration and shaft misalignment. Include metal coupling guard.
				3. Capacities and Characteristics:

Rated Capacity: <**Insert gpm**>.

Total Rated Head: <**Insert feet or psig**>.

Inlet Flange: [**Class 125**] [**Class 250**] <**Insert class**>.

Outlet Flange: [**Class 125**] [**Class 250**] <**Insert class**>.

Suction Head Available at Pump: <**Insert feet**>.

Engine Horsepower: <**Insert number**> hp.

Engine Speed: <**Insert number**> rpm.

Fuel Tank Capacity: <**Insert gal.**>.

Pump-Start, Pressure-Switch Setting: <**Insert psig**>.

Pump-Stop, Pressure-Switch Setting: <**Insert psig**>.

* + - 1. SINGLE-STAGE, SPLIT-CASE FIRE PUMPS

* + - * 1. [Manufacturers:](http://www.specagent.com/Lookup?ulid=1631) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

[A-C Fire Pump; a Xylem brand](http://www.specagent.com/Lookup?uid=123457164158).

[Patterson Pump Company; a Gorman-Rupp company](http://www.specagent.com/Lookup?uid=123457164159).

[Ruhrpumpen, Inc](http://www.specagent.com/Lookup?uid=123457164162).

Approved equivalent.

* + - * 1. Pump:

Standard: [**UL 448**] <**Insert standard**>, for split-case pumps for fire service.

Casing: Axially split case, cast iron with ASME B16.1 “Gray Iron Pipe Flanges and Flanges Fittings Classes 25, 125 and 250” pipe-flange connections.

Impeller: Double suction, cast bronze, statically and dynamically balanced, and keyed to shaft.

Wear Rings: Replaceable bronze.

Shaft and Sleeve: Alloy-steel shaft with bronze sleeve.

Shaft Bearings: Grease-lubricated ball bearings in cast-iron housing.

Seals: Stuffing box with minimum of four rings of graphite-impregnated braided yarn and bronze packing gland.

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

* + - * 1. Coupling: Flexible and capable of absorbing torsional vibration and shaft misalignment. Include metal coupling guard.
				2. Capacities and Characteristics:

Rated Capacity: <**Insert gpm**>.

Total Rated Head: <**Insert feet or psig**>.

Inlet Flange: [**Class 125**] [**Class 250**] <**Insert class**>.

Outlet Flange: [**Class 125**] [**Class 250**] <**Insert class**>.

Suction Head Available at Pump: <**Insert feet**>.

Engine Horsepower: <**Insert number**> hp.

Engine Speed: <**Insert number**> rpm.

Fuel Tank Capacity: <**Insert gal.**>.

Pump-Start, Pressure-Switch Setting: <**Insert psig**>.

Pump-Stop, Pressure-Switch Setting: <**Insert psig**>.

Rotation [**Clockwise**] [**Counterclockwise**].

* + - 1. MULTISTAGE, SPLIT-CASE FIRE PUMPS

* + - * 1. [Manufacturers:](http://www.specagent.com/Lookup?ulid=1633) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

[A-C Fire Pump; a Xylem brand](http://www.specagent.com/Lookup?uid=123457164165).

[Patterson Pump Company; a Gorman-Rupp company](http://www.specagent.com/Lookup?uid=123457164166).

[Reddy-Buffaloes Pump Company](http://www.specagent.com/Lookup?uid=123457164167).

Approved equivalent.

* + - * 1. Pump:

Standard: [**UL 448**] <**Insert standard**>, for split-case pumps for fire service.

Number Stages: Two.

Casing: Axially split case, cast iron with ASME B16.1 “Gray Iron Pipe Flanges and Flanges Fittings Classes 25, 125 and 250” pipe-flange connections.

Impeller: Double suction, cast bronze, statically and dynamically balanced, and keyed to shaft.

Wear Rings: Replaceable bronze.

Shaft and Sleeve: Alloy-steel shaft with bronze sleeve.

Shaft Bearings: Grease-lubricated ball bearings in cast-iron housing.

Seals: Stuffing box with minimum of four rings of graphite-impregnated braided yarn and bronze packing gland.

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

* + - * 1. Coupling: Flexible and capable of absorbing torsional vibration and shaft misalignment. Include metal coupling guard.
				2. Capacities and Characteristics:

Rated Capacity: <**Insert gpm**>.

Total Rated Head: <**Insert feet or psig**>.

Inlet Flange: [**Class 125**] [**Class 250**] <**Insert class**>.

Outlet Flange: [**Class 125**] [**Class 250**] <**Insert class**>.

Suction Head Available at Pump: <**Insert feet**>.

Engine Horsepower: <**Insert number**> hp.

Engine Speed: <**Insert number**> rpm.

Fuel Tank Capacity: <**Insert gal.**>.

Pump-Start, Pressure-Switch Setting: <**Insert psig**>.

Pump-Stop, Pressure-Switch Setting: <**Insert psig**>.

* + - 1. DIESEL ENGINE
				1. Fuel: Fuel oil, Grade DF-2. Meet manufacturer’s requirements.
				2. Horse Power Rating: Not less than 110 percent of maximum brake horsepower (after derating for temperature and elevation according to NFPA 20 “Standard for the Installation of Stationary Pumps for Fire Protection”).
				3. Emergency Manual Operator: Factory wired for starting and operating standby engine in case of malfunction in main controller or wiring.
				4. Controls:

Adjustable governor.

Over-speed shutdown.

Manual reset, speed switch.

Instrument panel with tachometer, oil pressure gage, water temperature gage, and hour meter.

* + - * 1. Fuel System:

Comply with NFPA 20 “Standard for the Installation of Stationary Pumps for Fire Protection”.

Main Fuel Pump: Mounted on engine. Pump ensures adequate primary fuel flow under starting and load conditions.

Relief-Bypass Valve: Automatically regulates pressure in fuel line and returns excess fuel to source.

Flexible metallic fuel lines.

Inline fuel filter.

Oil pressure safety switch.

Air cleaner.

Engine-driven oil pump.

Enclosed control wiring electric starter with voltage regulator.

Double-Wall  Storage Tank: Size indicated, but not less than required by NFPA 20 “Standard for the Installation of Stationary Pumps for Fire Protection”; with floor legs, direct-reading level gage, and secondary containment tank having capacity at least equal to storage tank.

* + - * 1. Exhaust System:

Piping: ASTM A53/A53M “Standard Specification for Pipe, Steel, Black and Hot-Dipper, Zinc-Coated, Welded and Seamless”, Type E or S, Schedule 40 black steel pipe; ASME B16.9 “Factory-Made Wrought Buttwelding Fittings” weld-type pipe fittings; ASME B16.5 “Pipe Flanges & Flanged Fittings” steel flanges; and ASME B16.21 “Nonmetallic Flat Gaskets for Pipe Flanges” nonmetallic gaskets.

Fabricate double-wall, ventilated thimble from steel pipe.

Flexible exhaust connector.

Industrial exhaust silencer with spark arrestor.

* + - * 1. Rated Engine Speed: 1800 rpm.
				2. Maximum Piston Speed for Four-Cycle Engines: 2250 fpm.
				3. Engine- or Skid-Mounted Lubrication System:

Filter and Strainer: Rated to remove 90 percent of particles 5 micrometers and smaller while passing full flow.

Thermostatic Control Valve: Controls flow in system to maintain optimum oil temperature. Unit shall be capable of full flow and is designed to be fail-safe.

Crankcase Drain: Arranged for complete gravity drainage to an easily removable container with no disassembly and without use of pumps, siphons, special tools, or appliances.

* + - * 1. Coolant Jacket Heater: Electric-immersion type, factory installed in coolant jacket system.

Retain "Cooling System, Factory-Mounted Radiator" or "Cooling System, Remote Radiator" Paragraph below. Coordinate with Drawings. Retain first paragraph for factory-mounted radiator used only on small engines. Retain second for remote radiator.

* + - * 1. Cooling System, Factory-Mounted Radiator:

Factory installed, closed loop, liquid cooled, with radiator factory mounted on fire-pump mounting frame and integral engine-driven coolant pump.

Coolant: Solution of 50 percent ethylene-glycol-based antifreeze and 50 percent water, with anticorrosion additives as recommended by engine manufacturer.

Retain "Size of Radiator" or "Expansion Tank" Subparagraph below. Retain second subparagraph if containment of coolant expansion by radiator is marginal or inadequate. Coordinate with Drawings.

Size of Radiator: Adequate to contain expansion of total system coolant from cold start to 110 percent load condition.

Expansion Tank: Constructed of welded-steel plate and rated to withstand maximum closed-loop coolant system pressure for engine used. Equip with gage glass and petcock.

Temperature Control: Self-contained, thermostatic-control valve modulates coolant flow automatically to maintain optimum constant coolant temperature as recommended by engine manufacturer.

Coolant Hose: Flexible assembly with inside surface of nonporous rubber and outer covering of aging-, ultraviolet-, and abrasion-resistant fabric.

Rating: 50-psig maximum working pressure, with coolant at 180 deg F, and noncollapsible under vacuum.

End Fittings: Flanges or steel pipe nipples with clamps to suit piping and equipment connections.

* + - * 1. Cooling System, Remote Radiator:

Closed loop, liquid cooled, with remote radiator and integral engine-driven coolant pump.

Configuration: [**Vertical**] [**Horizontal**] air discharge.

Radiator Core Tubes: [**Aluminum**] [**Nonferrous-metal construction other than aluminum**].

Retain "Size of Radiator" or "Expansion Tank" Subparagraph below. Retain second subparagraph if containment of coolant expansion by radiator is marginal or inadequate. Coordinate with Drawings.

Size of Radiator: Adequate to contain expansion of total system coolant from cold start to 110 percent load condition.

Expansion Tank: Constructed of welded-steel plate and rated to withstand maximum closed-loop coolant system pressure for engine used. Equip with gage glass and petcock.

Fan: Driven by [**multiple belts from engine shaft**] [**totally enclosed electric motor with sealed bearings**].

Coolant: Solution of 50 percent ethylene-glycol-based antifreeze and 50 percent water, with anticorrosion additives as recommended by engine manufacturer.

Temperature Control: Self-contained, thermostatic-control valve modulates coolant flow automatically to maintain optimum constant coolant temperature as recommended by engine manufacturer.

Retain "Muffler/Silencer, Critical Type"; "Muffler/Silencer, Residential Type"; or "Muffler/Silencer, Industrial Type" Paragraph below.

* + - * 1. Muffler/Silencer, Critical Type: Sized as recommended by engine manufacturer and selected with exhaust piping system to not exceed engine manufacturer's engine backpressure requirements.

Minimum sound attenuation of 25 dB at 500 Hz.

Sound level measured at a distance of 10 feet from exhaust discharge after installation is complete shall be [**85**] <**Insert number**> dBA or less.

* + - * 1. Muffler/Silencer, Residential Type: Sized as recommended by engine manufacturer and selected with exhaust piping system to not exceed engine manufacturer's engine backpressure requirements.

Minimum sound attenuation of 18 dB at 500 Hz.

Sound level measured at a distance of 10 feet from exhaust discharge after installation is complete shall be [**95**] <**Insert number**> dBA or less.

* + - * 1. Muffler/Silencer, Industrial Type: Sized as recommended by engine manufacturer and selected with exhaust piping system to not exceed engine manufacturer's engine backpressure requirements.

Minimum sound attenuation of 12 dB at 500 Hz.

Sound level measured at a distance of 25 feet from exhaust discharge after installation is complete shall be [**87**] <**Insert number**> dBA or less.

Retain second option in "Air-Intake Filter" Paragraph below if filters may not be serviced as often as recommended. If air contaminant level is excessive, consult manufacturers to determine if special filtration of combustion air is needed.

* + - * 1. Air-Intake Filter: [**Standard**] [**Heavy**]-duty, engine-mounted air cleaner with replaceable dry-filter element and "blocked filter" indicator.
				2. Starting System: [**12**] [**24**]-V dc, with negative ground.

Components: Sized so they will not be damaged during a full engine-cranking cycle with ambient temperature at maximum specified in "Performance Requirements" Article.

Cranking Motor: Heavy-duty unit that automatically engages and releases from engine flywheel without binding.

Cranking Cycle: [**60**] <**Insert number**> seconds.

First option in "Battery" Subparagraph below complies with general use. Second is a more conservative rule used for some industrial applications.

Battery: Adequate capacity within ambient temperature range specified in "Performance Requirements" Article to provide specified cranking cycle at least [**twice**] [**three times**] without recharging.

Coordinate "Battery Cable" Subparagraph below with Drawings.

Battery Cable: Size as recommended by engine manufacturer for cable length indicated. Include required interconnecting conductors and connection accessories.

Retain "Battery Compartment" Subparagraph below if compartment is required.

Battery Compartment: Factory fabricated of metal with acid-resistant finish and thermal insulation. Thermostatically controlled heater shall be arranged to maintain battery above 10 deg C regardless of external ambient temperature within range specified in "Performance Requirements" Article. Include accessories required to support and fasten batteries in place.

Battery-Charging Alternator: Factory mounted on engine with solid-state voltage regulation and 35-A minimum continuous rating.

Retain "Battery Charger" Subparagraph below if battery charger is not specified to be integral with transfer switch.

Battery Charger: Current-limiting, automatic-equalizing and float-charging type. Unit shall comply with UL 1236 “Standard for Safety Battery Chargers for Charging Engine-Starter Batteries” and include the following features:

Operation: Equalizing-charging rate of 10 A shall be initiated automatically after battery has lost charge until an adjustable equalizing voltage is achieved at battery terminals. Unit shall then be automatically switched to a lower float-charging mode and shall continue to operate in that mode until battery is discharged again.

Automatic Temperature Compensation: Adjust float and equalize voltages for variations in ambient temperature from minus 40 deg C to plus 60 deg C to prevent overcharging at high temperatures and undercharging at low temperatures.

Automatic Voltage Regulation: Maintain constant output voltage regardless of input voltage variations up to plus or minus 10 percent.

Ammeter and Voltmeter: Flush mounted in door. Meters shall indicate charging rates.

"Safety Functions" Subparagraph below covers sensing for safety indications on control and monitoring panel.

Safety Functions: Sense abnormally low battery voltage and close contacts providing low battery voltage indication on control and monitoring panel. Sense high battery voltage and loss of ac input or dc output of battery charger. Either condition shall close contacts that provide a battery-charger malfunction indication at system control and monitoring panel.

Enclosure and Mounting: NEMA 250 “Enclosures for Electrical Equipment”, Type 1 wall-mounted cabinet.

* + - 1. FIRE-PUMP ACCESSORIES AND SPECIALTIES

Pipe sizes for pump test header, relief valves, and discharge cones as well as number and size of manifold hose valves are set by NFPA 20, so are not required in this article.

* + - * 1. Automatic Air-Release Valves: Comply with NFPA 20 “Standard for the Installation of Stationary Pumps for Fire Protection” for installation in fire-pump casing.

Retain "Circulation Relief Valves" Paragraph below for engines with remote radiators.

* + - * 1. Circulation Relief Valves: UL 1478 “Fire Pump Relief Valves”, bronze or cast iron, spring loaded; for installation in pump-discharge piping.
				2. Inlet Fitting: Eccentric tapered reducer at pump suction inlet.
				3. Outlet Fitting: Concentric tapered reducer at pump-discharge outlet.
				4. Discharge Cone: [**Closed**] [**Open**] [**Closed or open**] type.

Retain "Hose Valve Manifold Assembly" Paragraph below, even if retaining "Flowmeter Systems" Article.

* + - * 1. Hose Valve Manifold Assembly:

Standard: Comply with requirements in NFPA 20 “Standard for the Installation of Stationary Pumps for Fire Protection”.

Header Pipe: ASTM A53/A53M “Standard Specification for Pipe, Steel, Black and Hot-Dipper, Zinc-Coated, Welded and Seamless”, Schedule 40 galvanized steel, with ends threaded according to ASME B1.20.1 “Pipe Threads, General Purpose, Inch”.

Header Pipe Fittings: ASME B16.4 “Gray Iron Threaded Fittings Classes 125 and 250” galvanized cast-iron threaded fittings.

Automatic Drain Valve: Complying with UL 1726 “Automatic Drain Valves for Standpipe Systems”.

Manifold:

Test Connections: Comply with UL 405 “Standard for Fire Department Connection Devices”, except provide outlets without clappers instead of inlets.

Body: [**Flush**] [**Exposed**]-type, brass or ductile iron, with number of outlets required by NFPA 20 “Standard for the Installation of Stationary Pumps for Fire Protection”.

Escutcheon Plate: Polished brass; rectangular.

Hose valves in "Hose Valves" Subparagraph below are typically unnecessary; retain if required.

Hose Valves: UL 668 “Hose Valves for Fire-Protection Service”, bronze, with outlet threaded according to NFPA 1963 “Standard for Fire Hose Connections” and matching local fire-department threads.

Exposed Parts Finish: Polished brass.

Escutcheon Plate Marking: Equivalent to "FIRE PUMP TEST."

* + - 1. FLOWMETER SYSTEMS

* + - * 1. [Manufacturers:](http://www.specagent.com/Lookup?ulid=1640) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

[Fire Research Corp](http://www.specagent.com/Lookup?uid=123457164171).

[Hose Monster company; a HydroFlow Products, Inc. company](http://www.specagent.com/Lookup?uid=123457164173).

[Rosemount; Emerson Electric Co., Automation Solutions](http://www.specagent.com/Lookup?uid=123457164170).

[Victaulic Company](http://www.specagent.com/Lookup?uid=123457164178).

Approved equivalent.

* + - * 1. Description: UL-listed or FM-Approved, fire-pump flowmeter system with capability to indicate flow to not less than 175 percent of fire-pump rated capacity.
				2. Pressure Rating: [**175 psig minimum**] [**250 psig**].
				3. Sensor: Annubar probe, orifice plate, or venturi unless otherwise indicated. Sensor size shall match pipe, tubing, flowmeter, and fittings.

Retain "Permanently Mounted Flowmeter" or "Portable Flowmeter" Subparagraph below.

* + - * 1. Permanently Mounted Flowmeter: Compatible with flow sensor, with dial not less than 4-1/2 inches in diameter. Include bracket or device for wall mounting.

Tubing Package: NPS 1/8 or NPS 1/4 [**soft copper**] [**or**] [**plastic**] tubing with copper or brass fittings and valves.

* + - * 1. Portable Flowmeter: Compatible with flow sensor, with dial not less than 4-1/2 inches in diameter and with two 12-foot- long hoses in carrying case.
			1. FUEL OIL STORAGE
				1. Comply with NFPA 30 “Flammable and Combustible Liquids Code”.
				2. Day Tank: UL 142 “Above-Ground Flammable Liquid Tanks”, freestanding, factory-fabricated fuel tank assembly, with integral, float-controlled transfer pump and the following features:

Containment: Integral rupture basin, with a capacity of 150 percent of nominal capacity of day tank.

Leak Detector: Locate in rupture basin and connect to provide audible and visual alarm in the event of day-tank leak.

Revise hours in "Tank Capacity" Subparagraph below or delete subparagraph and indicate capacity on Drawings. Coordinate with Drawings.

Tank Capacity: [**As recommended by engine manufacturer**] <**Insert gallons**>.

Pump Capacity: Exceeds maximum flow of fuel drawn by engine-mounted fuel supply pump at 110 percent of rated capacity, including fuel returned from engine.

Low-Level Alarm Sensor: Liquid-level device operates alarm contacts at 25 percent of normal fuel level.

Piping Connections: Factory-installed fuel supply and return lines from tank to engine; local fuel fill, vent line, overflow line; and tank drain line with shutoff valve.

* + - * 1. Base-Mounted Fuel Oil Tank: Factory installed and piped, complying with UL 142 fuel oil tank. Features include the following:

Tank level indicator.

Consult tank manufacturers about capacities available for size of set in Project.

Capacity: Fuel for [**eight**] <**Insert number**> hours' continuous operation at 100 percent rated power output.

Vandal-resistant fill cap.

Determine applicable codes and regulations, and coordinate "Containment Provisions" Subparagraph below with Drawings.

Containment Provisions: Comply with requirements of authorities having jurisdiction.

* + - 1. GROUT
				1. Standard: ASTM C1107/C1107M “Standard Specification for Packaged Dry, Hydraulic-Cement Grout”, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
				2. Characteristics: Nonshrink and recommended for interior and exterior applications.
				3. Design Mix: 5000-psi, 28-day compressive strength.
				4. Packaging: Premixed and factory packaged.
			2. SOURCE QUALITY CONTROL
				1. **[Conducted under specific contract**] [**C-Contract**] [**P-Contract**] [**Other**]Acceptance Testing for Underground water service: Flushing and Hydrostatic Tests: Flushing shall occur prior to hydrostatic test and shall meet the Minimum Flow Rates for Flushing Suction Piping as per NFPA 20 “Standard for the Installation of Stationary Pumps for Fire Protection” Table 14.1.1.1. Hydrostatic Test shall follow for suction and discharge piping be tested at not less than 200 psi pressure or at 50 psi in excess of the maximum pressure to be maintained in the system, whichever is greater for 2 hours. Witnessed by Director’s Representative’s representative and AHJ prior to the start of the fire pump acceptance test.
				2. Testing: Test and inspect fire pumps according to UL 448 “Centrifugal Stationary Pumps for Fire-Protection Service” requirements for "Operation Test" and "Manufacturing and Production Tests." Field Acceptance as per NFPA 20 “Standard for the Installation of Stationary Pumps for Fire Protection”. Tests shall have the pump manufacturer, controller manufacturer, or their Company Field Advisor.

Verification of Performance: Rate fire pumps according to UL 448 “Centrifugal Stationary Pumps for Fire-Protection Service”.

* + - * 1. Fire pumps will be considered defective if they do not pass tests and inspections.
				2. Prepare test and inspection reports.
1. EXECUTION
	* + 1. EXAMINATION
				1. Examine equipment bases and anchorage provisions, with Installer present, for compliance with requirements and for conditions affecting performance of fire pumps.
				2. Examine roughing-in for fire-suppression piping systems to verify actual locations of piping connections before fire-pump installation.
				3. Proceed with installation only after unsatisfactory conditions have been corrected.
			2. INSTALLATION
				1. Fire-Pump Installation Standard: Comply with NFPA 20 “Standard for the Installation of Stationary Pumps for Fire Protection” for installation of fire pumps, relief valves, and related components.
				2. Equipment Mounting:

Retain first subparagraph below to require equipment to be installed on cast-in-place concrete equipment bases.

Install fire pumps on cast-in-place concrete equipment base(s).

Attach pumps to equipment base using anchor bolts.

Retain one of two subparagraphs below. Retain first for projects in seismic areas; retain second for projects not in seismic areas. Indicate vibration isolation and seismic-control device type and minimum deflection in supported equipment schedule on Drawings.

Comply with requirements for vibration isolation and seismic control devices specified in Section 210548 "Vibration and Seismic Controls for Fire-Suppression Piping and Equipment."

Comply with requirements for vibration isolation devices specified in Section 210548.13 "Vibration Controls for Fire-Suppression Piping and Equipment."

* + - * 1. Install fire-pump suction and discharge piping equal to or larger than sizes required by NFPA 20 “Standard for the Installation of Stationary Pumps for Fire Protection”.
				2. Support piping and pumps separately, so weight of piping does not rest on pumps.
				3. Install valves that are same size as connecting piping. Comply with requirements for fire-protection valves specified in [**Section 211200 "Fire-Suppression Standpipes."**] [**Section 211313 "Wet-Pipe Sprinkler Systems."**]
				4. Install pressure gages on fire-pump suction and discharge flange pressure-gage tappings. Comply with requirements for pressure gages specified in [**Section 211200 "Fire-Suppression Standpipes."**] [**Section 211313 "Wet-Pipe Sprinkler Systems."**]
				5. Install piping hangers and supports, anchors, valves, gages, and equipment supports according to NFPA 20 “Standard for the Installation of Stationary Pumps for Fire Protection”.
				6. Install fuel system according to NFPA 20 “Standard for the Installation of Stationary Pumps for Fire Protection”.
				7. Install water supply and drain piping for diesel-engine heat exchangers. Extend drain piping from heat exchangers to point of disposal.
				8. Install exhaust-system piping for diesel engines. Extend to point of termination outside structure. Install pipe and fittings with welded joints; install components having flanged connections with gasketed joints.

Retain first paragraph below for long, horizontal exhaust piping.

* + - * 1. Install condensate-drain piping for diesel-engine exhaust system. Extend drain piping from low points of exhaust system to condensate traps and to point of disposal.

Retain first paragraph below if specifying flowmeter systems.

* + - * 1. Install flowmeters and sensors. Install flowmeter-system components and make connections according to NFPA 20 “Standard for the Installation of Stationary Pumps for Fire Protection” and manufacturer's written instructions.
				2. Electrical Wiring: Install electrical devices furnished by equipment manufacturers that are not factory mounted. Furnish copies of manufacturers' wiring diagram submittals to electrical Installer.
				3. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.
			1. ALIGNMENT
				1. Align [**end-suction**] [**and**] [**split-case**] pump and driver shafts after complete unit has been leveled on concrete base, grout has set, and anchor bolts have been tightened.
				2. 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.
				3. Align piping connections.
				4. Align pump and driver shafts for angular and parallel alignment according to ANSI/HI 1.4 “Rotodynamic Centrifugal Pumps for Manuals Describing Installation, Operation, and Maintenance” and to tolerances specified by manufacturer.
			2. CONNECTIONS

Coordinate fire-suppression piping installations and specialty arrangements with schematics on Drawings and with requirements specified in piping systems. If Drawings are explicit enough, these requirements may be reduced or omitted.

* + - * 1. Comply with requirements for piping and valves specified in [**Section 211200 "Fire-Suppression Standpipes."**] [**Section 211313 "Wet-Pipe Sprinkler Systems."**] Drawings indicate general arrangement of piping, fittings, and specialties.
				2. Install piping adjacent to pumps and equipment to allow service and maintenance.
				3. Connect relief-valve discharge to drainage piping or point of discharge.
				4. Connect flowmeter-system meters, sensors, and valves to tubing.
				5. Connect fire pumps to their controllers.
			1. IDENTIFICATION
				1. Identify system components. Comply with requirements for fire-pump marking according to NFPA 20 “Standard for the Installation of Stationary Pumps for Fire Protection” and also complying with the requirements for labeling and identifying equipment, piping, control valves, and drains specified in [**Section 210553 “Identification for Fire-Suppression Piping and Equipment”**.]
			2. FIELD QUALITY CONTROL
				1. Test each fire pump with its controller as a unit. Comply with requirements for diesel-engine-driver fire-pump controllers specified in **[Section 213900 "Controllers for Fire-Pump Drivers."]**

Retain "Manufacturer's Field Service" Paragraph below to require a factory-authorized service representative to perform tests and inspections.

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

Retain "Perform the following tests and inspections" Paragraph below to require Contractor to perform tests and inspections. Fire-pump-driver controllers will have to be installed and operational for these tests.

* + - * 1. Perform the following tests and inspections [**with the assistance of a Company Field Advisor per OGS Spec Section 014216**]:

After installing components, assemblies, and equipment, including controller, test for compliance with requirements.

Test according to NFPA 20 “Standard for the Installation of Stationary Pumps for Fire Protection” for acceptance and performance testing.

Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.

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

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

* + - * 1. Components, assemblies, and equipment will be considered defective if they do not pass tests and inspections.
				2. Prepare test and inspection reports.

Arrange for disposal of large amounts of water if fire-pump test water must be wasted.

* + - * 1. 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 Director’s Representative.
			1. STARTUP SERVICE
				1. Engage a Company field advisor per OGS Spec Section 014216 to perform startup service.

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

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

* + - 1. DEMONSTRATION
				1. Engage a Company Field Advisor per OGS Spec Section 014216 to train Facility’s maintenance personnel to adjust, operate, and maintain fire pumps.

END OF SECTION 213116