

SECTION 213115 - FIRE PUMP ASSEMBLIES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section specifies fire pumps, including but not limited to requirements for system components below:
1. Drive unit (diesel engine).
 2. Fire Pump.
 3. Pump controllers.
 4. Fuel tank.
 5. Batteries with charger.
 6. Flow meter.
 7. Skid assembly.
 8. Piping.
 9. Electrical/electronic control wiring.
- B. Fire Protection Water Storage Tank: See Drawings for individual water storage tank for dedicated fire protection purposes.
- C. Related Sections: Comply with applicable requirements of other Sections for work of this Section, and interfaces of related work of other Sections.
1. Division 01 Sections "Start-up and Commissioning" and "Demonstration and Training."
 2. Division 03 Section "Cast-in-Place Concrete."
 3. Division 09 Section "High Performance Coatings."
 4. Division 09 Section "Painting."
 5. Division 10 Section "Metal Storage Shelving" for lockable cabinet for spare parts.
 6. Division 21 Sections for sprinkler installation, and for labeling, identification, and signage requirements.
 7. Division 26 Sections for electrical provisions.
 8. Division 28 Section "Addressable Fire Alarm Systems."

1.2 STANDARDS

- A. General: Comply with the following industry standards, representing the latest edition applicable to the OBO criteria version applicable to the Project. These standards contain provisions which are explicitly applicable to work of this Section, as well as other standards identified in this Section.
1. Codes adopted by Overseas Buildings Operations as identified in Chapter 1 of the OBO Building Code. The adopted codes include the OBO Electrical Code (NFPA 70, "National Electrical Code" as amended by OBO).
 2. "Approval Guide" by Factory Mutual (FM).

3. "Fire Protection Equipment Directory" by Underwriters Laboratories, Inc. (UL).
4. Standards by the National Fire Protection Association (NFPA), including the following:
 - a. 2007 NFPA 13, Installation of Sprinkler Systems.
 - b. 2007 NFPA 20, Installation of Stationary Pumps for Fire Protection.
 - c. 2003 NFPA 22, Water Tanks for Private Fire Protection.
 - d. NFPA 24, Installation of Private Fire Service Mains and Their Appurtenances.
 - e. 2002 NFPA 25, Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems.
 - f. NFPA 37, Stationary Combustion Engines and Gas Turbines.
 - g. 2007 NFPA 72, National Fire Alarm Code.

1.3 PERFORMANCE REQUIREMENTS

- A. General: Provide skid-mounted, pre-fabricated, horizontally mounted fire pump assembly which is arranged and performs operationally in accordance with provisions of this Section, including each "Fire Pump Assembly Data Sheet."

1.4 SUBMITTALS

- A. Product Data: For each fire pump prefabricated assembly, submit product data to include, but not limited to, the following prepared information:
 1. 200mm x 250 mm (8" x 10") colored glossy photographs of each assembly from previously produced equivalent, if not identical assemblies.
 2. Specific pump certified performance curves for each fire pump. Record head developed, pump efficiency, and brake horsepower required for full range of operation.
 3. In addition to quantities required by Division 01 Section "Closeout Procedures," submit two copies of printed product literature for each of the principal component and sub-components installed in the assembly covering recommended installation, testing, operation, maintenance, trouble-shooting, special tools, service, spare parts, and similar user need-to-know information. Include base price lists, and ordering information for all replaceable parts. Include approved copy of factory pump curve, and drafts of field operating instructions.
- B. Shop Drawings: Show installation of each fire pump assembly with overall layout of service lines and assembly location at not less than 1:20 scale, fully dimensioned, with each principal element of unit indicated. Include marked plans, elevations, sequencing, and electrical/electronic wiring diagrammatically with circuit diagrams. Include separate plan of fabricated skid framing. List part numbers and weights of entire assembly.
- C. Hydraulic Calculations: Calculations indicating suction supply requirements, elevations, distance, fittings, pipe material, valves, static pressure, residual pressure, velocity, hydraulic reference points, and pump size. Approval for suction line installation will be denied until calculations are submitted. Failure to comply may result in excavation, and removal of installed suction piping at Contractor's expense.
- D. Seismic Design Data: Pump manufacturer shall provide documentation that fire pump package, including all piping, day tank, controller and other equipment, has been analyzed to be designed

and constructed to withstand a earthquake of force identified in the Article on "Quality Assurance." Manufacturer shall document that entire package will withstand earthquake according to seismic design requirements identified in Article on "Quality Assurance "Factory Test Procedures: Submit pump manufacturer's test procedure for approval prior to testing.

- E. Field Quality Control Test Data: Following installation of work in this Section, including field testing of fire pump assembly performances, submit field test report and certified statement of compliance with requirements signed by fire pump manufacturer's representative and installing contractor. Include markup of each previously certified pump curve sheet, recording start-up field test data for the installation. Indicate performance compliances for each primary component of the assembly in field test reports and in certified compliance statements. Comply with Project Director/COR and/or OBO/OPS/FIR requests.
- F. Operation and Maintenance Manuals: After submitted quality control data has been accepted by the Project Director/COR and OBO/OPS/FIR, prepare and submit updated operation and maintenance manuals to OBO/OPS/FIR designated acceptance representative through the Project Director/COR for every component of installed fire pump assemblies in titled/indexed loose-leaf binders. Include product data as specified in this Article, and all final adjustments/settings, and/or changes specific to contract installation upon completion and acceptance testing. Include complete spare parts listings, including price and source information for items specified in the Article on "Spare Parts." Identify recommended spare parts inventory by manufacturer, as well as required spare parts inventory listed by OBO/OPS/FIR in Article on "Spare Parts," indicating stock/quantity listing for expendable items, and every component of fire pump assemblies for Government's inventory of replacement materials and parts. Manuals shall contain one laminated set each of abbreviated and emergency instruction information placards as posted on controller(s).
- G. Warranties: Properly executed product warranties from manufacturer of principal components in assembly; both as required by these Specifications, and as noted to be available by published product literature.

1.5 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Manufacturer of fire pump assembly shall produce package system at their facility, and maintain ISO 9001 Quality Certification. Manufacturer must provide same-day, technical point of contact/response for inquiries by the Government from within United States and from OBO/OPS/FIR personnel on tour of duty (TDY) around the world.
- B. Manufacturer's equipment, design, shop drawings and equipment submittals are required to be sourced from the United States. Local sourcing is not permitted without specific authorization in writing from Project Director/COR and OBO/OPS/FIR.
- C. Pump start-up shall be supervised by pump manufacturer's qualified representative.
- D. Provide permanent labels on components of equipment, recording approval stamps, recorded listings, recognized ratings, and other markings to show compliance with applicable standards by NFPA, UL, MSS, NEMA, and other trade associations.

- E. Systems Testing: Manufacturer shall perform both factory testing and start-up/field testing of fire pump assembly operations in accordance with NFPA 20. Both tests are required to be witnessed by OBO/OPS/FIR.
- F. Seismic Design: Pump manufacturer shall design fire pump package, including all piping, day tank, controller and other equipment, according to the seismic design requirements in the Chapter 16 of the OBO Building Code. Brace and design package in accordance with requirements of NFPA 13 and NFPA 20. The Seismic Design Category for any Building is "A".

1.6 COORDINATION

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

1.7 DELIVERY, STORAGE, AND HANDLING

- A. General: Fabricate structural steel skid unit, and assemble fire pump assembly components on skid unit with sufficient strength to withstand shipping and handling stresses as well as operational stresses. Equip skid unit with suitable hoisting "eyes", and similar devices for accommodation of hoisting slings and other handling methods. Handle assembled unit in compliance with manufacturers' instructions and recommendations for rigging and hoisting.
 - 1. Preparation of Unit: After completion of factory test procedure for assembled unit, drain water and fuel from assembly, and dry entire unit. Treat bare steel/iron surfaces, internal and external, with rust-inhibiting coating of light oil or similar easily removed harmless substances. Package assembly components for overseas shipment in manner that will exclude moisture intrusion, and prevent corrosion of metal parts. Protect equipment, piping flanges, nozzles, and other openings or connections, and protect machines against intrusion of sand and other foreign matter. Plastic inserts/flange covers into the pipe ends is not acceptable; bolted wooden flange covers are acceptable.
 - 2. Store and ship packaged/protected fire pump assemblies in clean, airtight, moisture resistant, durable shipping container, and retain in dry location at all times.

1.8 WARRANTY

- A. Manufacturer's Special Product warranty: Manufacturer of fire pump assemblies shall provide special product warranty for period of one year after final acceptance testing by manufacturers' representative, which is witnessed by OBO/OPS/FIR. Warranty must be in writing, and be presented to the Project Director/COR upon final pump acceptance by Project Director/COR and OBO/OPS/FIR.

1.9 SPARE PARTS

- A. Initial Spare Parts Stock: For each required fire pump assembly and controller with an initial stock of expendable items required for two years of service, specific maintenance materials, and spare parts identified below by OBO/OPS FIR. In addition, supplement that stock with recommended spare parts inventory by manufacturer; where the two lists are identical provide the larger of the quantities recommended. Include not less than the following categories/quantities of materials:

1. Stock:

- a. One complete engine and pump rebuild gasket set, gasket material, seals and O-rings; for diesel only.
- b. Two complete sets of engine filter and engine filter O-rings (in addition to O-rings in rebuild kits); for diesel only.
- c. 38 L (10 gallons) engine oil as recommended by engine manufacturer. One set of drive belts; for diesel only.
- d. Ten indicator light bulbs.
- e. Three each type relay and diode.
- f. One battery charge card; for diesel only.
- g. One crank control; for diesel only.
- h. One voltage sensing unit.
- i. One solenoid drain valve.
- j. Two complete sets of all fuses for fire pump and jockey pump controller.
- k. Two 0-2500 KPa (0-300 psi) liquid filled gauges.
- l. One each jockey pump pressure switch and fire pump pressure switch.

2. Storage: Store spare parts inventory in separate, designated lockable storage cabinet specified in Division 10 Section "Metal Storage Shelving" which is attached to, or located adjacent to, the fire pump assembly, and located in fire pump room. Manufacturer shall determine size of cabinet necessary to store initial spare parts. Parts shall be individually labeled and packaged to resist environment in extended storage. Place laminated parts list, with both corresponding manufacturers' part numbers as well as manufacturers' telephone and fax numbers and ordering information, permanently attached inside of same cabinet. Fire pump package will not be accepted unless this requirement is complete.

1.10 MAINTENANCE AND OPERATION

- A. General: Following completion of installation, start-up, field testing, and acceptance of fire pump assemblies on project site, and through remainder of project construction time, provide continued maintenance, and scheduled weekly automatic testing and/or emergency operational readiness of units; comply with instructions and recommendations of the manufacturer. Operate units weekly in accordance with NFPA 25.

PART 2 - PRODUCTS

2.1 CENTRIFUGAL FIRE PUMPS

- A. Description, General: UL 448, factory-assembled and -tested, **diesel** drive, centrifugal fire pumps capable of furnishing not less than 150 percent of rated capacity at not less than 65 percent of total rated head and with shutoff head limited to 140 percent of total rated head.
1. Finish: Manufacturer's standard red paint applied to factory-assembled and -tested unit before shipping.
 2. Nameplate: Complete with capacities, characteristics, and other pertinent data.
- B. Fabricate base and attachment to fire pumps, pressure-maintenance pumps, and controllers with reinforcement to resist movement of pumps and controllers during a seismic event when their bases are anchored to building structure.
- C. Single-Stage, Horizontally Mounted, Split-Case Fire Pumps: Single-suction type with pump and driver mounted on same base and connected with coupling.
1. Pump: Axially split cast-iron casing with suction and discharge flanges machined to ASME B16.1, Class 125 dimensions, unless otherwise indicated.
 - a. Impeller: Cast bronze of construction to match fire pump, statically and dynamically balanced, and keyed to shaft.
 - b. Wear Rings: Replaceable, bronze.
 - c. Shaft and Sleeve: Steel shaft with bronze sleeve.
 - 1) Shaft Bearings: Grease-lubricated ball bearings in cast-iron housing.
 - 2) Seals: Stuffing box with minimum of four rings of graphite-impregnated braided yarn and bronze packing gland.
 2. Coupling: Flexible and capable of absorbing tensional vibration and shaft misalignment. Include metal coupling guard.
 3. Driver: Diesel Engine or UL-listed, NEMA MG 1, open dripproof, squirrel-cage, induction motor complying with NFPA 20 and NFPA 70. Include wiring compatible with controller used.
- D. Fire-Pump Characteristics and Specialty Data:
1. Fire-Pump Plan No.: **Primary Fire-Pump in the UTL**
 - a. Rated Capacity: **5,678.12 LPM**
 - b. Total Churn Pressure: **1,069 kPa**
 - c. Outlet Flange Class: 125.
 2. Skid: No greater than 4450mm x 2300mm (175-inches x 90-inches).
 3. Speed: Same as driver.
 4. Churn pressure shall not exceed 1,200 kPa/sq. m (175 psi). Do not use high pressure pumps without written approval from OBO/OPS/FIR through the Project Director/COR.
 5. **Altitude: 91.44 m**

6. Ambient Temperature: 39.44 C

2.2 FIRE-PUMP CONTROLLERS

A. Fire-Pump Controllers, General: UL 218 and NFPA 20; listed for pump driver, fire-pump service and service entrance; combined automatic and manual operation; factory assembled and wired; and factory tested for capacities and electrical characteristics. Equip controller with capability/means to download event history onto easily removable media without use of laptop or serial port.

1. Rate controllers for scheduled fire-pump horsepower and short-circuit withstand rating at least equal to short-circuit current available at controller location. Take into account cable size and distance from substation or supply transformers.
2. Enclosure: UL 50, NEMA Type 4 (minimum), drip proof, indoor, unless special-purpose enclosure is indicated. Include manufacturer's standard red paint applied to factory-assembled and -tested unit before shipping.
3. Controls, devices, alarms, functions, and operations listed in NFPA 20 as required for drivers and controller types used, and specific items listed.
 - a. Isolating means and circuit breaker.
 - b. "Power on" pilot lamp.
 - c. Visual and Audio Alarms: Provide the following:
 - 1) Critically low oil pressure in lubrication system. Controller shall provide means for testing position of pressure switch contacts without causing trouble alarms.
 - 2) High engine jacket coolant temperature.
 - 3) Failure of engine to start automatically.
 - 4) Shutdown from overspeed.
 - 5) Battery failure or missing battery. Provide each controller with separate visible indicator for each battery.
 - 6) Battery Charger Failure: Provide each controller separate visible indicator for battery charger failure; they shall not require audible alarm for battery charger failure.
 - 7) Low Fuel Level: Alarm at two-thirds tank capacity.
 - 8) Switch in automatic.
 - 9) Low reservoir (two inputs).
 - 10) Fuel spill.
 - d. Automatic and manual operation, with minimum run-time relay to prevent short cycling.
 - e. Water-pressure-actuated switch with independent high and low calibrated adjustments responsive to water pressure in fire-suppression piping.
 - f. Automatic and manual shutdown.
 - g. System pressure recorder, electric ac driven with spring backup.
 - h. Remote alarms: Provide the following:
 - 1) Engine is running (separate signal).
 - 2) Controller main switch has been turned to off or manual position (separate signal).

- 3) Trouble on controller or engine.
 - 4) Water Level Monitoring: Low water level in fire protection water supply tank.
 - 5) Diesel Fuel Oil Tank Monitoring: Low fuel oil level in fire pump fuel oil storage tank.
4. Nameplate: Complete with capacity, characteristics, approvals and listings, and other pertinent data.
 5. Controller Sensing Pipes: Fabricate pipe and fittings according to NFPA 20 with nonferrous-metal sensing piping, NPS 1/2 (DN 15), with globe valves for testing controller mechanism from system to pump controller as indicated. Include bronze check valve with 3/32-inch (2.4-mm) orifice in clapper or ground-face union with noncorrosive diaphragm having 3/32-inch (2.4-mm) orifice.

2.3 PRESSURE GAGES – OIL FILLED

- A. Description: Oil-filled only permitted. UL 393, 90- to 115- mm (3-1/2- to 4-1/2-inch-) diameter dial. For gauge ranges, see Paragraph on “Suction and Discharge Gauges” in Article on “Components” below. Include caption "WATER" on dial face.

2.4 COMPONENTS

- A. Include the following, in addition to primary components (i.e., fire pump, drive unit, skid assembly, and internal-to-package piping and electrical/electronic control wiring as applicable for each unit as required):
 1. Jockey Pump Relief Valve: Equip jockey pump with pressure relief valve on discharge side. Install pressure relief valves after discharge side of pump and before system check valve. It shall be UL listed and/or FM rated, and no smaller than 20 mm (3/4 inch). It shall be visibly piped to open floor drain so flow can be regulated and adjusted. Drain line shall be piped of non-corrosive material.
 2. Pump Casing Relief Valve: Equip pump casings with automatic air relief valve.
 3. Suction and Discharge Gauges: Provide suction and discharge gauges, Ashcroft mfg., or equal with 90 mm (3-1/2 inch) dials on fire pump, and having -250 to 830 KPa (-30 to 100 psi) suction, and 0 to 2500 KPa (0-300 psi) discharge. Suction and pressure gauges shall be liquid filled and piped so they can be readily viewed by operator from fire pump controller. Gauges shall have brass ballcock to facilitate gauge maintenance. Adjust suction gauge rating if municipal bypass is provided.
 4. Controller Sensing Line Gauge: Fire pump and jockey pump controller sensing lines shall have one each 0-2500 KPa (0-300 psi) liquid filled gauge, Ashcroft mfg., or equal, piped with brass ballcock 300 mm (12 inches) above the piping entrance to their respective enclosures.
 5. Discharge Piping Gauge: Fire pump discharge piping shall have 0-2500 KPa (0-300 psi) liquid filled gauge, Ashcroft mfg., or equal, with brass ballcock located on discharge, after discharge check valve and flow meter by-pass, and at furthest point of pump manufacturers discharge piping.
 6. Discharge Piping Drain Valve: Fire pump discharge piping shall have 25 mm (1 inch) drain valve with 25 mm (1 inch) plug, located at furthest point of fire pump manufacturers' discharge piping.

7. Drain Lines: Drains located on fire pump package (including, but not limited to, fire pump packing bowls, fire pump and jockey pump controller sensing line drains, and 25 mm (1 inch) drain line on furthest point of fire pump discharge piping) shall be piped to common 40 mm (1-1/2 inch) galvanized pipe header, piped to edge of skid, and ready for Contractor's piping to floor drain. Each drain branch line shall have union for maintenance, and shall be piped above level of properly grouted skid, and substantially supported. Galvanized piping from fire pump packing bowls shall be 25 mm (1 inch), and have check valve installed to prevent backflow through bowls during substantial discharge of other lines. All drain lines shall be of non-corrosive material.
8. Discharge Outlet and Suction Inlet: Provide tapered concentric increaser at discharge outlet and tapered eccentric reducer at suction inlet. Both shall be flanged and with straight tapers; weld reducers/increasers are not acceptable.
9. Main Relief Valve Piping: Main relief valve, when diesel driven unit, shall begin operation at 1,200 kPa (175 psi) and be piped back to reservoir unless otherwise approved by Project Director/COR and OBO/OPS/FIR. If reservoir is potable water source, main relief shall be piped to alternative non-potable reservoir in accordance with the OBO Mechanical Code, or provide drain that is sized to accept full flow from main relief valve. Piping shall have sight glass of type with removable window and indicator ball. Relief valve discharge piping shall have check valve installed if piping is returned below expected reservoir water level, or piping is installed in such manner as to trap 1.3 L (five gallons) or more water. If trapped water is present, install 25 mm (1 inch) drain valve after relief valve and before check valve (to facilitate maintenance) on sight glass or relief valve. If 25-mm (1 inch) drain is installed, it shall be piped to common skid drain header. If pump drivers are electric, pipe typical 20-mm (3/4 inch) relief valve to drain header, and equip with sight glass.
10. Name Plates: Nameplates on fire pump skid package and components shall be permanent and legible throughout life of the equipment. If component name plates are not easily accessible, or subcontracted component labels of fire pump manufacturer are not of permanent stamped steel type, then fire pump skid package manufacturer shall construct permanent label and place it in conspicuous location near referenced equipment. If fire pump manufacturer utilizes "in-house" reference number, number shall appear on permanent metal placard, attached to skid in conspicuous location.
11. Flow Meter: Flow meter shall be Gerand mfg. or equal.
12. Pump Valves: Provide OS&Y valve with DPDT tamper switch on suction side of pump. Provide butterfly valve equipped with DPDT tamper switch on discharge side of pump.
13. Check Valves: Provide wafer type check valve or swing check valves on discharge side of fire pump. All system control valves and system check valves shall be UL listed and/or FM approved. They shall be rated not less than 1400 kPa (175 psi). Check valves shall have Rubber Faced Clapper Assemblies.
14. Fuel Tank: Fuel tank shall be single-wall with spill basin, with mechanism to drain sediment from tank bottom. Provide ball valve with locking feature and with design to maintain integrity against diesel fuel. Fuel capacity shall be in accordance with minimum NFPA 20 requirements.
15. Fuel Tank Water Separator: Provide fuel tank with water separator, in-line to diesel driver.
16. Jockey Pump: Grundfos mfg. or equivalent.
17. Jockey Pump Controller: Jockey pump controller shall not to be equipped with minimum run timer.

18. Fire Pump Controller: Provide fire pump controller with minimum run timer. Controller shall not be timed self starting for weekly pump runs. "Manual" pressure switch test starts only.
 19. Batteries: Dual acid starting type; provide charger.
 20. Tamper Resistance for Valves: All control valves controlling water supply to fire suppression system shall be tamper equipped/supervised.
 21. Sensing Lines: Equip controller sensing lines with brass check valves, with 2.4 mm (3/32 inch) orifices or 2.4 mm (3/32 inch) restricting unions, installed per NFPA 20 guidelines for pressure switch protection against surges. All related piping for sensing lines shall be brass piping, and no smaller than 15 mm (1/2 inch) in size.
 22. Jockey Pump Piping: Equip jockey pump with brass suction strainer with clean-out. Suction side of jockey pump shall be tied-in before OS&Y valve on suction side of main fire pump. Pipe jockey pump discharge to system side of OS&Y valve.
 23. Miscellaneous Assembly Requirements:
 - a. Provide red factory finish for (virtually) entire assembly.
 - b. Provide fire pump suction and discharge piping, flow meter return piping, heat exchanger discharge piping, combination drain header (at contractor's connection point), and pressure relief piping (for diesels), shall be provided with flanged, braided, stainless steel type vibration isolation devices.
 - c. Connect diesel exhaust piping to engine with flanged strain relief, rated for diesel exhaust use. Locate flanged, braided stainless steel vibration isolation devices between fire pump package and building piping.
 - d. Firmly anchor piping, pressure sensing lines, by-pass with check valves (when applicable), shut-off valve drains, meters, controllers, and pumps to steel skid by means of structural steel supports.
 - e. All electrical wiring between controllers, motors, and engine shall be completed and tested at factory. Entire package shall require just one power connection by electrical subcontractor. Connect fire pump, jockey pump and jockey pump controller, and all accessories/equipment which supports fire pump installation to essential bus.
- B. Component Description: Design packaged fire pump system in accordance with requirements of NFPA 20. Fire pump shall be listed by Underwriters Laboratories and/or approved by Factory Mutual for fire pump services. Pump manufacturer shall assume unit responsibility for proper operation of entire system as specified herein.
1. Fire Pump Design: Fire pump basis of design is horizontal split case type, and shall be U.L. listed and/or F.M. approved. The responsible fire protection subcontractor/designer shall identify: 1) 2,100 RPM, 2) Clockwise rotation, and 3) 5,678.12 LPM (1,500 GPM) as dictated by sprinkler demand calculations, and maximum churn pressure in 1,069 KPa (155 psi). Pump shall deliver not less than 150 percent of rated capacity at not less than 65 percent of total rated head. Fire pump shall be manufactured by Peerless, Fairbanks-Morse, Patterson, ITT-AC or approved equal.
 2. Pump Drive Unit: Fire pump shall be driven by diesel engine specifically listed by Underwriters Laboratories, and approved by Factory Mutual for fire pump service. Engine horsepower shall be de-rated for elevation and temperature as required by NFPA 20. Engine shall have sufficient horsepower to operate fire pump under any condition of pump load. Engine shall be wired for 12 Volt operations.
 3. Diesel Engine Controller: Provide UL and FM approved automatic diesel engine controller by Metron, Firetrol, mfg. or approved equal. House in NEMA type 4

- enclosure. Required voltage is 230 volts. Equip controller with means to electronically record event history, automatic starting; provide with minimum run timer, having minimum run time of ten minutes. Controller shall sense pressure on system by way of mercoird pressure switch. Equip controller with surge protection, and digital, programmable time clock. Omit devices designed to stop pump in event of low suction pressure. Provide UL and FM approved automatic electric engine controller by Metron, Firetrol, mfg. or equal, housed in NEMA type 4 enclosures.
4. Jockey Pump Design: Jockey pump shall be manufactured by Grundfos mfg. or equal. Provide installation with fusible disconnect. Equip pre-piped sensing lines with brass check valves with 2.4 mm (3/32 inch) orifices; restricted unions are not acceptable. Mount jockey pump controller in NEMA Type 3 minimum enclosure, with front mounted HAND-OFF-AUTO selector switch and overload relays. Provide jockey pump with emergency AC power circuit.
- a. For jockey pump, the responsible fire protection subcontractor/designer shall identify 1) delivered 40 LPM (10 GPM), 2) total dynamic head in 999.74 kPa (145 psi), and 3) operating HP, RPM, 400 voltage, 3 phase, and 50 hertz.
- b. Sizing:
- 1) Volume: 40 LPM (10 GPM) maximum.
 - 2) Churn Pressure (Maximum): 140 kPa (20 psi) maximum above fire pump churn.
5. Protection: Enclosures for controllers shall be NEMA type 4 minimum. Tropicalization is required via humidistat and a thermostat, wired in parallel to heater. Tropicalization devices shall be adjustable to protect controls from effects of humidity. Install equipment at factory by controller manufacturer.
6. Power Distribution: Provide power distribution system to accept incoming feeder, and distribute power to: (a) Engine controller, (b) Engine jacket water heater. (c) Jockey pump. Distribution shall have disconnect from main power supply. Each item referenced shall have independent breaker or approved disconnect, properly labeled with permanent signage. The incoming power distribution shall be 3-phase, 400 volts, 50 hertz, and 4-wire distribution. The main electrical disconnect for the skid is sized for a 60 amp main breaker. The contractor shall coordinate the voltage, phase, and AIC ratings of any associated electrical equipment with the voltage, phase, and short-circuit capacities experienced on the project site. These ratings shall be coordinated with the electrical contractor prior to equipment purchase. Load centers are not permitted; bolt-on style panelboards shall meet the requirements of specification section 262416, including permitted manufacturers and basis of design. Voltage and phase operation of fire pump equipment shall be coordinated with the ratings experienced on the project site, and voltage transformation should not be required within the fire pump room.

2.5 FACTORY TESTING

- A. Factory Testing: Fire pump's initial commissioning shall be by manufacturer's licensed representative. Testing shall be in accordance with NFPA 20. The fire pump package shall be hydrostatically tested at factory at 1600 KPa (200psi) for two hours. Test system as a unit at manufacturer's facility prior to shipment. Energize system through power distribution system panel; all system failures shall be demonstrated. Test shall be witnessed and approved by OBO/OPS/FIR, with notification of Project Director/COR. Refer to Article on "Submittals" for requirements prior to testing.
- a. Pump drive unit engine shall be tested prior to shipment from the manufacturer's factory. Provide test header, flow meter, and related components as required by NFPA 20.

PART 3 - EXECUTION

3.1 FACTORY ASSEMBLY INSTALLATION

- A. General: Comply with manufacturers' and OBO/OPS/FIR instructions/recommendations for installation, alignment of equipment, and connected piping. Comply with industry standards identified in Part 1 of this Section. Support connected pipelines independently from support of fire pump components. Include flowmeter and heat exchanger discharge return lines to water source, unless otherwise approved by Project Director/COR and OBO/OPS/FIR. Locate lines to avoid interfering with access to components for service and maintenance, including for removal of driver units, couplings, pump impellers, seals, and accessories. Proceed as follows:
1. Disconnect driver-to-pump couplings during setting, leveling, anchoring, and grouting of structural skid on foundation. Contractor shall assure qualified personnel perform this function correctly.
 2. Support structural skid at required elevation on steel plate wedge shims at each anchor bolt location, nominally at 25 mm (1 inch) above concrete foundation. Adjust level of skid so that pump shaft and driver are level. Check to ensure coupling face and suction/discharge flanges are plumb when anchor bolts are nominally tightened.
 3. Install forms at edges of foundation to retain grout, and to form edges of grout into a 25 mm (1 inch) chamfer.
 4. Pour skid grout to depth of approximately 40 mm (1-1/2 inches), inside skid and strike to level of skid bottom for exposure outside skid. Ensure grout is substantially under skid frame members to inhibit voids under the skid. Allow initial pour to harden and cure.
 5. Nominally retighten anchor bolt nuts, and recheck level/plumb of main components.
 6. Align pump and driver shafts and reconnect driver to pump couplings. Ensure with dial indicator, precision straight edge and taper gauge (if applicable), alignment is correct.
 7. Fill skid frame to top flange with skid grout, allow to harden and cure. Tighten anchor bolts and nuts. Recheck pump/driver alignment, and correct as necessary, complying with manufacturer's recommendations. Repeat coupling alignment checks after making pipe connections.
- B. Connections, General: Reinstall any components, connections, or accessories that might have been temporarily removed or disassembled for fire pump assembly installation. Exercise care to remove temporary fluids, coating and closures. Replace with operational fluids, coatings, and

lubricants as specified by manufacturer. Proceed with final pipe sizes and connections as shown, with suction piping elevations and configurations fully complying with standards referenced in Part 1 of this Section and manufacturers' recommendations and OBO/OPS/FIR direction. Keep pipe and equipment clean internally by use of plugs and temporary closure plates. Comply with applicable Divisions 21, 22 and 23 Sections for extension of pipelines to fire pump assemblies, and for connections thereto, including installation of flanges, unions, valves, and other pipe line devices indicated. Refer to Division 26 Sections for extension of electrical/electronic services to fire pump assemblies and for connections thereto for supplying power, controlling equipment, operating connecting alarms, devices, and other systems; these are not work of this Section, except as otherwise indicated.

1. Exhaust System: Fabricate engine exhaust piping as required to remove exhaust gas from pump room, and/or building. Connect flexible piping units to engine, and mount muffler units as indicated near shield/cage units to protect personnel from accidental contact and resulting burns. Install exhaust piping system with vibration dampeners, and supported independently from fire pump assembly. Insulate extended piping system, except where shown to be non-insulated; apply indicated thickness of exhaust piping insulation in compliance with insulation manufacturer's instructions and recommendations.
 2. Welding: Comply with ASME "Boiler and Pressure Vessel Code", Section IX, "Welding and Brazing Qualifications" for qualification of welding processes and operators used in the fabrication of exhaust piping systems.
- C. System Finishes, General: Refer to Division 09 section on "Painting" for cleaning/priming/painting exposed surfaces of any work of this section to include touch-up of abraded factory finishes on fire pump assemblies, and extensions of red enamel finishes, and other finishes as indicated on connected service piping, conduits, and similar work not in this Section. The Project Director/COR will determine extent of specific paint color applications.

3.2 INSTALLATION AND INSTALLATION MATERIALS

- A. Except as otherwise indicated, provide materials for completing connections for mechanical and electrical service lines to installed fire pump assemblies to match materials of those service lines, either as specified in other Sections hereof, or as existing on previously installed lines. This requirement is applicable to piping, conduit, wiring and other lines for materials, finishes, operational equipment and devices, including valves and switches.
1. Pump Foundation Materials: Comply with applicable provisions of Division 03 section "Cast-in-Place Concrete" for concrete and reinforcing materials as required to form/pour/reinforce, pump foundations as indicated; using 30 MPa (4000 psi) Portland cement mix. Comply with fire pump manufacturers' printed directions/recommendations for selection of materials.
 2. Skid Grout: Provide non-shrinking and non-metallic grout mix, complying with ASTM 1107, Grade B, with design-mix strength of 35 MPa (5000 psi) for 28 day compression. Fill assembly level to top of skid without covering drain, power, control, or sensing line of any type.
 3. Engine Exhaust Piping: ASTM A 53 Type E/S, Schedule 40 butt-welded black carbon pipe and fittings. Flange gaskets shall be non-asbestos, surface temperature rating of up to 1,100 deg C (2,000 deg F). Exhaust gasses shall not be discharged where they will affect persons, disrupt occupants, or endanger buildings.

4. Exhaust Piping Insulation: Insulation, reusable/removable thermal blankets; standard construction; high density 175 kg/cu. m (11 lbs/cu. ft.) flexible fibrous glass; standard 25 mm (1 inch) thick; silicone coated outer jacket, stainless steel mesh inner surface liner; stainless steel seaming materials; custom fitted for muffler, pipe fittings, and flanges located inside building; 550 deg C (1,000 deg F) operating temperature; installed with stainless steel lacing wire; Basis of Design is GT Exhaust Systems Series 100.
5. Exhaust Sound Suppression: Pump manufacturer shall provide muffler and flexible connection between engine and muffler. Engines exhausting from normally occupied buildings. Package shall utilize residential grade mufflers. Provide muffler inside of building. Install muffler horizontally, and provide with vibration isolators.
6. Engine Exhaust Installation: Connect exhaust piping to engine with flanged, strain relief, rated for diesel exhaust use. Suspend exhaust piping by approved devices that allow limited movement of pipe to prevent stress cracks from developing. Piping that must pass through walls shall utilize steel sleeves, with minimum of 25 mm (1 inch) clearance. Fill exhaust piping-to-sleeve clearance with non-hardening, fire proofing.
 - a. Roof/Wall Penetrations: Thimble, factory fabricated, aluminized steel with thermal insulation. Provide with rainguard when penetration is through exterior wall or roof. Basis of Design is GT Exhaust Systems Series 20.
 - b. Raincap (if roof discharge): Hinged, black steel with stainless bushing and hinge. Basis of Design is GT Exhaust Systems Series 22.
7. Heat Exchanger Discharge: Manufacturer of fire pump assembly shall provide stainless steel, flexible hose connection at discharge of heat exchanger for installing contractor to begin piping back to drain. Provide sight glass for heat exchanger discharge line with spring-loaded "ball" to indicate water flow. Heat exchanger discharge gauge shall be liquid filled, isolated from destructive engine vibration, and equipped with brass ballcock to facilitate maintenance. Return heat exchanger water to fire-protection water tank where reasonably feasible.

3.3 FIELD QUALITY CONTROL:

- A. General: Perform each fire pump assembly installation and field testing procedure under direct supervision, at project site, of manufacturer's authorized technical representative who is acceptable to Project Director/COR and OBO/OPS/FIR. Record in writing, and deliver copy promptly to Project Director/COR, running record on each installation activity, with observed/measured/tested results of such activities. Begin and maintain fire pump logbook, starting with first operational test/date, including any faults, or corrections made. Logbook, or similar hard cover log book with identical information, shall be left in controller for maintenance personnel to track weekly tests, problems, and maintenance performed. Logbook will be used to assist OBO/OPS/FIR Technicians, and Fire Marshal inspections and tests. Advise Project Director/COR in advance of scheduled test times, and provide OBO/OPS/FIR a minimum of 45 days advance notice.
 1. Piping Tests: Prior to proceeding with fire pump operating tests, complete hydrostatic tests to confirm water tight installation of pressurized piping systems at 1600 kPa (200 psi) for two hours. Test suction piping at minus one-half atmosphere to confirm absence of negative pressure (air) leakage into system during operation. A two-hour 1600 KPa (200 psi) hydrostatic test is also acceptable. Test shall be witnessed by Project Director/COR or their representative, before any suction piping is covered in any manner.