SECTION 15320 - FIRE PUMPS

PART 1 - GENERAL

1.1 SUMMARY:

A. This Section includes fire pumps.

B. Refer to Division 3 for concrete work for formwork, reinforcement, and concrete for equipment pads.

C. Refer to Division 7 for flashing and sheet metal for roof and wall penetrations

D. Refer to Division 15 for mechanical/electrical requirements, mechanical identification, fire protection system, piping and fuel oil systems.

E. Refer to Division 16 for electrical connection for equipment, power-supply wiring, field-installed electrical devices, and fire alarm systems.

1.2 DEFINITIONS:

A. Fire Pump: Pump intended to supply water, at rated capacity and at total rated head, required for fire protection service.

B. Fire pump unit is defined as an assembled unit consisting of fire pump, driver, controller, and accessories.

C. Horizontal fire pump category includes axially-split-case (both horizontal and vertical mounting) and radially-split-case (both end suction and vertical in line) fire pump types.

D. Pressure Maintenance Pump: Pump intended to maintain water pressure in system.

E. Pressure maintenance pump unit is defined as an assembled unit consisting of pressure maintenance pump, driver, controller, and accessories.

1.3 SYSTEM PERFORMANCE REQUIREMENTS:

A. Provide fire pump systems consisting of fire pump units, pressure maintenance pump units, accessories, and piping, complying with performance requirements determined by fire protection design build contractor, and compatible with building fire protection systems.

1.4 SUBMITTALS:

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.

B. Product data for each fire pump unit and each pressure pump unit, including clearly stated rated capacities of each selected model, performance curve with each selection point indicated, driver, pump controller, furnished specialties, and accessories; plus weights (shipping and installed).

C. Installation and start-up instructions for each fire pump unit and each pressure maintenance pump unit.

D. Product certificates signed by manufacturers of fire pumps, certifying that their products comply with specified requirements.

E. Test curves of fire pump manufacturer's factory shop tests for each fire pump and certificates signed by manufacturer verifying that the test results comply with specified requirements.

F. Welding procedures specifications for each welding process, welding procedures qualifications test records, and welders qualification test records complying with requirements specified in "Quality Assurance" below.

G. Shop drawings showing the layout and connections for each fire pump unit and each pressure maintenance pump unit, including pump, pump driver, pump controller, related accessories, and piping. Include setting drawings with templates, and directions for installation of foundation bolts, anchor bolts, and other anchorages.

H. Wiring diagrams detailing field-installed wiring for power, signal, and control systems.

I. Field acceptance test data showing proper performance in accordance with provisions specified.

J. Maintenance Data: Submit maintenance data for each type of fire pump unit and pressure maintenance pump unit for inclusion in Operating and Maintenance Manual specified in Division 15.

1.5 QUALITY ASSURANCE:

A. Manufacturer Qualifications: Firms whose fire pumps, pressure maintenance pumps, drivers, controllers, and major accessories are listed by product name and manufacturer in UL "Fire Protection Equipment Directory" and FM "Approval Guide" and comply with other requirements indicated. Pressure maintenance pumps are exempt from UL and FM requirements. Pressure maintenance pump controllers are exempt from FM requirement. Flow measuring systems are exempt from UL requirement. Those products which have been in satisfactory use in similar service for not less than 5 years.

B. Provide listing/approval stamp, label, or other marking on equipment made to specified standards.

C. Comply with local fire department/marshal standards pertaining to material, hose threads, and installation.

D. Comply with the requirements of NFPA 20 "Centrifugal Fire Pumps" for fire pumps, drivers, controllers, accessories, materials, and installation.

E. Comply with the requirements of NFPA 70 "National Electrical Code" for electrical materials and installation.

F. Comply with the requirements of FM "Approval Guide" as applicable to fire pumps, drivers, controllers, and accessories, and provide system capable of FM acceptance.

G. Regulatory Requirements: Comply with the provisions of the following:

1. ASME B31.9 "Building Services Piping" for materials, products, and installation.

2. ASME "Boiler and Pressure Vessel Code," Section IX, "Welding and Brazing Qualification" for qualifications for welding processes and operators according to 15055, 1.04.

H. Manufacturer's Factory Tests: Perform factory test of each fire pump. Copy to be submitted to engineer prior to shipment.

1.6 DELIVERY, STORAGE, AND HANDLING:

A. Preparation for Shipping: After assembly and testing, clean flanges and exposed machined metal surfaces and treat with an anticorrosion compound. Protect flanges, pipe openings, and nozzles.

B. Store fire pumps, pressure maintenance pumps, drivers, controllers, and accessories in a clean dry place.

C. Retain shipping flange protective covers and protective coatings during storage.

D. Protect bearings and couplings against damage from sand, grit, and other foreign matter.

E. For extended storage greater than 5 days, dry internal parts with hot air or a vacuum-producing device to avoid rusting internal parts. Upon drying, coat internal parts with a protective liquid, such as light oil. Dismantle bearings and couplings, dry and coat them with an acid-free heavy oil, and then tag and store in a dry location.

F. Comply with Manufacturer's rigging instructions for handling.

PART 2 - PRODUCTS

2.1 MANUFACTURERS:

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

1. Axially-Split-Case Fire Pumps:

a. Allis-Chalmers Corp.; Industrial Pump Div.
b. Fairbanks Morse Pump Div.; Colt Industries.
c. Peerless Pump; A Sterling Co.
d. Aurora Fire Pump

2. End Suction, Radially-Split-Case Fire Pumps:

a. Allis-Chalmers Corp.; Industrial Pump Div.
b. Aurora Fire Pump

3. In-Line, Radially-Split-Case Fire Pumps:

a. Peerless Pump; A Sterling Co.
b. Aurora Fire Pump

4. Vertical Turbine Fire Pumps:

a. Allis-Chalmers Corp.; Industrial Pump Div.
b. Fairbanks Morse Pump Div.; Colt Industries.

c. Goulds Pumps, Inc.
d. Peerless Pump; A Sterling Co.
e. Aurora Fire Pump

5. Multi-Stage, Pressure Maintenance Pumps:

a. Allis-Chalmers Corp.; Industrial Pump Div.
b. Peerless Pump; A Sterling Co.
c. Aurora Fire Pump

6. Regenerative Turbine, Pressure Maintenance Pumps:

a. Allis-Chalmers Corp.; Industrial Pump Div.
b. Fairbanks Morse Pump Div.; Colt Industries.
c. Aurora Fire Pump

7. Vertical Turbine, Pressure Maintenance Pumps:

a. Allis-Chalmers Corp.; Industrial Pump Div.
b. Fairbanks Morse Pump Div.; Colt Industries.
c. Peerless Pump; A Sterling Co.
d. Aurora Fire Pump

8. Electric Motor Drivers: Electric motor driver manufacturers are option of fire pump manufacturers. Electric motor curves are to be submitted prior to bid date.

a. Diesel Engine Drivers:
b. Caterpillar, Inc.
c. Clarke GM Diesel, Inc.
d. Cummins Engine Co., Inc.
e. Aurora Fire Pump

9. Diesel Engine Driver Gear Drives: Right-angle gear drive manufacturers are option of fire pump manufacturers.

10. Fire Pump Controllers, Alarm Panels, and Pressure Maintenance Pump Controllers:

a. Firetrol, Inc.
b. Metron, Inc.

11. Flow Measuring Systems:

a. Barco Div.; Marison Industries.
b. Dieterich Standard; A Dover Industries Co.
c. Gerand Engineering Co.

2.2 FIRE PUMP SYSTEMS, GENERAL:

A. Fire Pump Systems: Provide fire pump units and pressure maintenance pump units, having specified compatible components and accessories.

B. Horizontal fire pumps, except in line type, and drivers shall be factory assembled, mounted on same base, and connected with a flexible coupling having a guard.

C. Vertical turbine fire pumps and electric motor drivers shall be factory assembled.

2.3 FIRE PUMPS, GENERAL:V

A. Fire Pumps: UL 448, base-mounted, factory-assembled, and factory-tested, of types, capacities, and characteristics indicated.

B. Fire Pumps: Base-mounted, factory-assembled, and factory-tested, of types, capacities, and characteristics indicated.

C. Preparation for Shipping: After assembly and testing, clean flanges and exposed machined metal surfaces and treat with an anticorrosion compound. Protect flanges, pipe openings, and nozzles.

D. Nameplates: Provide nameplates, complete with capacities, characteristics, and other pertinent data.

E. Factory Finish: Red, enamel paint applied to assembled, tested units prior to shipping.

2.4 AXIALLY-SPLIT-CASE FIRE PUMPS:

A. Characteristics: Fire pumps shall furnish not less than 150 percent of rated capacity at not less than 65 percent of total rated head. The shutoff head shall not exceed 120 percent of total rated head.

B. General Description: Base-mounted, centrifugal, separately coupled, bronze-fitted, axially-split-case design, specifically labeled for fire service.

1. Type: Horizontally mounted, single stage - double suction.
2. Type: Horizontally mounted, multistage - single suction.
3. Type: Vertically mounted, single stage - double suction.

C. Casing Construction: Axially-split-case centrifugal design; cast-iron pump casing with suction and discharge flanges machined to ANSI B16.1 dimensions, and 125-psi pressure rating, except where 250-psi rated flanges are indicated.

D. Impeller Construction: Statically and dynamically balanced, of construction to match type fire pump, fabricated from cast bronze, keyed to shaft.

E. Wear Rings: Replaceable, bronze.

F. Pump Shaft and Sleeve: Steel shaft, with bronze sleeve.

G. Pump Shaft Bearings: Grease-lubricated ball bearings contained in a cast-iron housing.

H. Seals: Stuffing box consisting of a minimum of 4 rings of graphite-impregnated braided yarn with a bronze lantern ring between center 2 graphite rings, and a bronze packing gland.

I. Pump Couplings: Flexible, capable of absorbing torsional vibration and shaft misalignment; complete with metal coupling guard.

J. Motor: Flexible-coupled to pump.

K. Baseplate: Steel construction with grout holes, I beam will not be allowed.

2.5 RADIALLY-SPLIT-CASE FIRE PUMPS:

A. Characteristics: Fire pumps shall furnish not less than 150 percent of rated capacity at not less than 65 percent of total rated head. The shutoff head shall not exceed 140 percent of total rated head.

B. End-Suction-Type Fire Pump General Description: Base-mounted, centrifugal, separately coupled, end-suction, single-stage, bronze-fitted, radially-split-case design, specifically labeled for fire service.

1. Pump Coupling: Flexible, capable of absorbing torsional vibration and shaft misalignment; complete with metal coupling guard.

2. Motor: Flexible-coupled to pump.

C. In-Line-Type Fire Pump General Description: Centrifugal, close-coupled, single-stage, vertical in-line, bronze-fitted, radially-split-case design, specifically labeled for fire service.

1. Motor: Direct-mounted to pump casing.

D. Casing Construction: Radially-split-case centrifugal design; cast-iron pump casing with suction and discharge flanges machined to ANSI B16.1 dimensions, and 125-psi pressure rating, except where 250-psi rated flanges are indicated.

E. Impeller Construction: Statically and dynamically balanced, closed, overhung, single-suction, cast bronze, and keyed to shaft.

F. Wear Rings: Removable, bronze.

G. Pump Shaft and Sleeve: Ground and polished steel shaft, with bronze sleeve.

H. Seals: Stuffing box having a minimum of 4 rings of graphite-impregnated braided yarn with a bronze lantern ring between center 2 graphite rings and a bronze packing gland.

I. Base or Pedestal: Steel or Cast Iron

2.6 VERTICAL TURBINE FIRE PUMPS:

A. Characteristics: Fire pumps shall furnish not less than 150 percent of rated capacity at a total head of not less than 65 percent of the total rated head. The total shutoff head shall not exceed 140 percent of total rated head.

B. General Description: Vertical shaft turbine type, centrifugal design, having impellers discharging into bowls and a vertical pump column, specifically labeled for fire service.

C. Pump Head Construction: Cast iron, with discharge flange machined to ANSI B16.1 dimensions, and 125-psi pressure rating, except where 250-psi rated discharge flange is indicated.

D. Line Shaft: Stainless steel or steel with corrosion-resistant shaft sleeves.

E. Pump Line Shaft Bearings: Rubber sleeve water lubricated.

F. Line Shaft: Steel.

G. Pump Line Shaft Bearings: Corrosion-resistant oil lubricated.

H. Impeller Shaft: Monel metal or stainless steel.

I. Pump Bowl Assemblies: Cast-iron with closed type bronze impellers.

J. Pump Column: Of length indicated.

K. Suction Cans must be UL/FM approved.

L. Suction Strainer: Cast or fabricated nonferrous corrosion- resistant metal suction strainer having free area not less than 4 times suction inlet cross-sectional area, with the openings that will not permit passage of a 5/16-inch sphere for pump rating of 500 gpm or less and a 1/2-inch sphere for pump rating more than 500 gpm.

2.7 ELECTRIC MOTORS:

A. Fire Pump Electric Motor Drivers: NEMA MG 1, open dripproof, squirrel cage, induction motor, complying with NFPA 20 and NFPA 70, and wiring compatible with type controller used.

B. Fire Pump Electric Motor Drivers: Vertical hollow shaft, open dripproof, squirrel cage, induction motor, complying with NFPA 20 and NFPA 70, and wiring compatible with type controller used. Construction of motor such that total hydraulic and static thrust of pump rotating assembly can be carried by motor thrust bearings. Mount motor directly on pump discharge head assembly for correct shaft alignment. Equip motor with top drive coupling and nut for axial adjustment of pump impellers, and nonreverse ratchet to prevent pump backspin.

C. Fire Pump Motor Nameplates: Provide nameplates, complete with motor horsepower, characteristics, and other pertinent data.

D. Fire Pump Motor Factory Finish: Red, enamel paint, same as for fire pump, applied to assembled, tested units prior to shipping.

E. Pressure Maintenance Pump Electric Motors: NEMA MG 1, open dripproof, squirrel cage, induction motor, complying with NFPA 20 fire pump motor requirements and NFPA 70, and wiring compatible with controller.

F. Pressure Maintenance Pump Motor Factory Finish: Enamel paint, same as for pressure maintenance pump, applied to assembled unit.

2.8 DIESEL ENGINES:

A. Fire Pump Diesel Engine Driver: UL 1247, horizontal shaft, open-type diesel engine, of scheduled capacity. Provide the following accessories for automatic operation:

B. Fire Pump Diesel Engine Driver: UL 1247, horizontal shaft open-type diesel engine, of scheduled capacity, for operation with right-angle gear drive. Provide the following accessories, compatible with and of capacity to match diesel driver, for automatic operation:

1. Emergency manual operator, factory-wired, for standby engine starting and operation in case of main controller or wiring malfunction.

2. Engine cooling system consisting of water piping, valves, strainer, pressure regulator, heat exchanger, coolant pump, bypass piping, and fittings; factory-installed.

3. Flexible exhaust connector.

4. Residential exhaust silencer (85 dba).

5. Commercial exhaust silencer.

6. Engine jacket water heater, factory-installed, electric elements.

7. Dual batteries, lead-acid-storage type, providing 100 percent standby reserve capacity.

8. Fuel system, in compliance with NFPA 20.

9. Fuel storage tank, of size indicated, with floor legs and direct-reading level gauge.

10. Exhaust System, ASTM A 53, Type E or Type S, Schedule 40, black steel pipe, ANSI B16.9 weld-type pipe fittings, ANSI B16.5 steel flanges, ANSI B16.21 nonmetallic gaskets, and fabricated double wall steel pipe ventilated thimble.

C. Gear Drive: Vertical hollow shaft right-angle gear drive unit. Direct connect drive to pump shaft and equip with nonreverse ratchet. Connect drive to engine with flex shaft with enclosing guard. Provide drive with provision for adjusting pump impeller lateral setting for proper pump operation and performance.

D. Nameplates: Provide nameplates, complete with engine horsepower, characteristics, and other pertinent data.

E. Factory Finish: Red, enamel paint same as for fire pump, applied to assembled, tested unit and to ferrous metal accessories, except where other finish is specified, prior to shipping.

2.9 FIRE PUMP CONTROLLERS AND ALARM PANELS, GENERAL:

A. Fire Pump Controllers and Alarm Panels: Combined automatic and nonautomatic operation, UL listed and FM approved, factory-assembled and wired, and factory-tested, of types, capacities, electrical characteristics, and with features indicated.

1. Standard: UL 508.

B. Enclosure: NEMA ICS 6, Type 2, dripproof, indoor, except where special-purpose enclosure is indicated.

C. Provide controls, devices, alarms, functions, and operations listed in NFPA 20, as required for the type driver and controller used, and the specific items listed for each type controller.

D. Nameplates: Provide nameplate complete with capacity, electrical characteristics, approvals and listings, and other pertinent data, on enclosure door.

E. Provide mounting for enclosures as indicated:

1. Full-Service Fire Pump Controller Mounting: Wall or floor stand type, as indicated, for field electrical connections.

2. Full-Service Fire Pump Controller Mounting: Wall type, for field electrical connections.

3. Full-Service Fire Pump Controller Mounting: Floor stand type, for field electrical connections.

4. Full-Service Fire Pump Controller Mounting: Unit mounted on pump base and factory-wired.

5. Limited-Service Fire Pump Controller Mounting: Wall or floor stand type, as indicated, for field electrical connections.

6. Limited-Service Fire Pump Controller Mounting: Wall type, for field electrical connections.

7. Limited-Service Fire Pump Controller Mounting: Floor stand type, for field electrical connections.

8. Alarm Panel Mounting: Wall type.

9. Factory Finish: Red, enamel paint applied to assembled, tested units prior to shipping.

F. Controller Sensing Pipes: Provide nonferrous metal sensing piping, 1/2-inch size, with 1/2-inch globe valves for testing mechanism of controller, from system to pump controller, as indicated. Provide bronze check valve with 3/32-inch orifice in clapper or ground-face union with noncorrosive diaphragm having 3/32-inch orifice.

1. Fabricate pipe and fittings in accordance with NFPA 20.

2.10 FULL-SERVICE, ELECTRIC-MOTOR-DRIVE FIRE PUMP CONTROLLERS:

A. Motor Controllers: Controller specifically listed for electric motor drive fire pump service and service entrance.

EDIT NOTE: Coordinate and select starter type with Electrical Engineer. Also, coordinate terminal lug sizes with Electrical Engineer.

1. Type: Across the line (up to 75 HP).
2. Type: Primary resistance (up to 100 HP).
3. Type: Part winding (up to 100 HP).
4. Type: Wye-delta (closed transition) (up to 100 HP).
5. Type: Wye-delta (open transition) (up to 100 HP).
6. Type: Autotransformer

B. Rate controller for scheduled horsepower. Provide controller with short circuit withstand rating at least equal to short circuit current available at controller location, taking into account cable size and distance from substation or supply transformers.

EDIT NOTE: ATC only where required for dual feed or emergency power.

C. Automatic Transfer Switch: Enclosure complying with requirements for and attached to fire pump controller above, containing an automatic transfer switch having rating at least equal to the fire pump driver motor horsepower; or when motor is rated in amperes, shall have an ampere rating not less than 115 percent of the motor full-load current and also shall be suitable for switching the motor locked rotor current. Provided by coordinate with electrical.

1. Standard: UL 1008.

D. Voltage Surge Arrestor: Provide voltage surge arrestors complying with ANSI C62.1 or C62.11 installed from each line terminal of the isolating switch to ground. These devices shall be rated to suppress voltage surges above rated line voltage.

E. Provide controller capable of performing or containing the following features:

1. Isolating means and circuit breaker.
2. "Power Available" and "Phase Reversal" pilot lamps.
3. Ammeter with current transducers.
4. Three separate dry contacts indicating motor running condition, loss of line power (including low voltage or loss of any one phase), and line power phase reversal.
5. Automatic and manual operation, and minimum run time relay to prevent short cycling.
6. Remote start.
7. Water pressure actuated switch having independent high and low calibrated adjustments responsive to water pressure in fire protection system.
8. Manual and automatic shutdown.
9. Emergency start lever bypassing all control circuits.

2.11 LIMITED-SERVICE, ELECTRIC-MOTOR-DRIVE FIRE PUMP CONTROLLERS:

A. Motor Controllers: Limited-service controller for electric motor drive fire pump service, and service entrance.

EDIT NOTE: Coordinate starter type and terminal lug sizes with Electrical Engineer.

1. Type: Across the line.

B. Rate controller for scheduled horsepower. Provide controller with short circuit withstand rating at least equal to short circuit current available at controller location, taking into account cable size and distance from substation or supply transformers.

2.12 DIESEL ENGINE DRIVE FIRE PUMP CONTROLLERS:

A. Engine Controllers: Controller specifically listed for diesel engine drive fire pump service, capable of performing or containing the following features:

1. Built-in dual battery charger.
2. Time clock for weekly automatic test.
3. System pressure recorder, electric alternating current driven with spring backup.
4. Timing relay for automatic stop.
5. Power failure start, with time delay to prevent start at momentary loss of power.
6. Low-fuel-level alarm.
7. Alarm contacts for remote alarm of "Engine Run," "Switch Off," and "Engine Failure."
8. Pump room alarms shall be both audible and visible signals.

2.13 ALARM PANELS:

A. Alarm Panel: NEMA ICS 6, Type 1 remote wall-mounting-type panel with audible and visible alarms matching type controller used. Provide following features and manufacturer's standard features:

1. Electric Motor Drive Fire Pump Controller Alarm Panels:

a. Motor operating condition.

b. Loss of line power.
c. Phase reversal.
d. Low water alarm.

2. Diesel Engine Drive Fire Pump Controller Alarm Panels:

a. Engine running.
b. Main switch off or in manual position.
c. Engine trouble.
d. Low water alarm.
e. Low fuel.

2.14 HORIZONTAL FIRE PUMP ACCESSORY FITTINGS:

A. Provide the following accessory fittings, matching fire pump suction and discharge ratings, as required for fire pump capacity rating:

1. Automatic air release valve.

2. Casing relief valve.

3. Suction and discharge pressure gauges.

4. Eccentric tapered reducer at suction inlet.

5. Concentric tapered reducer (increaser) at discharge outlet.

6. Hose valve test header manifold and round brass identification escutcheon plate, for wall mounting, manufacturer's standard finish, with lettering equivalent to "PUMP TEST CONN."

7. Hose valves with caps and chains, NFPA 1963 hose thread conforming to local fire department standards, bronze finish.

8. Ductile iron or brass body, hose valve test header manifold having nozzle outlets arranged in a single line, for horizontal flush wall mounting, polished chrome-plated rectangular brass escutcheon plate with lettering equivalent to "PUMP TEST CONNECTION."

9. Hose valves with caps and chains, NFPA 1963 hose threads conforming to local fire department standards, bronze with polished chrome finish.

10. Ball drip valve.

11. Main relief valve, UL 1478.

12. Closed discharge cone.

13. Open discharge cone.

14. Factory Finish: Red, enamel paint except where brass or other finish is specified.

2.15 VERTICAL TURBINE FIRE PUMP ACCESSORY FITTINGS:

A. Provide the following accessory fittings, matching fire pump discharge rating, as required for fire pump capacity rating:

1. Automatic air release valve.

2. Casing relief valve.

3. Discharge pressure gauge.

4. Concentric tapered reducer (increaser) at discharge outlet.

5. Hose valve test header manifold and round brass identification escutcheon plate, for wall mounting, manufacturer's standard finish, with lettering equivalent to "PUMP TEST CONN."

6. Hose valves with caps and chains, NFPA 1963 hose threads conforming to local fire department standards, bronze finish.

7. Ductile iron or brass body, hose valve test header manifold having nozzle outlets arranged in a single line, for horizontal flush wall mounting, polished chrome-plated rectangular brass escutcheon plate with lettering equivalent to "PUMP TEST CONNECTION."

8. Hose valves with caps and chains, NFPA 1963 hose threads conforming to local fire department standards, bronze with polished chrome finish.

9. Ball drip valve.

10. Main relief valve, UL 1478.

11. Closed discharge cone.

12. Open discharge cone.

13. Water level detecting device, ASTM B 88 Type L copper water tube, ANSI B16.22 wrought-copper, solder-joint fittings, ASTM B 32 Alloy Sb5 solder; with pressure gauge and connection fitting for attaching a hand-operated air pump. Piping arrangement and length shall be as detailed in NFPA 20 Appendix A.

B. Factory Finish: Red, enamel paint except where brass or other finish is specified.

2.16 PRESSURE MAINTENANCE PUMPS:

A. Pressure Maintenance Pumps, General: Base-mounted, factory- assembled, and factory-tested, of pump types, capacities, and electrical characteristics indicated. Close coupled pressure maintenance pumps are exempt from base-mounted requirement.

B. Characteristics: Pressure maintenance pumps shall furnish not less than rated capacity at not less than total rated head indicated.

C. Construction: Cast-iron pump casing with suction and discharge connections of size indicated, threaded, or flanged and machined to ANSI B16.1 dimensions, and 125-psi minimum pressure rating, except where 250-psi rated flanges are indicated.

1. Impeller: Bronze or stainless steel.

2. Shaft: Stainless steel.
3. Seals: Mechanical.

D. Nameplates: Provide nameplate complete with capacity, electrical characteristics, and other pertinent data.

E. Factory Finish: Manufacturer's standard color enamel paint applied to assembled, tested units prior to shipping.

F. Multi-Stage Pressure Maintenance Pumps:

1. Construction: Multi-stage, centrifugal, vertical construction, base mounting.

G. Regenerative Turbine Pressure Maintenance Pumps:

1. Construction: Regenerative turbine, close coupled construction, for pad mounting.

H. Vertical Turbine Pressure Maintenance Pumps:

1. Construction: Vertical turbine, base mounting.
2. Pump Head: Cast iron.
3. Line Shaft: Stainless steel or steel with corrosion-resistant shaft sleeves.
4. Pump Line Shaft Bearings: Rubber sleeve water lubricated.
5. Line Shaft: Steel.
6. Pump Line Shaft Bearings: Corrosion-resistant oil lubricated.
7. Impeller Shaft: Monel metal or stainless steel.
8. Pump Bowl Assemblies: Cast-iron with closed-type bronze impellers.
9. Pump Column: Of length indicated.
10. Suction Strainer: Cast or fabricated nonferrous corrosion- resistant metal suction strainer having free area not less than 4 times suction inlet cross-sectional area; with the openings that will not permit passage of a 5/16 inch sphere.

2.17 PRESSURE MAINTENANCE PUMP CONTROLLERS:

A. Pressure Maintenance Pump Controllers: Combined automatic and nonautomatic operation, UL listed, factory-assembled and wired, and factory-tested, of types, capacities, electrical characteristics, and with features indicated, for electric motor drive pressure maintenance pump service.

1. Type: Across the line.
2. Standard: UL 508.

B. Enclosure: NEMA ICS 6, Type 2, wall mounted, for field electrical wiring.

C. Provide controls, devices, alarms, functions, and operations listed in NFPA 20, and the specific items listed.

D. Rate controller for scheduled horsepower and provide the following items:

1. Fusible disconnect switch.
2. Pressure switch.
3. "HAND-OFF-AUTO" selector switch.
4. Pilot light.
5. Running period timer.

E. Nameplates: Provide nameplate complete with capacity, electrical characteristics, approvals and listings, and other pertinent data, on enclosure door.

F. Mounting: Wall type for field electrical connections.

G. Factory Finish: Manufacturer's standard color enamel paint applied to assembled, tested units prior to shipping.

H. Controller Sensing Pipes: Provide nonferrous metal sensing piping, ½ inch size, with ½ inch globe valves for testing mechanism of controller, from system to pump controller, as indicated. Provide bronze check valve with 3/32 inch orifice in clapper or ground-face union with noncorrosive diaphragm having 3/32 inch orifice.

1. Fabricate pipe and fittings in accordance with NFPA 20.

2.18 PRESSURE MAINTENANCE PUMP ACCESSORIES:

A. Provide following accessory fittings, matching pressure maintenance pump suction and discharge ratings, as required for pump capacity rating:

1. Casing relief valve.
2. Suction and discharge pressure gauges.

2.19 FLOW MEASURING SYSTEMS:

A. General: Fire pump flow measuring systems shall be FM approved, indicate flow in gpm to not less than 175 percent of fire pump rated capacity, and consist of a sensing element of size to match pipe, tubing, flow meter, and fittings.

B. Pressure Rating: 175 psi minimum.

C. Provide flow measuring device manufactured by Meriam Model FM-D15 6 inch dial flow meter; Barco or equal.

D. Provide flow measuring systems complete with operating instructions.

2.20 SOURCE QUALITY CONTROL:

A. Factory Tests: Hydrostatically test and test run each pump prior to shipment. Test at 150 percent of shut-off head plus suction head, but not less than 250 psig. Produce certified test curves showing head capacity and brake-horsepower of each pump.

PART 3 - EXECUTION

3.1 EXAMINATION:

A. Examine areas, equipment foundations, and conditions with Installer present, for compliance with requirements for installation and other conditions affecting performance of fire pumps. Do not proceed with installation until unsatisfactory conditions have been corrected.

B. Examine fire protection piping systems to verify actual locations of piping connections prior to installation.

3.2 INSTALLATION OF FIRE PUMPS:

A. General: Comply with the manufacturer's written installation and alignment instructions and with NFPA 20 and FM standards.

B. Install pumps in locations indicated and arrange to provide access for periodic maintenance, including removal of motors, impellers, couplings, and accessories.

C. Support pumps and piping separately so that the weight of the piping system does not rest on pumps.

D. Set base-mounted pumps on concrete foundations. Disconnect coupling halves before setting. Do not reconnect couplings until alignment operations have been completed.

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

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

E. Provide piping accessories, hangers, supports and anchors, valves, meters and gauges, and equipment supports as indicated for complete installation.

F. Electrical Wiring: Install electrical devices furnished by manufacturer but not specified to be factory-mounted. Furnish copy of manufacturer's wiring diagram submittal to Electrical Installer.

1. Verify that electrical wiring installation is in accordance with manufacturer's submittal and installation requirements of Division 16 sections. Do not proceed with equipment start-up until wiring installation is acceptable.

3.3 ALIGNMENT:

A. Align pump and driver shafts after complete unit has been leveled on foundation and after grout has set and foundation bolts have been tightened.

B. After alignment is correct, tighten the foundation bolts evenly but not too firmly. Fill the base plate completely with nonshrink, nonmetallic grout, with metal blocks and shims or wedges in place. After grout has hardened, fully tighten foundation bolts. Check alignment and take corrective measures required.

C. Make piping connections, check alignment, and take corrective measures required.

1. Adjust alignment of pump and driver shafts for angular and parallel alignment by one of the two methods specified in the Hydraulic Institute "Centrifugal Pumps - Instructions for Installation, Operation and Maintenance."

2. Alignment tolerances shall meet manufacturer's recommendations.

3.4 CONNECTIONS:

A. General: Install valves of types and at locations indicated, that are same size as the piping connecting the fire pump, bypass, test header, and other piping systems.

B. Install suction and discharge pipe sizes equal to or greater than the diameter of fire pump nozzles.

C. Install pressure gauges on the suction and discharge of each pump at the integral pressure gauge tappings provided.

D. Install cooling system piping connection for water supply to heat exchanger, and piping and connection for drain from heat exchanger to point of disposition.

E. Install exhaust system piping from diesel engine driver to point of termination outside the structure. Install pipe and fittings with welded joints, and components having flanged connections with gasketed joints.

F. Install flow meters and sensing elements where indicated. Install connections, tubing, and fittings between flow sensing elements and meters as prescribed by manufacturer's installation instructions.

G. Electrical wiring and connections are specified in Division 16 sections.

3.5 FIELD QUALITY CONTROL:

A. Manufacturer's Field Service: Provide the services of a factory-authorized service representative to supervise field assembly of components, installation of fire pump units and pressure maintenance pump units, including piping and electrical connections, field acceptance tests, and to report test results in writing.

B. Check suction lines connections for tightness to avoid drawing air into the pump.

C. Perform field acceptance tests of each fire pump unit (fire pump, driver, and controller) and system piping, when installation of fire pump units is complete. Comply with operating instructions and procedures of NFPA 20 to demonstrate compliance with requirements. Where possible, field correct malfunctioning equipment, then retest to demonstrate compliance. Replace equipment that can not be satisfactorily corrected or that does not perform as specified and as indicated, then retest to demonstrate compliance. Verify that each fire pump unit performs as specified and as indicated.

3.6 COMMISSIONING:

A. Start-Up Services, General: Provide the services of a factory-authorized service representative to provide start-up service and to demonstrate and train Owner's maintenance personnel as specified below.

1. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and components.

2. Train Owner's maintenance personnel on procedures and schedules related to start-up and shutdown, troubleshooting, servicing, and preventative maintenance.

3. Review data in Operating and Maintenance Manuals. Refer to Division 1 Section "Project Closeout."

4. Schedule training with at least 7 days' advance notice.

5. Provide fire hoses in number, size, and of length as required to reach a storm drain or other acceptable location for the disposal of fire pump test water. These fire hoses are for use during field acceptance tests only and are not to become property of the Owner.

B. Final Checks Before Start-Up: Perform the following preventative maintenance operations and checks before start-up:

1. Lubricate oil-lubricated bearings.

2. Remove grease-lubricated bearing covers and flush the bearings with kerosene and thoroughly clean. Fill with new lubricant in accordance with the manufacturer's recommendations.

3. Disconnect coupling and check electric motor for proper rotation. Rotation shall match direction of rotation marked on pump casing.

4. Check that pump is free to rotate by hand. If the pump is bound or even drags slightly, do not operate the pump until the cause of the trouble is determined and corrected.

5. Install coolant in cooling system. Fill closed loop cooling system with potable water and add a rust inhibitor.

6. Install coolant in cooling system. Fill closed loop cooling system with a solution of 50 percent potable water and 50 percent ethylene glycol permanent antifreeze. Add rust inhibitor, if not included in antifreeze.

C. Starting procedure for pumps:

1. Prime the pump, opening the suction valve, closing the drains, and prepare the pump for operation.

2. Open the sealing liquid supply valve if the pump is so fitted.

3. Start motor.

4. Open the discharge valve slowly.

5. Observe the leakage from the stuffing boxes and adjust the sealing liquid valve for proper flow to ensure the lubrication of the packing. Do not tighten the gland immediately, but let the packing run in before reducing the leakage through the stuffing boxes.

6. Check the general mechanical operation of the pump and motor.

END OF SECTION 15320