SECTION 21 30 00

FIRE PROTECTION PUMPS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

A. The Conditions of the Contract and applicable requirements of Division 1, "General Requirements", and Section 23 01 00, "Mechanical General Provisions", govern this Section.

1.2 DESCRIPTION OF WORK:

A. Work Included: Provide pumps as specified, scheduled, and indicated. The Work shall be installed in accordance with the Drawings and Specifications. All devices and equipment shall be listed by Underwriters' Laboratories, Inc. or Factory Mutual-approved, individually and as a system, as applicable.

B. Types: The types of fire protection pumps required for the project include, but are not limited to, the following:

1. **[Horizontal electric] [and] [diesel driven]** fire pump systems.
2. Jockey pumps.

1.3 QUALITY ASSURANCE:

A. Manufacturers: Provide products complying with these specifications and produced by one of the following:

1. Pumps:
   a. Allis-Chalmers Corporation.
   b. Armstrong Pumps, Inc.
   c. Aurora Pump Company.
   d. Bell and Gossett, ITT Division.
   e. Burks.
   f. Fairbanks-Morse.
   g. Ingersol-Rand.
   h. PACO Pumps.
   i. Patterson.
   j. Peerless.
   k. Taco, Inc.
   l. Weil Pump Company.
   m. Weinman.
   n. Worthington Pump Division, Dresser Industries.
2. Fire Pump Controllers:
   a. Firetrol, Inc.
   b. Metron.

c. Sylvania/Clark.

B. Electrical Standards: Provide electric motors and products which have been listed and labeled by Underwriters' Laboratories, Inc. (UL) and comply with National Electrical Manufacturers' Association (NEMA) standards.

C. Certification, Pump Performance: Provide pumps whose performance, under specified conditions, is certified by the manufacturer.

1.4 SUBMITTALS:

A. Shop drawing submittals shall include, but not be limited to, the following:

1. Fire and jockey pump cut sheets with all pump capacities, UL/FM approval, pump characteristics, features and accessories clearly indicated.
2. Pump curves with selection point clearly indicated.
3. Motor data as required in Section 23 04 00, "Motors and Controllers".
4. Fire Pump Controller**[/Automatic Transfer Switch]** and remote annunciator cut sheets with features and options clearly indicated, wiring diagrams, nameplate text and a written system operational sequence.
5. Jockey pump controller cutsheets with features and options clearly indicated.
6. Additional information as required in Section 23 01 00.

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING:

A. Deliver pumps, controllers, **[automatic transfer switch,]** and accessories in factory-fabricated water-resistant wrapping.

B. Handle pumps, controllers, **[automatic transfer switch,]** and accessories carefully to avoid damage to material component, enclosure, and finish.

C. Store pumps, controllers, **[automatic transfer switch,]** and accessories in a clean, dry space and protect from the weather.

PART 2 - PRODUCTS

2.1 HORIZONTAL ELECTRIC FIRE PUMP SYSTEM

A. General: Provide a complete and operational horizontal electric fire pump system with fire pump controller**[/automatic transfer switch]** as specified herein and as scheduled and as shown on the Drawings. All equipment furnished and the complete installation shall be in accordance with NFPA 20. Pump and controller**[/automatic transfer switch]** shall bear the UL label.

B. Fire Pump:

1. The electric driven fire pump shall be a double suction horizontal split case, centrifugal type, UL-Listed, FM-approved and in compliance with all requirements of NFPA 20. The pump shall be of bronze-fitted construction with Class 30 cast iron casing, bronze impeller, renewable bronze sleeves and bronze wear rings, packed stuffing boxes and grease lubricated ball bearings. Pump shaft shall be high strength steel. Pump shaft deflection shall not exceed 0.002" at the stuffing boxes when operating at 25% of the best operating point. Pump suction and discharge flanges shall be ANSI 250# flanges suitable for working pressures up to 250 psi. The fire pump shall be factory mounted on a fabricated steel drip-lip base and connected through a flexible coupling to an open drip-proof motor. Motor shall have a 1.15 service factor shall be sized so as to not exceed the permissible loading limits of NFPA 20 at any point on the pump performance curve. Locked rotor current shall not exceed the values specified in NFPA 20. Each motor shall be of such capacity that at rated voltage under any pump operating condition,

the full load ampere rating shall not be exceeded except as permitted by the service factor stamped on the motor nameplate. Motors shall be compatible with the specified motor controller. Motor electrical characteristics and capacity shall be as scheduled and shown on the Drawings. Refer to Section 23 04 00 for additional motor requirements.

2. The fire pump shall have capacities as scheduled on the drawings and shall have a maximum shutoff head not to exceed 120% of design and shall be capable of pumping a minimum of 150% of rated capacity at 65% of rated pressure. **[Pump shall deliver the scheduled capacity at a suction condition of zero psi.]**

3. Pump shall be hydrostatically tested at 1.5 times the maximum working pressure but in no case less than 250 psig.

C. Accessories:

1. Provide pump accessories per NFPA 20, including, but not limited to:

a. 1/2" automatic air release.

b. 3/4" minimum casing overheat relief.

c. Casing relief solenoid valve.

d. 3-1/2" dial compound suction pressure gauge.

e. 3-1/2" dial discharge pressure gauge.

f. Eccentric tapered suction reducer.

g. Concentric tapered discharge increaser.

h. Base-mounted coupling guard.

i. Splash shield.

[VERIFY INSURANCE REQUIREMENT]

j. [Test header with 2-1/2" valves with caps and chains; test header valve quantity shall be per NFPA 20]. [Pump test flow measuring device in a bypass routed back to the house tank.]

2. Fire pump accessories shall be approved for domestic water use.

D. Factory Testing: The fire pump shall be factory tested and certified in accordance with NFPA 20. Certified performance test results and curves shall be delivered to the Engineer for review prior to final fire pump acceptance.

E. Field Service: The pump supplier shall provide pump checkout, start-up, testing and adjusting of system components and shall perform field certification testing on the installed fire pump. The pump supplier shall also train the Owner's Engineer in the proper operation and maintenance of the fire pump system. Refer to Section 23 05 93, "Operational Test-Adjust-Balance".

F. Fire Pump Controller:

[COORDINATE WITH DIVISION 26]

1. The fire pump controller shall be UL/FM approved for automatic and manual start **[and UL Labeled for service entrance].** Controller shall have a NEMA 2 **[or 3R]** enclosure**, [22,000] [30,000] [42,000] [65,000] [100,000] [150,000]** AIC circuit breaker, disconnect**, [across-the-line] [wye-delta closed transition]** starter, **[automatic transfer switch,]** pressure control, minimum run timer, pilot light, start-stop push buttons, manual operator, alarm relays, **[sequence start timer,]** phase reversal monitor, alarm bell and lights, fused power control transformer, and remote annunciator all as required by and in accordance with NFPA 20.

2. The fire pump controller shall be factory assembled, wired and tested [with an Automatic Transfer Switch (ATS) listed by Underwriters' Laboratories, Inc. for transfer switch and fire pump controller service,] and shall conform with NFPA 20 and NFPA 70 and be in accordance with [UL 1008 and] UL 508. Ammeter test links and voltmeter test studs shall be provided in the enclosure and a two-position pushbutton marked "START-STOP" and an emergency start handle shall be provided on the enclosure.

3. The **[ATS shall be mounted in a separate enclosure factory assembled to the]** fire pump controller**[. The two common] enclosure[s]** shall be provided with legs for floor mounting.

4. **[The ATS shall include a motor rated disconnect/isolating switch capable of interrupting the motor locked rotor current. The disconnect/isolating switch shall be mechanically interlocked so that the enclosure door cannot be opened with the handle in the "ON" position except via a hidden defeater. The disconnect/isolating switch shall be padlockable in the open or closed position.]** The **[ATS and]** Fire Pump Controller doors shall have locking handles and three point cam and roller type hardware.

5. **[Refer to Section 26 36 23 "Automatic Transfer Switches", for general requirements, controls, annunciators and accessories for Transfer Switches. Generator control wiring from ATS shall be provided by Division 26.]**

6. **[The ATS shall have "Transfer Switch Normal", "Transfer Switch Emergency" and "Emergency Isolating Switch Off" pilot lights, "Test" and "Transfer Bypass" switches, audible alarm and "Silence Alarm" pushbutton mounted in the flange of the enclosure.]**

[INCLUDE ONLY IF DUAL FIRE PUMPS ARE PROVIDED]

7. **[The fire pump controller shall be equipped with a sequential start timer. Upon a signal from the pressure controls, dry contacts shall close to start the emergency power system and the sequential start timer. After the timer delay has elapsed (field adjustable and set at 60 seconds), and the pump operating interlock from the diesel fire pump indicate that the diesel fire pump has failed to start or failed then the electric fire pump shall start. If the diesel fire pump starts, then the electric fire pump shall not be started. The generator start contact shall be a manual reset contact.]**

8. Pressure control shall be provided to sense scheduled psig at pump discharge for starting pump and to maintain system pressure of 65 psig at the point in the system with the greatest head loss at design pump flow.

9. Operation of the fire pump shall be automatic from the pressure controls with **[manual] [automatic minimum runtimer activated]** shutoff plus provisions for manually starting and stopping the pump from the controller. **[Minimum run times shall be set to operate motor when started automatically for a minimum running period of one minute for each 10 hp motor rating, but not to exceed 7 minutes.]**

10. The fire pump controller shall have indicator lights for "Main Power Supply On", "Fire Pump Running", "Loss of Main Power", "Phase Reversal" and "Low Discharge Pressure" with an audible alarm with silence pushbutton. The "Loss of Main Power" alarm shall be powered from a separate emergency power branch circuit.

11. A remote annunciator panel shall be furnished and installed by this Division in the Fire Command Center and shall be wired to the fire pump controller by Division 26. The remote annunciator shall be flush mounted and shall have a audible alarm with silence pushbutton and indicator lights for "Fire Pump Running", "Loss of Main Power", "Phase Reversal", **["Emergency Isolation Switch Off"]** and "Low Discharge Pressure". **[The remote alarms shall also have alarm output contacts for monitoring of fire pump trouble and run alarms by the Fire Alarm System specified under Division 28] [and the Building Control and Automation System specified [in Section 23 06 00, "Building Controls",] [under Division 23].**

12. All fire pump controller**[, ATS]** and remote annunciator control switches and indicators shall have engraved identifying nameplates.

[COORDINATE WITH DIVISION 16]

13. **[The fire pump controller/ATS shall also have the following control functions in addition to those specified in Section 26 36 23:]**

    a. **[Provide an interlock between the fire pump controller and ATS that will when the fire pump is running, inhibit the automatic transfer switch from "TRANSFERRING-TO-NORMAL" power source as long as the fire pump is operating on the "EMERGENCY" source. Interlock control wiring from the Fire Pump Controller to the Fire Pump Automatic Transfer Switch shall be factory-installed.]**

    b. **[Provide a timed contact (adjustable 0 - 30 seconds) that will inhibit all elevators operating on the "EMERGENCY" power source until after the pump has started. Interlock control wiring from the Fire Pump Controller to each elevator controller to be provided and installed by Division 26.]**

2.2 DIESEL DRIVEN FIRE PUMPS:

A. General: Provide a complete and operational horizontal diesel driven fire pump system with fire pump controller, as specified herein and as scheduled and as shown on the Drawings. All equipment furnished and the complete installation shall be in accordance with NFPA 20. Pump and controller shall bear the UL label.

B. Fire Pump:

1. The diesel driven fire pump shall be a double suction, horizontal split case, centrifugal type UL-listed, FM-approved and in compliance with all requirements of NFPA 20. The pump shall be bronze-fitted construction with Class 30 cast iron casing, bronze impeller, renewable bronze sleeves and bronze wear rings, packed stuffing boxes and grease lubricated ball-bearings.

2. Pump shaft shall be high strength steel. Pump shaft defection shall not exceed 0.002" at the stuffing boxes when operating at 25% of the best operating point. Pump suction and discharge flanges shall be ANSI 250# flanges suitable for working pressures up to 250 psi. The fire pump shall be factory-mounted on a fabricated steel skid/drip lip base and connected through a flexible coupling to a diesel engine driver.

3. The fire pump shall have capacities as scheduled on the drawings and shall have a maximum shutoff head not to exceed 120% of design and shall be capable of pumping a minimum of 150% of rated capacity at 65% of rated pressure. **[Pump shall deliver the scheduled capacity at a suction pressure of zero psi].**

C. Diesel Driver:

1. The Diesel Engine Pump Driver shall be UL and FM-listed for fire pump service and rated for the elevation above sea level that it is installed. The engine shall be arranged for dual battery automatic starting and be complete with engine driven generator, voltage regulator and battery charger with "run" disconnect relay.

2. The engine cooling system shall consist of a factory-installed heat exchanger and circulating pump factory-piped for connection to the fire water supply and controlled by a solenoid valve.

3. Cooling water piping shall also include a pressure reducing valve with isolating hand valves, strainers valved bypass and pressure gauge. A **[480 volt, 3-phase,]** water jacket heater with thermostatic control shall be provided.

4. The engine instrument panel shall include ammeter, oil pressure gauge, water temperature gauge, engine speed indicator and total hour meter. Engine batteries shall consist of a dual bank

of heavy duty industrial batteries for 12 or 24 volt service and shall be complete with storage racks, cables and battery charger.

5. The diesel engine shall be furnished with a critical grade side or end inlet silencer (as shown on the Mechanical Drawings), a stainless steel flexible exhaust connector and a ventilated **[roof] [wall]** thimble.

6. Fuel system accessories in addition to the engine mounted components shall include a fuel strainer, check valve, stop cock, flexible connectors, fuel tank sized in accordance with NFPA 20, state and local codes, fill cap, fill and vent pipes, direct reading level gauge and low fuel level float switch.

D. Accessories:

1. Provide pump accessories per NFPA 20, including, but not be limited to:

a. Eccentric suction reducer.

b. Concentric suction reducer.

c. Main relief valve with closed-cone and discharge piped as shown on the drawings.

d. Overflow cone.

e. Discharge tee with relief valve elbow.

f. Test header with 2-1/2" valves; valve quantity shall be per NFPA 20.

g. 3-1/2" dial compound suction gauge.

h. 3-1/2" dial discharge pressure gauge.

i. 1/2" automatic air release valve.

j. 3/4" minimum thermostatic relief valve with solenoid valve.

2. Fire pump accessories shall be approved for domestic water use.

E. Factory Testing: The fire pump shall be factory tested and certified in accordance with NFPA 20. Certified performance test results and curves shall be delivered to the Architect/Engineer for review prior to final fire pump acceptance.

F. Field Service: The pump supplier shall provide pump checkout, start-up, testing and adjusting of system components and shall perform field certification testing on the installed fire pump. The pump supplier shall also train the Owner's Engineer in the proper operation and maintenance of the fire pump system.

G. Fire Pump Controller:

1. The fire pump controller shall be UL/FM-approved for automatic and manual start. Controller shall have a disconnect switch, control relays, pressure control, minimum run timer, pilot light, TEST-AUTO-OFF-MANUAL selector switch, manual start pushbuttons for each battery stop pushbutton, alarm relays, and other specified or required accessories as required by and in accordance with NFPA 20. Controller shall be installed in a NEMA 3R locking enclosure with suitable legs for floor mounting.

2. The fire pump controller be provided with a timer for automatic weekly testing, a solid state crank control and battery alternating circuit, an automatic battery failure lockout, status lights for power available from Battery 1 and Battery 2 and control switch in AUTO position, local alarm signal and lights for overcrank, low oil pressure, high water temperature, overspeed, loss of battery charger output and low fuel level, alarm output contacts for remote annunciation and automatic stop.

3. Remote annunciator panels shall be furnished and installed by this Division in the Fire Command Center and Engineers Office and shall be wired to the fire pump controller by Division 26. The remote annunciators shall be flush mounted and shall have an audible alarm with silence

pushbutton and indicator lights for "Fire Pump Running", "System Failure", "Control Switch in Manual or Off Position" and "Battery Failure". **[The remote alarms shall also have alarm output contacts for monitoring of fire pump trouble and run alarms by the Fire Alarm System specified under Division 26.] [and the Building Control and Automation System specified [in Section 23 06 00, "Building Controls",] [under Division 23].]**

4. The fire pump controller control switches and indicators shall have engraved identifying nameplates.

5. Fire pump controller shall be fully factory wired and tested.

2.3 JOCKEY PUMP:

A. General: Provide a complete and operational electric driven fire jockey pump and jockey pump controller as specified herein and as scheduled and as shown on the Drawings.

B. Pump:

1. The jockey pump shall be bronze fitted, horizontal regenerative, turbine vane type with cast iron casing, bronze impeller, stainless steel shaft, mechanical seals, grease lubricated ball-bearings and a relief valve. Jockey pump capacities shall be as scheduled on the Drawings. Pumps, casings, flanges, and mechanical seals shall be rated for operation with the working pressures scheduled.

2. The jockey pump shall be mounted on a fabricated **[cast iron] [steel]** drip lip base and shall be **[close-coupled] [flexible coupled]** to an **[energy efficient, high efficiency]** open dripproof motor. Motor electrical characteristics and capacity shall be as scheduled or listed on the drawings. Refer to Section 23 04 00 for additional motor requirements.

C. Relief Valve: Provide the fire jockey pump with a factory-mounted bypass relief valve complete with piping. Set relief valve to relieve at a pressure of 25 psig above design total dynamic head to prevent motor overload and system damage.

D. Controller: The jockey pump controller shall contain a FVNR magnetic starter with 3-phase overload protection, fused disconnect, control power transformer, H-O-A selector switch and an adjustable mercury-in-tube pressure control all housed in a NEMA 1 enclosure with door mounted disconnect handle.

E. Field Service: The pump supplier shall provide pump checkout, start-up, testing and adjusting of system components and shall perform field certification testing on the installed jockey pump. The pump supplier shall also train the Owner's Engineer in the proper operation and maintenance of the jockey pump system. Refer to Section 23 05 93 for additional requirements.

PART 3 - EXECUTION

3.1 INSPECTION:

A. General: Installer shall examine conditions under which pumps are to be installed and notify Contractor in writing of conditions detrimental to proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to Installer.

3.2 TYPICAL INSTALLATION OF PUMPS:

A. General: Install pumps where shown, in accordance with manufacturer's written instructions and recognized industry practices to ensure that pumps comply with requirements and serve intended purposes. Comply with NEMA standards and requirements of NEC. Fire and fire jockey pumps shall be installed in accordance with NFPA 20 and the manufacturer's UL-listed installation instructions.

B. Base-mounted Pumps: Pumps shall be leveled, bolted, and grouted to pump bases. Piping shall be arranged so pump cases are not subjected to any piping forces. Contractor shall check for proper angular and concentric alignment of pumps and motors and shall get Engineer's approval of this alignment before pumps are operated.

C. Alignment: Check alignment and, where necessary, realign shafts of motors and pumps within tolerances recommended by manufacturer.

D. Housekeeping Pads/Vibration Isolation: Refer to Section 23 03 00, "Basic Materials and Methods", and Section 23 05 48, "Vibration Isolation", for applicable requirements.

E. Drain Lines: Provide a drain line (3/4" minimum) for each pump drip base to the nearest floor drain.

F. Casing Relief Valves: Provide individual casing relief drain lines from each fire pump casing relief valve **[to the] [nearest floor drain] [house/break tank]**.

G. [Fuel Oil Tank: The diesel fire pump fuel oil tank shall be installed inside a spill containment curb sized to contain the entire contents of the tank. Fuel oil for testing and to fill the fuel tank at the time of final acceptance shall be provided by this Contractor.]

3.3 ELECTRICAL CONNECTIONS:

A. Controllers and Annunciators: Set pump controllers and annunciators in place for wiring by Division 16.

B. Grounding: Provide positive electrical pump and motor grounding in accordance with applicable requirements of the NEC.

3.4 COORDINATION:

A. General: This Contractor shall be responsible for coordinating installation requirements and provisions with the work of other Divisions and the General Contractor.

3.5 START-UP SERVICES:

A. General: The pump supplier shall provide pump checkout, start-up, testing and adjusting of system components for the pump**[s]**. The pump supplier shall also train the Owner's Engineer in the proper operation and maintenance of **[these] [this]** pump system**[s]**.

B. Checkout: After pumps have been in operation for 90 days, the contractor shall check all seals and replace any which are defective.

3.6 TESTING:

A. General: Test and adjust all installed plumbing pumps, controllers, and annunciators to verify proper operation as specified herein and as recommended by the manufacturers. Where specified hereinabove, start-up, testing, and adjustment shall be provided by a representative of the equipment supplier.All tests shall be witnessed by the UH Fire Marshal's Office.

B. Functional Tests: Test pumps, controllers, and annunciators to verify that all control, alarm and indicator functions operate properly and to verify that pump discharge pressures and flows are as specified.

C. Fire Pump Testing: Each fire pump shall be field flow tested by a representative of the manufacturer and certified in accordance with NFPA 20.

D. Refer to Section 23 05 93 for additional start-up, testing, and adjustment requirements.

3.7 IDENTIFICATION:

A. Refer to Section 23 03 00 for applicable painting, nameplates, and labeling requirements.

END OF SECTION 21 30 00