

## SECTION 21 31 16 - DIESEL-DRIVE, CENTRIFUGAL FIRE PUMPS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Split-case fire pumps.
  - 2. Fire-pump Controllers, accessories and specialties.
  - 3. Flowmeter systems.
  - 4. Pressure-Maintenance pumps, controllers, and accessories and specialties.
  - 5. Alarm Panels.
  - 6. Factory Pre-Fabricated Building and Accessories.

#### 1.3 PERFORMANCE REQUIREMENTS

- A. Pump Equipment, Accessory, and Specialty Pressure Rating: 175 psig (1200 kPa) minimum unless higher pressure rating is indicated.

#### 1.4 SUBMITTALS

- A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, performance curves, electrical characteristics, and furnished specialties and accessories.
- B. Shop Drawings: For fire pumps, engine drivers, and fire-pump accessories and specialties. Include plans, elevations, sections, details, and attachments to other work.
  - 1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
  - 2. Wiring Diagrams: For power, signal, and control wiring.
- C. Product Certificates: For each fire pump, from manufacturer.
- D. Source quality-control reports.
- E. Field quality-control reports.
- F. Operation and Maintenance Data: For fire pumps to include in operation and maintenance manuals.

#### 1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain fire pumps, drives, pressure-maintenance pumps, and controllers through one source from a single manufacturer for each type of equipment.
- B. Product Options: Drawings indicate size, profiles, and dimensional requirements of fire pumps, pressure-maintenance pumps, and controllers and are based on specific systems indicated. Refer to Division 1 Section "Product Requirements."
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

- D. Comply with standards of authorities having jurisdiction pertaining to materials, hose threads, and installation.
- E. NFPA Compliance: Comply with NFPA 20, "Installation of Stationary Pumps for Fire Protection."

## 1.6 COORDINATION

- A. Coordinate sizes and locations of concrete bases with actual equipment provided.

## PART 2 - PRODUCTS

### 2.1 GENERAL REQUIREMENTS FOR CENTRIFUGAL FIRE PUMPS

- A. Description: Factory-assembled and -tested fire-pump and driver unit.
- B. Base: Fabricated and attached to fire-pump and driver unit with reinforcement to resist movement of pump during seismic events when base is anchored to building substrate.
- C. Finish: Red paint applied to factory-assembled and -tested unit before shipping.

### 2.2 SINGLE-STAGE, SPLIT-CASE FIRE PUMPS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. A-C Fire Pump Systems; a business of ITT Industries.
  - 2. Patterson Pump Company; a subsidiary of the Gorman-Rupp Company.
  - 3. Peerless Pump, Inc.
  - 4. Pentair Pump Group; Aurora Pump.
  - 5. S.A. Armstrong Limited.
- B. Pump:
  - 1. Standard: UL 448, for split-case pumps for fire service.
  - 2. Casing: Axially split case, cast iron with ASME B16.1 pipe-flange connections.
  - 3. Impeller: Cast bronze, statically and dynamically balanced, and keyed to shaft.
  - 4. Wear Rings: Replaceable bronze.
  - 5. Shaft and Sleeve: Steel shaft with bronze sleeve.
    - a. Shaft Bearings: Grease-lubricated ball bearings in cast-iron housing.
    - b. Seals: Stuffing box with minimum of four rings of graphite-impregnated braided yarn and bronze packing gland.
  - 6. Mounting: Pump and driver shafts are horizontal, with pump and driver on same base.
- C. Coupling: Flexible and capable of absorbing torsional vibration and shaft misalignment. Include metal coupling guard.
- D. Driver:
  - 1. Standard: UL 1247.
  - 2. Type: Diesel engine.
  - 3. Emergency Manual Operator: Factory wired for starting and operating standby engine in case of malfunction in main controller or wiring.
  - 4. Engine Cooling System: Factory-installed radiator.
    - a. Coolant: Type recommended by driver manufacturer.
  - 5. Engine Cooling System: Factory-installed water piping, valves, strainer, pressure regulator, heat exchanger, coolant pump, bypass piping, and fittings.

DIESEL-DRIVE, CENTRIFUGAL FIRE PUMPS

- a. Piping: ASTM B 88, Type L (ASTM B 88M, Type B), copper water tube; ASME B16.22, wrought-copper, solder-joint pressure fittings; AWS A5.8/A5.8M, BCuP Series brazing filler metal; and brazed joints.
  6. Engine-Jacket Water Heater: Factory-installed electric elements.
  7. Dual Batteries: Lead-acid-storage type with 100 percent standby reserve capacity.
  8. Fuel System: Comply with NFPA 20.
    - a. Fuel Storage Tank: Size indicated but not less than required by NFPA 20. Include floor legs, direct-reading level gauge, and secondary containment tank with capacity at least equal to fuel storage tank.
  9. Exhaust System: ASTM A 53/A 53M, Type E or S, Schedule 40, black steel pipe; ASME B16.9, weld-type pipe fittings; ASME B16.5, steel flanges; and ASME B16.21, nonmetallic gaskets. Fabricate double-wall, ventilated thimble from steel pipe.
    - a. Exhaust Connector: Flexible type.
    - b. Exhaust Silencer: Residential type.
- E. Capacities and Characteristics:
1. Rated Capacity: 500 gpm.
  2. Total Rated Head: 50 psi.
  3. Inlet Flange: Class 125.
  4. Outlet Flange: Class 125.
  5. Suction Head Available at Pump: 41 psi.

2.3 PRESSURE MAINTENANCE PUMPS

- A. Description: Factory-assembled and tested, electric-drive pumps with stainless-steel casing and 304 stainless steel impellers and high temperature mechanical seal with Carbon vs. Silicon Carbide, EPDM elastomers throughout, Tungsten Carbide against Ceramic pump bushings, and a Cast Iron motor bracket. Include flanged suction and discharge flanges machined to ASME B16.1, Class 125 dimensions except that connections may be grooved type flange fittings.
- B. Multistage Centrifugal, Pressure-Maintenance Pumps: Multiple-impeller type complying with HI 1.1-1.5 requirements for multistage centrifugal pumps, include base.
- C. Finish: Manufacturer's standard color paint supplied to factor-assembled and tested unit before shipping.
- D. Nameplates: Complete with capacities, characteristics, and other pertinent data.

2.4 PUMP CONTROLLERS

A. DIESEL FIRE PUMP CONTROLLER

1. The fire pump controller shall meet the requirements of the most recent edition of NFPA20 and shall be listed by Underwriters Laboratories, Inc. and approved by Factor Mutual Research Corporation. The controller shall be 12 volts negative ground and shall be field configured by means of jumpers to be compatible with all listed diesel type fire pump engines. Controllers limited to specific models will not be acceptable.
2. The enclosure shall be NEMA Type 2 lockable with break glass panel, suitable for floor or wall mounting. The enclosure shall be painted with a UL recognized corrosion resistant red baked enamel.
3. A voltage surge arrestor for the incoming AC volts shall be provided and connected to a line disconnect switch.
4. The following visual indicators and audible alarms will be provided.
  - a. Automatic ON
  - b. Fail to Start
  - c. Low Oil Pressure
  - d. Engine Over Temp
  - e. Engine Over Speed

- f. #1 Battery Overcharge
  - g. #1 Battery Failure
  - h. #2 Battery Overcharge
  - i. #2 Battery Failure
  - j. Charger Loss
  - k. Low Fuel Level
  - l. Low Pump Room Temp
  - m. Safety Shut Down
- 5. Two sets of SPDT alarm contacts will be provided for remote alarm of the following:
  - a. Engine Running
  - b. Engine Failure
  - c. Controller Switch Off
- 6. One set of SPDT alarm contacts will be provided for remote alarm of the following:
  - a. Charger loss
  - b. Battery #1 Failure
  - c. Battery #2 Failure
  - d. Battery #1 Overcharge
  - e. Battery #2 Overcharge
  - f. Low Fuel Level
  - g. Low Pump Room Temperature
- 7. The system will provide two battery chargers of a solid state design, 12 amps current limiting. Chargers shall be jumper configured for 12 volt operation and lead acid batteries. Chargers will provide LED indication for the following items: normal operation (green), reverse battery polarity (red), battery missing (red), battery voltage less than 50% (red), battery overcharge (red). The overcharge alarm will activate when the battery maintains equalized voltage charging for more than 36 hours continuous.
- 8. The controller shall include a 7 day pressure recorder battery driven type located below and away from the electrical components.
  - a. Internal plumbing and solenoid valve shall be rated for 300 PSI service.
- 9. A weekly programmable timer with LCD indication will be provided to start and test the engine for 30 minutes once a week.
- 10. The controller shall include a safety shut down circuit to shut down the engine on "Low Oil Pressure" and "Engine Over Temperature" if the engine is running due to Weekly Test or AC Power Failure. An alarm will sound if this condition occurs.
- 11. The controller shall include a logic control panel combining the reliability of solid state circuit board construction and plug-in relays. All components shall be clearly identified with diagram symbols as well as operational functions on the board. All plug-in relays shall be identical and interchangeable. LED's for all engine functions will be provided. When the controller provides the appropriate signal to energize the specific engine terminal, the LED will illuminate. All terminals shall be clearly identified with terminal numbers and circuit functions.
- 12. The controller shall have a twin cluster LED annunciator control panel. Green "Auto ON" indicators shall be provided for normal stand-by operation and red indicators shall be provided for alarm indicators. The LED alarms shall be presented in a logical and organized format. The upper row will contain engine related signals. The next row will contain charger and battery related signals. The third row will provide normal and optional signals. Individual volt and amp meters will be provided. A three position "Manual, Off, Auto-On Test" selector will be provided. Individual battery crank pushbuttons will be provided with the capability of individual or simultaneous operation for hard cranking conditions.
- 13. Where a multiple pump system is utilized, each controller will be provided with an adjustable time delay relay. Each controller will be capable of individual setting such that a failure in one does not affect the other controllers. Timers will be capable of a 5 to 10 second minimum delays between pumps and will be activated upon low pressure.
- 14. Controller shall be a Tornatech model GPD, diesel fire pump controller, or functional equivalent by Master Controls. or Eaton.

B. PRESSURE MAINTENANCE PUMP CONTROLLER

1. Controller shall be a Tornatech model JPLT or functional equivalent by Master Controls. or Eaton.
2. Description: UL 508; factory-assembled, wired, and tested; across-the-line type for combined automatic and non-automatic operation.
3. UL Listed full voltage combination motor controller with built-in pressure switch designed to automatically start and stop pump motor assemblies which are used to maintain system water pressure in a fire pump system.
4. Electric Service: 208 VAC, 3 phase, 60 Hz
5. Include externally operable fused disconnect with fuse blocks and horsepower rated fuses, a motor contactor with protective overload relay, pressure switch with independent low turn-on and high turn-off adjustments, pilot light for pump running, and a HAND-OFF-AUTO selector switch, in a wall mountable NEMA 2 drip proof enclosure.

2.5 ALARM PANELS

- A. Description: Factory-assembled and -wired remote panel complying with UL 508 and requirements in NFPA 20. Include audible and visible alarms matching controller type.

1. Manufacturers:
  - a. Cutler-Hammer.
  - b. Firetrol, Inc.
  - c. Hubbell Industrial Controls, Inc.
  - d. Joslyn Clark.
  - e. Master Control Systems, Inc.
  - f. Metron, Inc.
2. Enclosure: NEMA 250, Type 2, remote wall-mounting type.
  - a. Finish: Manufacturer's standard red paint applied to factory-assembled and -tested unit before shipping.
3. Features: Include manufacturer's standard features and the following:
  - a. Motor-operating condition.
  - b. Loss-of-line power.
  - c. Phase reversal.
  - d. Low-water alarm.

2.6 FIRE-PUMP ACCESSORIES AND SPECIALTIES

- A. Automatic Air-Release Valves: Comply with NFPA 20 for installation in fire-pump casing.
- B. Circulation Relief Valves: UL 1478, brass, spring loaded; for installation in pump discharge piping.
- C. Relief Valves:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. BERMAD Control Valves.
    - b. CLA-VAL Automatic Control Valves.
    - c. Kunkle Valve; a part of Tyco International Ltd.
    - d. OCV Control Valves.
    - e. Watts Regulator Company; a division of Watts Water Technologies, Inc.
    - f. Zurn Plumbing Products Group; Wilkins Water Control Products.
  2. Description: UL 1478, bronze or cast iron, spring loaded; for installation in fire-suppression water-supply piping.
- D. Inlet Fitting: Eccentric tapered reducer at pump suction inlet.
- E. Outlet Fitting: Concentric tapered reducer at pump discharge outlet.

- F. Discharge Cone: Closed type.
- G. Hose Valve Manifold Assembly:
  - 1. Standard: Comply with requirements in NFPA 20.
  - 2. Header Pipe: ASTM A 53/A 53M, Schedule 40, galvanized steel with ends threaded according to ASME B1.20.1.
  - 3. Header Pipe Fittings: ASME B16.4, galvanized cast-iron threaded fittings.
  - 4. Automatic Drain Valve: UL 1726.
  - 5. Manifold:
    - a. Test Connections: Comply with UL 405 except provide outlets without clappers instead of inlets.
    - b. Body: Flush type, brass or ductile iron, with number of outlets required by NFPA 20.
    - c. Nipples: ASTM A 53/A 53M, Schedule 40, galvanized-steel pipe with ends threaded according to ASME B1.20.1.
    - d. Adapters and Caps with Chain: Brass or bronze, with outlet threaded according to NFPA 1963 and matching local fire-department threads.
    - e. Escutcheon Plate: Brass or bronze; rectangular.
    - f. Hose Valves: UL 668, bronze, with outlet threaded according to NFPA 1963 and matching local fire-department threads.
    - g. Exposed Parts Finish: Polished.
    - h. Escutcheon Plate Marking: Equivalent to "FIRE PUMP TEST."

## 2.7 FLOWMETER SYSTEMS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Emerson Process Management; Rosemount Division.
  - 2. Fire Research Corp.
  - 3. Gerand Engineering Co.
  - 4. Hydro Flow Products, Inc.
  - 5. Hyspan Precision Products, Inc.
  - 6. Meriam Process Technologies.
  - 7. Preso Meters; Division of Racine Federated Inc.
  - 8. Reddy-Buffaloes Pump Company.
  - 9. Victaulic Company.
- B. Description: UL-listed or FM-Approved, fire-pump flowmeter system with capability to indicate flow to not less than 175 percent of fire-pump rated capacity.
- C. Pressure Rating: 175 psig minimum.
- D. Sensor: Annubar probe, orifice plate, or venturi unless otherwise indicated. Sensor size shall match pipe, tubing, flowmeter, and fittings.
- E. Permanently Mounted Flowmeter: Compatible with flow sensor; with dial not less than 4-1/2 inches (115 mm) in diameter. Include bracket or device for wall mounting.
  - 1. Tubing Package: NPS 1/8 or NPS 1/4 soft copper tubing with copper or brass fittings and valves.
- F. Portable Flowmeter: Compatible with flow sensor; with dial not less than 4-1/2 inches (115 mm) in diameter and with two 12-foot- (3.7-m-) long hoses in carrying case.

## 2.8 GROUT

- A. Standard: ASTM C 1107, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- B. Characteristics: Non-shrink and recommended for interior and exterior applications.
- C. Design Mix: 5000-psi (34-MPa), 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

2.9 SOURCE QUALITY CONTROL

- A. Testing: Test and inspect fire pumps according to UL 448 requirements for "Operation Test" and "Manufacturing and Production Tests."
  - 1. Verification of Performance: Rate fire pumps according to UL 448.
- B. Fire pumps will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.

2.10 PRE-ERECTED BUILDING

- A. Design Criteria
  - 1. Building Size: 12' wide x 21'-4" long (maximum) x 12' (nominal) high. The building width and length shall be measured from the outside of the building wall panels and the height of the building shall be the distance measured from the bottom surface of the base channel to the exterior juncture of the roof and sidewall panels. The packaged system shall be supplied complete with all necessary component parts, to form a complete and functional system. All parts shall be new and free from all defects or imperfections
  - 2. The Pre-Erected Building shall be designed by a Registered Professional Engineer that the building is designed in accordance with applicable section of the latest edition of the AISC "Specifications for Structural Steel Buildings" and the AISI "Specifications the Design of Cold Formed Steel Structural Members".
  - 3. The building shall be designed for the following load in addition to the stationary weight (dead load) of the building. Reduction of loads due to tributary loaded areas will not be permitted.
    - a. The vertical Live Load of the building shall be not less than 40 pounds per square foot applied on the horizontal projection of the roof.
    - b. The horizontal Wind Load of the building shall be not less than 90 miles per hour and shall distributed and applied in accordance with the applicable edition of the Metal Building Manufactures Associated (MBMA) publication "Low Rise Building Systems Manual".
    - c. The building and portions thereof shall be designed to resist the effects of seismic ground motions as may be expected in the seismic zone.
- 3. The above pump and controllers to be mounted on a structural steel open I-beam base, and enclosed in a self-framing metal building conforming to local building codes. Steel base to include lifting eyes for off loading at job site. Fire pump to be pre-piped from six (6) inch discharge head flange, six (6) inch check valve, six (6) inch tee and butterfly valve for test header, six (6) inch discharge control butterfly valve, and six (6) inch flanged elbow for system discharge connection. Diesel engine muffler and exhaust piping shall be 100% wrapped with calcium silicate insulation and aluminum roll jacketing. Controller sensing lines, and interior sprinkler system pre-piped. Service entrance connection to 208 volt, 3 phase main distribution panel by others. All electrical wiring between fire pump controller, unit heater, and 208/120 volt transformer shall be pre-wired with circuit breaker protection from main distribution panel. All other electrical fixtures pre-wired, with circuit breaker protection, from transformer secondary. Design and construction is to be in accordance with NFPA 13 and 20. All pipe to be schedule 40 carbon steel, all flanged fittings to be 125# class. Unit to be hydrostatic tested, painted, and completely assembled prior to shipment. System includes a sprinkler system per NFPA 13.
- B. Roof Panel Material
  - 1. Roof panels shall be supplied in a single continuous length from the eave line to ridge line and shall be designed to tightly interlock so that no fasteners are required at intermediate points along the panel side laps.
  - 2. Roof panels shall be a maximum of 16" wide with a flat surface between the interlocking side ribs. The interlocking ribs shall be a minimum 3" high, and shall be turned upward. All roof panels shall be factory punched for connection at the eave line of the building.
  - 3. Roof panels shall be a nominal 24 ga. galvanized steel conforming to ASTM A525 specifications with the galvanized coating conforming to G90 (1 - 1/4 oz.) standards. Minimum yield strength of panel materials shall be 50,000 PSI.

4. All exterior surfaces of the galvanized steel roof panels, shall receive two factory, roller applied, paint coats having a combined coating thickness of .08 to 1.2 mils of dry film thickness. The finish coat for roof panels shall be a white siliconized polyester formula.
5. The building shall have a simple slope interlocking panel roof system with 1 ½" slope over the building width. Roof panel shall be attached to the wall cap through factory punched holes, with #14 corrosion resistant fasteners.
6. The roof system shall include a gutter and downspout system at the low sidewall, eave trim at the high sidewall, and matching rake trim at the building endwalls. All gutter and trim shall be galvanized steel pre-painted Arctic White.
7. Transmission of horizontal windloads across the building shall be made through the panel roof system and no separate roof or wall diagonal bracing shall be required.

C. Wall Panel Material

1. Exterior wall panels of the building shall be a single continuous length from the base channel to the roof line of the building at the sidewalls and endwalls of the building except where interrupted by wall openings.
2. Wall panels shall be maximum 16" wide with a 3" deep inward turned interlocking side rib. Wall panels shall contain two ¾" deep by 3 - 1/8" wide fluted recesses, each starting 2 - 7/16" from each panel edge.
3. Wall panels shall be fastened internally to the base channel and eave cap of the building with 3/8" diameter electro galvanized machine bolts placed within the panel interlock. The fastening system shall be designed so that no wall fasteners are exposed on the exterior surfaces of the wall.
4. Wall panels shall be nominal 24 ga. galvanized steel conforming to ASTM A525 Specifications with the galvanized coating conforming G90 (1-1/4 oz.) standards. Minimum yield strength of panel material shall be 40,000 PSI. panel material shall be embossed with a random pattern pebble embossure of approximately .007 - .008 depth.

D. Color Coatings

1. All exterior surfaces of the galvanized steel wall panels and exterior trim shall receive two factory, roller applied, paint coats having a combined coating thickness of .8 to 1.2 mils of dry film thickness. The finish coat for wall panels shall be a siliconized polyester formulation of one of the following Parkline colors as selected by the architect: Twilight Blue, Desert Tan, Laurel Green, Arctic White, Harvest Gold, Roman Bronze or Shell Gray.
2. The wall panel color coating shall carry a low fire hazard rating equal to a Class 1 material as defined by Factory Mutual. The panel coating shall have achieved a Flame Spread Index of 25 or less and a Fuel Contributed Index of 100 or less when tested in accordance with ASTM E-84 test 13.9 exterior color coatings shall meet the flowing performance standards after 10 years continuous exposure in normal atmospheric conditions not containing corrosive fumes such as chemical fumes or salt spray.
3. Exterior color coatings shall meet the following performance standards after 10 years continuous exposure in normal vertical atmospheric conditions.
  - a. Panels shall show no evidence of blistering, peeling, or chipping.
  - b. Panels shall not show surface chalking in excess of the No. 8 rating D659-80 as established by the American Society for Testing and Materials (ASTM).
  - c. Panels, after cleaning, shall not show color change in excess of five (5) NBS units when measured in accordance with the ASTM D2244-85 standards.

E. Wall Openings

1. The building manufacturer shall supply all necessary framing and connectors to structurally replace the panel removed by any wall opening. All trim and flashings required to make weathertight the unit placed in any opening shall be provided by the supplier of the unit being installed.

F. Hollow Metal Doors

1. All doors shall be 1 - 3/4" thick flush type. Door panels shall be nominal 20 gauge galvanized steel reinforced by lamination to a honeycomb core enclosed with lock reinforcements shall be nominal 16 gauge.
2. Door frames shall be 4-3/4" deep double rabbeted type of nominal 16 gauge galvanized steel.
3. Door and frames shall be factory painted with one coat of baked on primer, and finished to match building color. All doors shall be preassembled in their frames and hardware installed and tested prior to shipment. Field installation of single leaf door units shall not require any frame assembly, or door hanging.



G. Door Hardware

1. Door hardware shall consist of:
  - a. 3 - 4-1/2" x 4-1/2" steel hinges per ANSI #A8132 (Old Govt. Spec. FFH-116C, Type T2127) US26D (626) Satin Chrome Finish with non-removable pins.
  - b. 3 - 11/16" wide x 5/8" high extruded aluminum threshold (Out Swing)
  - c. 3/16" x 1/2" polyurethane and vinyl weather stripping
  - d. Mortise cylinder lockset per ANSI A156.13 =, Series 100, Grade 1, Function F13 (Old Govt. Spec. 86B) US26D (626) Satin Chrome Finish

H. Lock-In Wall Liner

1. The interior of the building shall be finished with a factory assembled insulated metal liner panel having no exposed fasteners except at the matching base, ceiling and accessory trim.
2. Liner panels shall be 16" wide, nominal 26 gauge, embossed, galvanized steel, per-painted Arctic White. Insulation shall be non-combustible, nominal 1" thick, 2# minimum density fiberglass laminated to the liner panel
3. The void between the exterior wall panel and the lock-in liner shall be insulated with 3 1/2" thick R-11 un-faced fiberglass insulation.
4. The "U" value of the finished wall system shall be 0.13 BTU's per square foot when calculated in accordance with the "Zone Method" contained in ASHRAE "Handbook of Fundamentals."

I. Ceiling

1. The metal ceiling system shall consist of 3" deep, 16" wide interlocking panels of nominal 24 gauge embossed galvanized steel, factory painted Arctic White. The ceiling system shall be supported at its perimeter by concealed angles and hook bolts. The ceiling system shall be supported at its perimeter by concealed angles and hook bolts. The ceiling system shall be furnished complete with all necessary connectors and fasteners.
2. The metal ceiling shall be insulated with 16" wide by 3 1/2" thick R-11 unfaced fiberglass insulation laid at right angles to the panel ribs.
3. The "U" value of the finished wall system shall be 0.13 BTU's per square foot when calculated in accordance with the "Zone Method" contained in ASHRAE "Handbook of Fundamentals," 1981 edition.

J. Installed House Accessories

1. Fire Department connection with check valve interconnected between fire pump discharge piping.
2. 6" City bypass to include (2) isolation butterfly valves and (1) wafer check valve.
3. 6" Reduced Pressure Zone Backflow Preventer assembly with OS&Y valves.
4. 1 - 7 1/2 KW 650 CFM Unit Heater with Thermostat.
5. 2 - Dampers.
6. 1 - 20" Exhaust Fan & line voltage thermostat.
7. 4 -(2) T8 lamp / 32 Watt wet location dust resistant fluorescent light fixtures with on/off control from entryway. Fluorescent lamps shall be 4100k, 78 CRI and EPA TCLP compliant with 6 mg or less mercury.
8. 3 - 120v, 20A industrial grade GFCI Convenience Outlets Wall Mounted.
9. Provide overcurrent protection devices as required, following NEC requirements. Provide additional five (5) spare 20A/ single pole circuit breakers. All circuit breakers shall be bolt-on type.
10. 1 - Gardco #111L-16L-350-NW-GR-4-UNV-PCB-CC or equal, Exterior mounted light fixture, IESNA dark sky compliant lighting fixture with photo cell. Color selected by Architect.
11. 1 - Square D NQOD 100A MLO, 30 pole breaker panel with copper bus bars and hinged cover, NEMA 3R. Inlet power required is 100 amps of 120/208/3/60.
12. 1 - Interior battery-operated emergency light.
13. 1- 48"x48" combination louver with rainshield.
14. 1- Alarm junction box with initiating devices pre-wired to enclose terminal strips.
15. 1- Overhead automatic sprinkler system with inspector's test outlet.

K. Factory Prefabrication

1. All of the above equipment, including pre-fabricated house, (except the test header, hose valves and muffler) shall be mounted on an open I beam steel base. All piping, pressure sensing lines,

DIESEL-DRIVE, CENTRIFUGAL FIRE PUMPS

and shut-off valves, as well as approved suction and discharge valves shall be firmly anchored to the steel base by means of structural steel supports. All electrical wiring between controllers and motor, shall be completed and tested at the factory. (The entire package will require one power connection by the electrical contractor.)

L. Pump House Foundation

1. Provide a 4" thick homogenous concrete slab with 36" frost walls around the perimeter for a point of building anchorage. The slab shall extend beyond the boundaries of the structural base by a minimum of 6". Piping connections stubbed from underground supply and distribution systems shall be blocked out to permit ease for field connections.
2. Provide a separate 4" thick concrete splash slab with 36" frost walls as indicated on the drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine equipment bases and anchorage provisions, with Installer present, for compliance with requirements and for conditions affecting performance of fire pumps.
- B. Examine roughing-in for fire-suppression piping systems to verify actual locations of piping connections before fire-pump installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Fire-Pump Installation Standard: Comply with NFPA 20 for installation of fire pumps, relief valves, and related components.
- B. Equipment Mounting: Install fire pumps on concrete bases. Comply with requirements for concrete bases specified in Division 03.
  1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of concrete base.
  2. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
  3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
  4. Install anchor bolts to elevations required for proper attachment to supported equipment.
- C. Install fire-pump suction and discharge piping equal to or larger than sizes required by NFPA 20.
- D. Support piping and pumps separately so weight of piping does not rest on pumps.
- E. Install valves that are same size as connecting piping.
- F. Install pressure gauges on fire-pump suction and discharge flange pressure-gauge tapings. Comply with requirements for pressure gauges specified in Division 21 Section "Wet-Pipe Sprinkler Systems."
- G. Install piping hangers and supports, anchors, valves, gauges, and equipment supports according to NFPA 20.
- H. Install fuel system according to NFPA 20.
- I. Install water supply and drain piping for diesel-engine heat exchangers. Extend drain piping from heat exchangers to point of disposal.
- J. Install exhaust-system piping for diesel engines. Extend to point of termination outside structure. Install pipe and fittings with welded joints; install components having flanged connections with gasketed joints.

DIESEL-DRIVE, CENTRIFUGAL FIRE PUMPS

- K. Install condensate-drain piping for diesel-engine exhaust system. Extend drain piping from low points of exhaust system to condensate traps and to point of disposal.
- L. Install flowmeters and sensors. Install flowmeter-system components and make connections according to NFPA 20 and manufacturer's written instructions.
- M. Electrical Wiring: Install electrical devices furnished by equipment manufacturers but not factory mounted. Furnish copies of manufacturers' wiring diagram submittals to electrical Installer.
- N. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.

3.3 ALIGNMENT

- A. Align split-case pump and driver shafts after complete unit has been leveled on concrete base, grout has set, and anchor bolts have been tightened.
- B. After alignment is correct, tighten anchor bolts evenly. Fill baseplate completely with grout, with metal blocks and shims or wedges in place. Tighten anchor bolts after grout has hardened. Check alignment and make required corrections.
- C. Align piping connections.
- D. Align pump and driver shafts for angular and parallel alignment according to HI 1.4 and to tolerances specified by manufacturer.

3.4 CONNECTIONS

- A. Comply with requirements for piping and valves specified in Division 21 Section "Wet-Pipe Sprinkler Systems." Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to pumps and equipment to allow service and maintenance.
- C. Connect relief-valve discharge to drainage piping or point of discharge.
- D. Connect flowmeter-system meters, sensors, and valves to tubing.
- E. Connect fire pumps to their controllers.

3.5 IDENTIFICATION

- A. Identify system components. Comply with requirements for fire-pump marking according to NFPA 20.

3.6 FIELD QUALITY CONTROL

- A. Test each fire pump with its controller as a unit. Comply with Manufacturer requirements for diesel-engine-driver fire-pump controllers.
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
- C. Perform tests and inspections.
  - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- D. Tests and Inspections:
  - 1. After installing components, assemblies, and equipment including controller, test for compliance with requirements.
  - 2. Test according to NFPA 20 for acceptance and performance testing.

DIESEL-DRIVE, CENTRIFUGAL FIRE PUMPS

3. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
  4. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
  5. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- E. Components, assemblies, and equipment will be considered defective if they do not pass tests and inspections.
- F. Prepare test and inspection reports.
- G. Furnish fire hoses in number, size, and length required to reach storm drain or other acceptable location to dispose of fire-pump test water. Hoses are for tests only and do not convey to Owner.

3.7 STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform startup service.
1. Complete installation and startup checks according to manufacturer's written instructions.

3.8 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain fire pumps.

END OF SECTION 21 31 16