UNIVERSITY OF MICHIGAN
ARCHITECTURE, ENGINEERING AND CONSTRUCTION

ARCHITECTURE & ENGINEERING
326 East Hoover, Mail Stop B
Ann Arbor, MI 48109-1002
Phone: 734-764-3414
Fax: 734-936-3334

BuildingName
The Description of the Project
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SPECIFICATION DIVISION 22

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DIVISION 22 PLUMBING
SECTION 221333 - PACKAGED SUBMERSIBLE STORM AND SANITARY PUMPS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

INCLUDE PARAGRAPH 1.1.A AND B IN EVERY SPECIFICATION SECTION. EDIT RELATED SECTIONS 1.1.B TO MAKE IT PROJECT SPECIFIC.

A. Drawings and general provisions of the Contract, Standard General and Supplementary General Conditions, Division 01 Specification Sections, and other applicable Specification Sections including the Related Sections listed below, apply to this Section.

B. Related Sections:

1. Section 018113: Sustainable Design Requirements
2. Section 019110/019100: Commissioning
3. Section 220500: Common Work Results for Mechanical
4. Section 220513: Motors
5. Section 220523: Valves
6. Division 26: Electrical

EDIT SUMMARY TO MAKE PROJECT SPECIFIC. THIS SPECIFICATION PERTAINS TO PUMPS SERVING BUILDING DRAINS, I.E. PUMPS LOCATED WITHIN BUILDINGS. IT IS NOT WRITTEN TO APPLY TO PUMPS SERVING BUILDING SEWERS OR OTHER SEWERS. SUCH PUMPS HAVE ADDITIONAL REQUIREMENTS (EXPLOSION PROOF, ETC.) PER NFPA 820.

1.2 SUMMARY

A. Pumps and accessories serving Building Drains. This specification does not apply to pumps and accessories serving sewers of any type. Products specified in this section include the following:

1. Submersible pumps for elevator sumps
2. Submersible storm pumps
3. Submersible sewage pumps
4. Submersible grinder sewage pumps
5. Controls for the specified pumps
6. Sump basins and covers
7. Check valves and accessories for submersible pumps
8. Guide rail support system

1.3 SUBMITTALS.

A. Product Data: Include catalog illustrations, model, rated capacities, performance, weights, dimensions, component sizes, rough-in requirements, piping and wiring diagrams and details, materials of construction, accessories, operating and maintenance clearance requirements. Wiring diagrams shall be project specific, and differentiate between factory wiring and field wiring. Include written sequence of operations for all controls.

B. Provide information for the following:

1. Individual pump curves indicating flow rate, head, horsepower, and pump efficiency.
2. Pump pipe connection size and type.
3. Maximum passable solid size.
4. Shaft seals, bearings, and cord sealing information.
5. Motor insulation data.
6. Pump starter information.
7. Float information.
8. Control panel wiring diagrams.
9. Control panel face diagrams indicating components on the panel face and sides and how the components are labeled.
10. Float rod information.
11. Basin data, including depth, diameter; size, arrangement, and elevations of all openings; and data on gaskets and bushings to seal the cover and cover penetrations gas-tight.
12. Guide rail support system data.

C. Installation, Operation and Maintenance Manuals

1.4 QUALITY ASSURANCE STANDARDS

A. Manufacturers and Products: The products and manufacturers specified in this Section establish the standard of quality for the Work. Subject to compliance with all requirements, provide specified products from the manufacturers named in Part 2.

B. Reference Standards: Products in this section shall be built, tested, and installed in compliance with the specified quality assurance standards; latest editions, unless noted otherwise.

1. American Water Works Association
2. ANSI/HI 9.6.1-1998, NPSH Margin
3. ANSI/HI 9.6.3-1997 Operating Region
4. NEC-National Electrical Code
5. National Electrical Manufacturers Association
6. National Sanitation Foundation
7. Underwriters Laboratories Inc. listed as a manufacturer of packaged pumping systems under UL/CUL Category QCZJ.
8. Underwriters Laboratories Inc. listed as a manufacturer of control panels under UL/CUL 508a.
9. UL Standard 778 Motor Operated Water Pumps.

1.5 DEFINITIONS

A. Building Drains: Refer to the Michigan Plumbing Code.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Ship the pump and accessories in weather-proof wrap for storage outdoors. Protect control panels, pipe openings, and other sensitive components with heavy plastic or other durable means to ensure cleanliness and prevent damage during shipping and storage. Maintain protection during installation.

B. Comply with pump manufacturer's written rigging instructions for handling and installation.

1.7 WARRANTY

A. Provide a complete warranty for parts and labor for a minimum of one year from the date of Substantial Completion.

PART 2 - PRODUCTS

PROVIDE A DETAIL ON THE DRAWINGS INDICATING PIT SIZE AND DEPTH, QUANTITY AND ELEVATIONS OF FLOATS, INVERT ELEVATIONS OF CONNECTIONS TO PIT, ETC.

2.1 ACCEPTABLE MANUFACTURERS

A. Acceptable Manufacturers:

1. Barnes
2. Zoeller
3. Hydromatic
4. Goulds

ELEVATOR SUMP PUMPS MUST DISCHARGE TO SANITARY. SEE THE CONVEYING SYSTEMS DESIGN GUIDELINE FOR DETAILED REQUIREMENTS REGARDING ELEVATOR SUMP PUMPS.

2.2 SUBMERSIBLE CENTRIFUGAL PUMPS FOR ELEVATOR SUMPS

A. Simplex design, minimum capacity of 3000 gallons per hour per hoistway.

B. Pump Type: Completely submersible, end-suction, close-coupled, overhung-impeller, centrifugal pump with controls. Capable of operating un-submerged without damage to pump. Factory-assembled and tested.

C. Impeller: Capable of passing spherical solids 1/2 inch in diameter or greater. Statically and dynamically balanced, cast iron, stainless steel, or engineered plastic, keyed and secured to shaft.

D. Pump Casing: Cast iron, with open inlet, legs that elevate pump to permit flow into impeller, and vertical discharge for piping connection. Powder coated epoxy finish. Stainless steel screws, bolts, and lift handle.

EDIT MOTOR HP BELOW, OR DELETE AND INCLUDE IN PUMP SCHEDULE. MICHIGAN ELEVATOR CODE PROHIBITS PUMPS OVER 300 VOLTS. VOLTAGE RANGES INDICATED BELOW ARE THE TYPICAL DESIRED BUT MAY REQUIRE REVISION DEPENDING ON THE PROJECT. SEE THE CONVEYING SYSTEMS DESIGN GUIDELINE FOR MORE INFORMATION.

E. Motor: Hermetically sealed, oil filled, with waterproof power cable of length required with cord cap (control panel will be wired to control a receptacle in the elevator hoistway that the pump will be plugged into) and a cable-sealing assembly for connection at pump. Class B or better insulation, 1.15 service factor minimum. Non-overloading through the length of the curve.

1. Pumps 1 HP or less: 120 VAC single phase.

2. Pumps greater than 1 HP: 208 VAC three phase.
3. Single Phase Pumps: Provide capacitor-start type motors with built-in overload protection.

F. Pump and Motor Shaft: Stainless steel with factory-sealed, oil or grease-lubricated ball bearings. Upper bearing may be sleeve type.

G. Shaft Seals: Mechanical seals, single or double.

H. Controls:

1. Float Switches: Provide multiple tethered style float switches to turn the pump on and off and to detect high level, with waterproof cables of length required. High level detection shall be provided by use of a separate float switch. Float switches shall be non-mercury mechanical type. Provide stainless steel clamps to secure floats to the pump discharge pipe.
2. Control Panel: Minimum NEMA 1 rated. Hinged, lockable, dead front cover. No electrical switches, indicator lights, or enunciators of any kind shall be located on the outside of the panel/panel cover.
3. Controls: Provide UL listed controller/starter assembly. Provide a magnetic contactor (single phase pumps) or magnetic starter with overload protection (three phase pumps) that starts and stops the pump via float switch(es) separately wired to the control panel. Provide a non-latching dry alarm contact for monitoring by the Owner's building monitoring system. The dry alarm contact shall energize *whenever the pump runs*, and when high sump level is detected by the high level float switch. When high water level is detected by the high level float switch, the pump shall turn on (if not already running) and the dry alarm contact shall energize. Provide panel circuit breaker or fuse, numbered terminal strip(s) for all electrical connections, and a project specific wiring diagram in a plastic pouch inside the panel.

THE ARTICLE BELOW IS FOR STORM PUMP APPLICATIONS.

2.3 SUBMERSIBLE DOUBLE SEAL CENTRIFUGAL STORM WATER PUMPS

A. Pump Type: **Duplex** design, completely submersible, end-suction, close-coupled, overhung-impeller, centrifugal pump with controls. Capable of operating un-submerged without damage to pump. Factory-assembled and tested.

B. Impeller: Vortex style, uncoated, capable of passing spherical solids 3/4 inch in diameter or greater. Statically and dynamically balanced cast or ductile iron, bronze, or stainless steel; keyed and secured to shaft.

C. Pump Casing: Cast iron, with open inlet, legs that elevate pump to permit flow into impeller, and vertical discharge for piping connection. Powder coated epoxy finish. All fasteners exposed to liquid shall be 300 series stainless steel. Provide stainless steel lifting handle. Provide lift ring (of stainless steel) and self-sealing discharge fittings for connection to guide-rail supports, when guide rail supports are indicated.

D. Motor: Hermetically sealed, oil filled, with waterproof power cable of length required. Class B or better insulation, 1.15 service factor minimum. Non-overloading through the length of the curve.

1. Single Phase Pumps: Provide capacitor-start type motors with built-in overload protection.

E. Cable-sealing assembly at pump connection: shall employ compression gland and epoxy potting of individual motor leads to prevent moisture from entering the motor housing if cord is damaged.

F. Pump and Motor Shaft: Stainless steel with factory-sealed, oil or grease-lubricated upper and lower ball bearings.

G. Shaft Seals: Double mechanical seals. Lower and upper seals to be silicon carbide/silicon carbide. Provide seal moisture probes for leak detection.

THE ARTICLE BELOW SHOULD BE USED FOR SEWAGE PUMPS THAT PRIMARILY SERVE LIGHT DUTY SANITARY APPLICATIONS SUCH AS FLOOR DRAINS IN MECHANICAL SPACES OR WHERE A FEW LOW USE WATER CLOSETS DRAIN TO THE PUMP. FOR PUMPS THAT SERVE A SIGNIFICANT NUMBER OF WATER CLOSETS A SEWAGE GRINDER PUMP AS SPECIFIED IN THE NEXT SECTION IS TYPICALLY RECOMMENDED. BE SURE TO INDICATE WHICH TYPE PUMP IS REQUIRED ON THE PROJECT DRAWINGS, PREFERABLY IN A SCHEDULE.

2.4 SUBMERSIBLE DOUBLE SEAL CENTRIFUGAL SEWAGE PUMPS

A. Pump Type: **Duplex** design, completely submersible, end-suction, close-coupled, overhung-impeller, centrifugal pump with controls. Capable of operating un-submerged without damage to pump. Factory-assembled and tested.

B. Impeller: Vortex style, uncoated, capable of passing spherical solids 2 inch in diameter or greater. Statically and dynamically balanced cast or ductile iron, bronze, or stainless steel; keyed and secured to shaft.

C. Pump Casing: Cast iron, with open inlet, legs that elevate pump to permit flow into impeller, and vertical discharge for piping connection. Powder coated epoxy finish. All fasteners exposed to liquid shall be 300 series stainless steel. Provide stainless steel lifting handle. Provide lift ring (of stainless steel) and self-sealing discharge fittings for connection to guide-rail supports, when guide rail supports are indicated.

D. Motor: Hermetically sealed, oil filled, with waterproof power cable of length required. Class B or better insulation, 1.15 service factor minimum. Non-overloading through the length of the curve.

1. Single Phase Pumps: Provide capacitor-start type motors with built-in overload protection.

E. Cable-sealing assembly at pump connection: shall employ compression gland and epoxy potting of individual motor leads to prevent moisture from entering the motor housing if cord is damaged.

F. Pump and Motor Shaft: Stainless steel with factory-sealed, oil or grease-lubricated upper and lower ball bearings.

G. Shaft Seals: Double mechanical seals. Lower and upper seals to be silicon carbide/silicon carbide. Provide seal moisture probes for leak detection.

THE ARTICLE BELOW SHOULD BE USED FOR SEWAGE PUMPS RECEIVING THE DISCHARGE FROM A SIGNIFICANT QUANTITY OF WATER CLOSETS, IN PARTICULAR FOR AREAS WHERE WATER CLOSETS MAY BE SUBJECT TO ABUSE SUCH AS DORMITORYS. FOR PUMPS SUBJECT TO HEAVY USE, CONSIDER SPECIFYING A REVERSE FLOW ASSEMBLY.

2.5 SUBMERSIBLE DOUBLE SEAL CENTRIFUGAL GRINDER SEWAGE PUMPS

A. Pump Type: **Duplex** design, completely submersible, end-suction, close-coupled, overhung-impeller, centrifugal pump with controls. Capable of operating un-submerged without damage to pump. Factory-assembled and tested. 1-1/4 inch minimum discharge opening.

B. Impeller: Vortex style, uncoated, capable of passing solids. Statically and dynamically balanced cast or ductile iron, bronze, stainless steel, or engineered thermoplastic; keyed and secured to shaft. Provide hardened stainless-steel cutter/grinder with shredding device.

C. Pump Casing: Cast iron, with open inlet, legs that elevate pump to permit flow into impeller, and vertical or horizontal discharge (as required for the project) for piping connection. Powder coated epoxy finish. All fasteners exposed to liquid shall be 300 series stainless steel. Provide stainless steel lifting handle. Provide lift ring (of stainless steel) and self-sealing discharge fittings for connection to guide-rail supports, when guide rail supports are indicated.

D. Motor: Hermetically sealed, oil filled, with waterproof power cable of length required. With Class F motor insulation. Non-overloading through the length of the curve.

1. Single Phase Pumps: Provide capacitor-start type motors with built-in overload protection.

E. Cable-sealing assembly at pump connection: shall employ compression gland and epoxy potting of individual motor leads to prevent moisture from entering the motor housing if cord is damaged.

F. Pump and Motor Shaft: Stainless steel with factory-sealed, oil or grease-lubricated upper and lower ball bearings, to provide radial and thrust support.

G. Shaft Seals: Double mechanical seals. Lower and upper seals to be silicon carbide/silicon carbide. Provide seal moisture probes for leak detection.

THE PUMP CONTROL ARTICLE BELOW REFLECTS TYPICAL U-M REQUIREMENTS. MODIFY AS REQUIRED TO MAKE PROJECT SPECIFIC. INCLUDE A MORE DETAILED PUMP SEQUENCE OF OPERATION WITH THE PUMP DETAIL ON THE DRAWINGS OR WITH THE ARTICLE BELOW, IF NECESSARY. INFORMATION BELOW DOES NOT INDICATE QUANTITY OF FLOATS SINCE FLOAT QUANTITIES VARY WITH PUMP CONFIGURATION.

THEREFORE, INDICATE REQUIRED QUANTITY OF FLOATS ON THE PUMP DETAIL OR BELOW.

2.6 PUMP CONTROLS:

A. Unless otherwise noted, provide UL listed controller/starter assembly with the following features for each pump.

1. Float Switches: Provide multiple tethered style non-mercury mechanical style float switches to turn the pump on and off and to detect high level, with waterproof cables of length required. Provide float rod/pipe, tether clamps, and hardware, to secure the floats at the required elevations, all of stainless steel construction.
2. Control Panel: Minimum NEMA 1 rated. Hinged, lockable.
3. Controls: Provide UL listed controller/starter assembly. Provide a magnetic contactor (single phase pumps) or magnetic starter with adjustable overload protection (three phase pumps) that starts and stops the pump via float switch(es) separately wired to the control panel.
   a. Automatic Alternator (duplex pump arrangements): Electrical alternator that starts pumps on successive cycles and starts multiple pumps if one cannot handle load.
   b. High-Water Alarm: Rod-mounted mechanical-float switch.
   c. Panel features (all mounted on panel face): control on/off switch, hand-off-auto switch and pump run light for each pump, high water alarm light, high water alarm test switch, seal failure light.
   d. Provide an audible alarm that activates upon high water or seal failure condition.
   e. Provide a latching dry auxiliary alarm contact for monitoring by the Owner’s building monitoring system, that energizes upon either a high water or seal failure condition.
   f. Provide an alarm silence button which deactivates the audible alarm but does not deactivate the local alarm lights or auxiliary alarm contact until the alarm condition clears.
   g. Provide motor disconnect for each motor, control transformer, control panel circuit breaker or fuse, numbered terminal strip(s) for all electrical connections, a project specific wiring diagram in a plastic pouch inside the panel, and all required accessories.
   h. Label all components on the exterior of the control panel with engraved plastic labels screwed to the panel face. Label all wiring, terminal strips, and electrical components inside the panels using labels made for that purpose.

2.7 SUMP BASINS AND BASIN COVERS

PROVIDE A DETAIL ON THE DRAWINGS INDICATING QUANTITY AND ELEVATIONS OF TOP AND SIDE WALL CONNECTIONS AND FLOAT ACTIVATION ELEVATIONS. DUE TO RADON CONCERNS ALL COVERS (I.E. INCLUDING STORM PUMPS) ARE SPECIFIED AS GAS TIGHT, WITH THE EXCEPTION OF THOSE USED FOR ELEVATOR SUMP PUMPS.

A. Basins: Factory-fabricated, watertight, cylindrical, basin sump with top flanges and sidewall openings for pipe connections.

1. Material: Fiberglass.
2. Reinforcement: Mounting plates for pumps, fittings, guide-rail supports if used, and accessories, adequately braced. Provide integral water tight anchor flange(s) that match the guide rail base plate and side support mounting holes, when guide rails are used.

RETAIN SUBPARAGRAPH BELOW IF REQUIRED TO ANCHOR BASIN TO CONCRETE SLAB IN CASE OF GROUND-WATER PROBLEMS.

3. Anchor Flange: Same material as or compatible with basin sump, cast in or attached to sump, in location and of size required to anchor basin in concrete slab.

B. Basin Covers: Gas tight cover with gaskets, seals, and bushings to seal hatches, piping, conduit and cords gas tight. Sealants and caulks shall not be used.

1. Cover Reinforcement: Reinforced to support anticipated loads in the area of use but no less than required for supporting foot traffic.
2. For basins larger than 36" diameter and for any duplex pump arrangement, provide a bolted sub-hatch centered above each pump and pump discharge pipe that allows the pump to be removed through the sub-hatch without disturbing the basin cover, cover vent or drainage connections, sump float rod, or adjacent pumps and their discharge pipes and power cords. Additionally, provide an inspection hatch that can be opened without disturbing any component penetrating the basin cover.

C. Covers for basins in elevator hoistways: Provide removable galvanized steel grating (capable of supporting foot traffic), notched around the pump discharge pipe to allow grate removal without disconnecting the discharge pipe.

2.8 ACCESSORIES

A. Check valves for elevator sump pumps and storm pumps:

1. Silent check valve per Related Section.

SILENT CHECK VALVES ARE NOT RECOMMENDED FOR WASTE WATER SERVICE, THEREFORE A RESILIENTLY HINGED TYPE CHECK VALVE HAS BEEN SPECIFIED FOR THAT SERVICE, BELOW.

B. Check valves for sewage pumps and grinder sewage pumps:

1. Non-slam resiliently hinged type check valve with peroxide cured EPDM disk, disk accelerator, and flanged connections; “SurgeBuster” as manufactured by Val Matic Valve and Manufacturing Corporation.

SPECIFY GUIDE RAIL SUPPORT SYSTEMS WHEN SUMP DEPTH EXCEEDS FOUR FEET. DELETE ARTICLE BELOW WHEN GUIDE RAILS ARE NOT REQUIRED.

2.9 GUIDE-RAIL SUPPORT SYSTEM:

A. Provide a guide rail support system allowing automatic disconnect and removal of pump, furnished by the same manufacturer that supplied the submersible pump.

B. Guide Rails: Vertical pipes or structural members, made of stainless steel, attached to baseplate and basin sidewall or cover.

C. Baseplate: Stainless Steel plate, attached to basin floor, supporting guide rails and stationary elbow.

D. Hardware: all nuts, bolts, fasteners and hardware shall be stainless steel.

E. Pull rods and lifting cable: Stainless steel.

F. Sliding guide rail connector: Stainless steel motor-mounted or casing-mounted yokes or other attachments for aligning pump during connection of flanges and sliding pump up and down rails.

G. Movable Elbow: Cast iron pump discharge-elbow fitting with flange and positioning device.

H. Stationary Elbow: Cast iron fixed discharge-elbow fitting with flange that mates to movable-elbow flange and connects to baseplate.

I. Seal between movable and stationary elbow: Elastomeric seal retained by non-corrosive clamp ring and stainless steel fasteners.

2.10 SOURCE QUALITY CONTROL

A. All pumps shall be factory tested. Verify all control panel functions. Verify pump grounding and integrity of winding insulation by megger testing. Run each pump submerged prior to shipment at maximum running point. Verify flow rate, head, amperage draw, and water tightness.

THE TEST REPORT BELOW IS OPTIONAL, BUT TYPICALLY RECOMMENDED FOR CRITICAL OR LARGE PUMP INSTALLATIONS.

B. A report detailing the results of the factory test shall be provided. An officer of the manufacturer’s company shall certify by signature that the report accurately reflects the test results, and that the package meets all performance requirements. The report shall clearly identify any performance requirements that were not achieved.

PART 3 - EXECUTION

3.1 EXAMINATION AND PREPARATION

A. Examine roughing-in for equipment support, piping, and electrical connections to verify actual locations, sizes, and other conditions affecting equipment performance, maintenance, and operations. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install in strict compliance with manufacturer's installation instructions and Related Sections. Maintain manufacturer's recommended clearances for service and maintenance.

B. Install separate devices furnished by manufacturer and not factory installed, including but not limited to float rods and floats, basins, basin covers and all related accessories, guide rail system, lift rods/cables, control panels, and any manufacturer’s accessory devices necessary or recommended to meet the particular needs of the pump installation.

C. Protect basins from trash and debris at all times including during temporary service.

SEWAGE AND GRINDER SEWAGE PUMP INSTALLATIONS SHOULD NOT BE DESIGNED WITH A DISCHARGE PIPE LESS THAN 2”. INDICATE THE PIPE SIZE ON THE DRAWINGS.

D. For all sewage and grinder sewage pump installations, regardless of pump connection size, provide minimum 2 inch diameter pipe (or larger as indicated) on the discharge side of each pump.

E. Provide a check valve and an isolation valve on each pump discharge pipe, near and above the basin cover or sump top rim level. Locate the check valve upstream of the isolation valve. Provide check valves of the type specified in Part 2.

F. Where discharge piping is below grade, locate the check and isolation valves outside of the basin in an accesses pit with access cover.

G. Run all power, float, and control wiring in conduit between basin cover and control panel. Seal inner diameter of conduit with sealing putty and connect to basin cover.

1. *Power cords* of elevator sump pumps shall not be run in conduit. Connect directly to the non-GFCI outlet in the elevator hoistway that is controlled by the pump control panel. Install weatherproof cover on the outlet.

H. Verify proper pump rotation of pumps before installing in basins.

I. Adjust level control to prevent effluent in the sump basin from rising to within 2 inches of the invert of the lowest gravity drain inlet connection to the sump.

J. Adhere to manufacturer’s start-up instructions.

3.3 TEMPORARY SERVICE

A. Start units for temporary use only with the expressed written permission of the Project Manager and in compliance with all requirements of the Contract Documents.

B. Prior to placement into temporary service, perform manufacturer's pre-start protocols.

C. Commission equipment prior to putting into temporary service to the extent required by the Commissioning Authority. Re-perform all commissioning activities prior to Owner acceptance, even if previously commissioned to prepare for temporary service.

D. Perform all required routine maintenance procedures during temporary service. Continuously maintain a log of such procedures. Store the log at unit during temporary use period and include log as part of the final O&M manual.

3.4 FIELD QUALITY CONTROL

A. In the presence of the Commissioning Authority:

1. Demonstrate the functionality of the slide rails by sliding the pump over the full length of the rails and out the basin cover, and reseating the pump on the stationary flange without entering the basin.
2. Demonstrate the operation of the pump by filling the basin with water and verifying all functions of the pump and control panel. Provide temporary plugs in basin connections to allow filling the basin for testing. Remove plugs at completion of testing.

WHEN JUSTIFIED, REQUIRE START-UP SERVICES BY A FACTORY SERVICE TECHNICIAN, OTHERWISE DELETE THE PARAGRAPH BELOW.

B. Provide a factory trained service technician to perform start-up services. The service technician shall perform the following:

1. Verify correct installation and organize, instruct and assist the mechanical contractor's personnel in start-up procedures.
2. Perform manufacturer’s pre-start checks.
3. Set all safety devices.
4. Commission the pump package, including demonstrating all safeties, proper pump staging, alteration, and all other features.
5. Provide a written service report prepared on site and submitted at the time of each service visit (with copies immediately provided to the Owner and Commissioner). Report shall indicate services provided and list all controller settings.
6. Train Owner personnel. Training and start up services are separate functions and training shall not be combined with startup services.

INCLUDE THE ARTICLE BELOW IN EVERY SPECIFICATION SECTION.

3.5 COMMISSIONING

A. Perform Commissioning activities per Related Sections above.

WHEN JUSTIFIED, REQUIRE TRAINING BY A FACTORY SERVICE TECHNICIAN, OTHERWISE DELETE THE FIRST PARAGRAPH BELOW.

3.6 TRAINING

A. Provide a qualified service technician from the Manufacturer's staff to provide training.

B. Train Owner's maintenance personnel on equipment operation, start-up and shutdown, trouble-shooting, servicing and preventative maintenance procedures, pump access and pump removal. Review the data contained in the Operating and Maintenance Manuals with Owner's personnel.

1. Provide 2 hours training, minimum.

END OF SECTION 221333