REQUEST FOR PROPOSAL

Town of Suffield, Connecticut

Miscellaneous Equipment

April 25, 2016

You are invited to submit a Proposal for Miscellaneous Mechanical Equipment for the Water Pollution Control Authority (WPCA) in Suffield, Connecticut. The materials and services are expected to encompass a packaged Plant Water System (PWS), Waste Activated Sludge (WAS) pumps and Return Activated Sludge Pumps (RAS) pumps as further specified herein. This includes the design, fabrication, and delivery to the Suffield WPCA at the address below.

The sealed proposals will be received at the office of the Water Pollution Control Authority, 844 East Street South, Suffield, CT. Statements **are due by 10 a.m. on Thursday, May 5, 2016**. Submissions transmitted by facsimile will not be accepted. Each envelope is to be marked on the front with the name of the company and labeled "Miscellaneous Equipment Proposal, Suffield WPCA". Bidders may submit on one or more equipment items as specified. The proposal shall also be marked with the corresponding equipment it is being submitted for. No postmarked submissions will be accepted.

Any questions should be directed to Shane McCannon, Chief Operator, at (860) 668-3853. Questions can also be sent to smccannon@suffieldtownhall.com. A copy of the specifications for the equipment listed above is attached under this cover and may also be found on the Town's website (http://www.suffieldtownhall.com/).

Please note that the schedule of this project is of the utmost importance and equipment fabrication and delivery MUST be met based on the dates below. If the Vendor/Manufacturer cannot meet the fabrication deadlines as specified, their proposal will not be accepted or considered.

- **Friday, May 6, 2016 – Vendor/Manufacturer will be alerted of award**
- **Thursday, June 30, 2016 – Equipment must be on site**

The Town of Suffield WPCA is an affirmative action – equal opportunity employer. The Suffield WPCA reserves the right to accept or reject any or all proposals or any part of a proposal; to waive formalities or informalities and to award the professional services deemed to be in the best interest of the Town.

Shane McCannon
Suffield WPCA
Chief Plant Operator

FORMAT OF PROPOSAL

The submitted proposals shall be for the equipment supplied by the identified Vendor/Manufacturer/Group. Items being submitted on shall adhere to the specifications and be identified as the equipment or equipment package being submitted on.

The Proposal shall include a minimum of the following information:

A. Name of Bidder
B. Business Address
C. Business Contact Information and Person
D. Bidders Signature, Date, Title, & Witness
E. Signed Copy of "Bidders Qualification Statement"
F. Detailed Scope of Supply
G. Equipment and delivery cost
H. Provide three references for Municipal Wastewater treatment plants with equipment used for a like purpose.
I. A clear statement of any deviations from the specifications, if applicable.

DELIVERY AND SHIPPING REQUIREMENTS

The terms of this contract include delivery (freight and insurance prepaid) of the equipment to the WPCA site (844 East Street South, Suffield, CT 06078) unless otherwise specified. The WPCA shall not accept ownership of the equipment until the equipment is delivered to the site and accepted by the WPCA. Any damaged incurred during shipping shall be the responsibility of the Manufacturer to resolve.

The WPCA shall be notified at least 24 hours prior to the equipment arriving on site. The WPCA operates between the hours of 7:00 AM and 3:00 PM, Monday through Friday. The WPCA reserves the right to refuse acceptance of the equipment at no additional cost if the equipment appears damaged. The WPCA reserves the right to inspect the equipment upon delivery to ensure that the equipment is undamaged.

GUARANTEE

The Manufacturer shall guarantee all equipment for a period of no less than two (2) years from the date of acceptance by the Owner is described in the following sections.

START-UP AND TRAINING

The Manufacturer shall provide start-up services, operation and maintenance training as required for the corresponding equipment.

SUBMISSION OF PROPOSALS

Proposals shall be delivered to the following:

Shane McCannon, Chief Operator
844 East Street South
Suffield, CT, 06078

Deadline for submission of proposals is 10:00 A.M., Thursday, May 5, 2016
Late submittals will not be considered.

All questions regarding this RFQ shall be directed to Mr. Shane McCannon, Chief Operator at smccannon@suffieldtownhall.com.

EQUIPMENT AND SYSTEMS DESCRIPTION

The equipment and materials included as part of this proposal include the following section:

A. Return Activated Sludge Pumps (RAS) & Motors – RAS pumps will be replaced similar to the current installation. The existing pumps include three (3) 10HP chopper style pumps that were installed in the late 1990's due to many problems with handling the rags in the system. Motors will also be replaced as part of this effort. The sludge pumped with the RAS pumps consists of 1-2% biological secondary sludge solids with rags typically found in sewage systems. The three (3) RAS pumps will be placed on the existing concrete pads where the current pumps are located. A fourth 15 (fifteen) horsepower chopper style pump was installed in 2007 to pump RAS from the new clarifier that was constructed at that time. It has much longer suction and discharge piping that the original 3 RAS pumps. The new RAS pumps provided in this project will also have to be able to pump RAS from the new clarifier (#3), according to the specifications provided in a backup or primary scenario. In this case, the suction piping is longer than the piping from the original 2 clarifiers.

B. Waste Activated Sludge Pumps (WAS) & Motors – WAS pumps and motors are to replace the three (3) existing Tutill Rotary Lobe pumps at the plant. The sludge consists of 1-2% biological secondary sludge solids with rags typically found in sewage systems. The sludge pumps will have existing Weisman grinders upstream of the new units to be supplied. The pump installed in the existing Pump #3 location will also be used to pump secondary scum from the scum pit located next to #1 clarifier. The pump installed in the existing #2 WAS pump location will also be used to pump scum on a back-up basis, but is normally used to pump WAS. WAS pumps will be placed on the existing concrete pads where the current pumps are located.

C. Package Plant Water System (PWS) – System to be provided shall pump treated plant effluent in a wastewater treatment system for various purposes and variable pressure and flow demand situations. The packaged system will contain at least three (3) pumps, motors, control panel, applicable controls, and piping in a skid mounted unit.

D. Strainer – The strainer will be placed upstream of the plant water system. The single Strainer unit will be automatic duplex type and placed on the existing 8-inch feed line to the PWS, where the existing manual strainer is located. The system supplier will be responsible for providing the strainer which best suits the facilities needs and plant water system flows including the expected solids in the plant effluent water, based on the specification provided in the attachments.

ATTACHMENTS

1. Bidders Qualification Statement

2. Technical Specifications

Attachment 1
Bidders Qualification Statement

TOWN OF SUFFIELD, CONNECTICUT
WATER POLLUTION CONTROL FACILITY
BIDDERS QUALIFICATION STATEMENT
MECHANICAL EQUIPMENT

Under penalty of perjury and other remedies available to the Town of Suffield, the undersigned certifies this proposal is submitted without collusion and all responses are true and accurate. If awarded this contract it is agreed this forms a contractual obligation to provide material at fees specified in this Bidder's Qualification Statement, subject to and in accordance with all instructions proposing and contract documents, including any addenda, which are all made part of this proposal.

_____ Date_____
Signature of Authorized Person

_____
Printed Name of Authorized Person

_____ _____
Company Title of Authorized Person Name of Company

_____ _____
Address of Company City, State, and Zip Code

_____
Telephone Number

References:

Municipality	Contact Name	Contact Number & Email
Municipality	Contact Name	Contact Number & Email
Municipality	Contact Name	Contact Number & Email

Attachment 2
Technical Specifications

A. Return Activated Sludge Pumps (RAS)

A. General

1. The RAS pumps shall be horizontal centrifugal chopper style pump for the handling of solids and other stringy and or "balled up rags" typically found in sewage treatment systems. The horizontal chopper pump shall be specifically designed to pump waste solids at heavy consistencies without plugging or dewatering of the solids. Materials shall be chopped/macerated and conditioned by the pump as an integral part of the pumping action. The pump must have demonstrated the ability to chop through and pump high concentrations of solids such as plastics, heavy rags, grease and hair balls, wood, paper products and stringy materials without plugging, both in tests and field applications. These specifications are for the replacement of the existing four (3) RAS pumps at the Suffield WWTP located in the pump building.
2. The provided equipment shall arrive **on site and on time as required** to be placed in the lower level of the Pump Building without requiring disassembly or having pieces exceeding 4,000 pounds without prior indication to plant staff. The largest component of the system shall be able to be lowered through the existing access hatch to the lower level of the building, which is 50 inches by 77 inches. System components shall arrive in the fewest pieces as possible to accommodate access to the building. All components shall be provided in **one** shipment unless approved by the WPCA.
3. The pump manufacturer shall be responsible for providing a product that meets performance criteria consistent with existing plant conditions, customer requirements, and will provide the minimum flow indicated in the table below under all conditions including as many as 3 pump operating at the same time discharging to the existing discharge header. The new pumps will replace existing pump # 1-3, which are currently 10HP chopper style pumps. Pump #4 is currently a 15 HP 870 RPM, 1020gpm, chopper style pump provided in the 2007 treatment plant upgrade to service the new clarifier #3. It has a longer pump suction and additional piping including pipe bends to adapt to the existing discharge pipe system. The new pumps provided may allow for a reduction in suction size and discharge size as specified below. The project owner will provide reducers necessary to adapt the new pumps to the existing system. All suppliers are reminded that this project is to provide the most efficient pump, and that this project is implemented to reduce facility energy requirements.

B. System and Fluid Conditions

Fluid Name	Return Activated Sludge (RAS)
Solids Content	1-2%
Capacity Requirement	750GPM (previously 1,000 gpm – 1989 design)
Discharge Pressure	10 PSI
Suction Condition	Flooded

Temperature	Ambient
pH Value	Neutral
Specific Gravity	1.0
Duty	Continuous

C. Pump Unit

Desired Motor Power	7.5 HP (was 10HP – 1989 design data)
Pump Speed	RPM as required/recommended (existing pump RPM is 870)
Suction Flange	8”
Discharge Flange	8”

D. Pump Construction

1. Casing and Back Pull-Out Plate: The pump casing shall be of volute design, spiraling outward to the Class 125 8” flanged centerline discharge. Back pull-out design shall incorporate jacking bolts for accurate adjustment of impeller-to-cutter bar clearance, and shall allow removal of pump components without requiring disconnection of casing from inlet or discharge piping. Casing & backplate shall be ductile cast iron with all water passages to be smooth, and free of blowholes and imperfections for good flow characteristics. A pressure tap shall be included on or near the discharge flange. Backplate shall include a replaceable Rockwell C 60 cast alloy steel cutter adjustable for 0.005-0.050" clearance to cut against the rotating impeller pump out vanes for removing fiber and debris.

2. Impeller: Shall be semi-open type with pump out vanes to reduce seal area pressure. Chopping/maceration of materials shall be accomplished by the action of the cupped and sharpened leading edges of the impeller blades moving across the cutter bar at the intake openings, with a set clearance between the impeller and cutter bar of 0.015-0.025” cold. Impeller shall be cast alloy steel heat treated to minimum Rockwell C 60 and dynamically balanced. The impeller shall be keyed to the shaft and shall have no axial adjustments and no set screws.

3. Cutter Bar Plate: Shall be recessed into the pump bowl and shall contain at least 2 shear bars extending diametrically across the intake opening to within 0.010-0.030” of the rotating cutter nut tooth, for the purpose of preventing intake opening blockage and wrapping of debris at the shaft area. Chopper pumps utilizing individually mounted shear bars shall not be acceptable. Cutter bar shall be cast alloy steel or alloy steel heat-treated to minimum Rockwell C 60.

4. Cutter Nut: The impeller shall be secured to the shaft using a cutter nut, designed to cut stringy materials and prevent binding using a raised, rotating cutter tooth. The cutter nut shall be cast alloy steel heat treated to minimum Rockwell C 60.

5. Upper Cutter: Shall be threaded into the back pull-out adapter plate behind the impeller, designed to cut against the pump-out vanes and the impeller hub, reducing and removing stringy materials from the mechanical seal area. Upper cutter shall be cast alloy steel heat treated to minimum Rockwell C 60. The upper cutter teeth are positioned as closely as possible to the center of shaft rotation to minimize cutting torque and nuisance motor tripping. The ratio of upper cutter cutting diameter to shaft diameter in the upper cutter area of the pump shall be 3.0 or less.

6. Pump Shafting: Shall be heat treated alloy steel.

7. Bearings: Shall be oil-bath lubricated with ISO Grade 100 oil. Shaft thrust in both directions shall be taken up by two back-to-back mounted single-row angular contact ball bearings or two face to face mounted tapered roller bearings. Two adjacently mounted single-row radial bearings or one cylindrical roller type shall also be provided. L-10 bearing life shall be minimum 100,000 hours.

8. Bearing Housing: Shall be ductile cast iron and machined with piloted bearing fits for concentricity of all components. Bearing housing shall include a side-mounted site glass. Bronze non-contacting labyrinth style, O-ring mount bearing isolators shall be provided at each end of the bearing housing to prevent egress of oil and ingress of contaminants. Thrust bearings are mounted in an adjustable cartridge to allow external upper cutter adjustment.

9. Stuffing Box: Shall be ductile cast iron. The stuffing box shall be designed to accommodate the mechanical seal, or packing. Mechanical seal with no seal water flush and flushed tandem mechanical seal as described below does not require stuffing box.

10. Mechanical Seal system specifically designed to require no seal flush: The mechanical seal shall be located immediately behind the impeller hub to eliminate the stuffing box and maximize the flushing available from the impeller pumpout vanes. The seal shall be a cartridge-type mechanical seal with Viton O-rings and silicon carbide (or tungsten carbide) faces. This cartridge seal shall be pre-assembled, and pre-tested so that no seal settings or adjustments are required from the installer. Any springs used to push the seal faces together must be shielded from the fluid to be pumped. The cartridge shall also include a 17-4PH, heat-treated seal sleeve and stainless steel seal housing.

11. Inlet Manifold: Shall be cast ductile iron assembly mounted horizontally with a Class 125 8” inlet flange, ½"-NPT pressure tap, cleanout, drain connection and mounting feet.

12. Shaft Coupling: Bearing housing and motor stool design is to provide accurate, self-aligning mounting for a C-flanged electric motor. Pump and motor coupling shall be T.B. Woods Sureflex elastomeric type.

13. Stainless Steel Nameplate: Shall be attached to the pump giving the manufacturer’s model and serial number, rated capacity, head, speed and all pertinent data.

14. Surface Preparation: Degreased and coated with 1-3 MDFT of acrylic urethane (except motor).

1.02 Motors

A. Each unit shall consist of a pump, pump base, premium efficiency electric motor. The Horsepower and RPM for the motor provided will be as required for the pump best suited for the application and advised by the pump manufacturer based on site specific requirements and include the most efficient application of their pump product. The motor shall be 3-phase, 60 Hz, 460 V with 1.15 SF and Class F Insulation.

B. All motors shall be built in accordance with latest NEMA, IEEE, ANSI and AFBMA standards.

C. Motors shall be inverter duty rated.

D. Motors shall conform to standards of NEMA Class B Insulation System.

E. Motors shall have a service factor rating of 1.15.

F. Motors shall be TEFC rated.

1.03 Manufacturers

A. Pumps shall be manufactured by Vaughan or approved equal.
Motor will be manufactured by US motors or equivalent.

B. Motor will be manufactured by US motors or equivalent.

1.04 Factory/Shop Testing

A. All equipment shall be tested in the shop of the manufacturer in a manner which shall conclusively prove that its characteristics comply fully with the requirements of these Contract Documents and it will operate in the manner specified or implied.

B. Equipment will not be fully accepted until certified copies of the test results have been provided to the Owner.

C. Three (3) certified copies of the manufacturer's actual test data and interpreted test results shall be submitted to the Owner for review.

D. Shop testing of the three phase electric motors shall be factory tested to determine compliance with the requirements of the IEEE, ANSI, and NEMA.

1.05 Submittals

A. Operation & Maintenance Manuals

1. Preliminary Submittal – Two (2) hard copies and one (1) electronic copy of the Operation and Maintenance Manuals shall be furnished to the Owner for review. Owner shall review and submit comments and modifications to be provided by the Manufacturer.

2. Final Submittal – Two (2) hard copies and one (1) electronic copy of the Operation and Maintenance Manuals addressing all Owner comments and modifications shall be provided.
3. Binding and Cover – Binders shall be locking three-ring/"D"-ring type, or three-post type. Three-ring binders shall be riveted to back cover and include plastic sheet lifter (page guard) at front of each volume.
4. Do not overfill binders.
5. Covers shall be oil-, moisture-, and wear-resistant, including identifying information on cover and spine of each volume.
6. Provide the following information on cover of each volume:
    i. Title: "OPERATING AND MAINTENANCE INSTRUCTIONS".
    ii. Name or type of material or equipment covered in the manual.
    iii. Volume number, if more than one volume is required, listed as "Volume __ of __", with appropriate volume-designating numbers filled in.
    iv. Name of Project and, if applicable, Contract name and number.
7. Print pages in manual on 30-pound (minimum) paper, 8.5 inches by 11 inches in size.
8. Reinforce binding holes in each individual sheet with plastic, cloth, or metal. When published, separately-bound booklets or pamphlets are part of the manual, reinforcing of pages within booklet or pamphlet is not required.
9. Provide each page with binding margin at least one inch wide. Punch each page with holes suitable for the associated binding.
10. Bind into the manual drawings, diagrams, and illustrations up to and including 11 inches by 17 inches in size, with reinforcing specified for pages.
11. Contents shall be original-quality copies. Documents in the manual shall be either original manufacturer-printed documents or first-generation photocopies indistinguishable from originals. If original is in color, copies shall be in color. Manuals that contain copies that are unclear, not completely legible, off-center, skewed, or where text or drawings are cut by binding holes, are unacceptable. Pages that contain approval or date stamps, comments, or other markings that cover text or drawing are unacceptable. Faxed copies are unacceptable.
12. Table of Contents:
    i. Provide table of contents in each volume of each operations and maintenance manual.
    ii. In table of contents and at least once in each chapter or section, identify material and equipment by their functional names. Thereafter, abbreviations and acronyms may be used if their meaning is clearly indicated in a table bound at or near beginning of each volume. Using material or equipment model or catalog designations for identification is unacceptable.
    iii. Use dividers and indexed tabs between major categories of information, such as operating instructions, preventive maintenance instructions, and other major subdivisions of data in each manual.

13. Electronic Copies

i. Each electronic copy shall include all information included in printed copy.

ii. File Format:

1. Files shall be in "portable document format (PDF)". Files shall be electronically searchable.
2. Submit separate file for each separate document in the printed copy.
3. Within each file, provide bookmarks for the following:
    a. Each chapter and subsection listed in the printed copy document's table of contents.
    b. Each figure.
    c. Each table.
    d. Each appendix.

14. Content

i. Submit complete, detailed written operating instructions for each material or equipment item including: function; operating characteristics; limiting conditions; operating instructions for start-up, normal and emergency conditions; regulation and control; operational troubleshooting; and shutdown. Also include, as applicable, written descriptions of alarms generated by equipment and proper responses to such alarm conditions.

ii. Submit written explanations of all safety considerations relating to operation and maintenance procedures.

iii. Submit complete, detailed, written preventive maintenance instructions including all information and instructions to keep materials, equipment, and systems properly lubricated, adjusted, and maintained so that materials, equipment, and systems function economically throughout their expected service life.

iv. Complete bills of material or parts lists for materials and equipment furnished. Lists or bills of material may be furnished on a per-drawing or per-equipment assembly basis.

v. Submit complete electrical schematics and wiring diagrams, including complete point-to point wiring and wiring numbers or colors between all terminal points.

vi. Programmable Logic Controllers including ladder diagrams.

vii. Submit complete programmable logic controller listing of all input/output address assignments, tag assignments, and pre-set constant values, with functional point descriptions.

viii. Submit complete manufacturer's programming manuals.

ix. Dimensional Drawings specific to the equipment installed at the plant.

x. Pump Curves – Factory developed pump curves shall be submitted for each pump. Generic pump curves will not be acceptable.

xi. Motor Data Sheets – Motor data sheets including General Specifications, Performance data, and dimensional drawings shall be provided.

xii. Copy of warranty bond and service contract as applicable

xiii. Copy of appropriate training material.

1.06 Start-up and Training / Manufacturer Field Services

A. Installation check-out shall be conducted in a single trip over a maximum of three (3) days provided by the manufacturer.

B. Startup and Testing shall be conducted in a single trip for a maximum of one (1) day provided by the Manufacturer.

C. Training shall be conducted in a single trip for a maximum of two (2) days provided by the manufacturer.

   a. Training and all travel costs for the equipment shall be covered through the contract price up to the maximum visits and days listed above.

   b. Training shall be conducted by an authorized representative of the equipment manufacturer. The manufacturer's representative shall be fully knowledgeable in the operation and maintenance of equipment.

D. Equipment shall not be accepted by the Owner until the following has been demonstrated:

   a. Pumps have been properly installed and aligned.

   b. Pumps operate without overheating of overloading of any parts, and without objectionable vibration. Vibration shall be within the Hydraulic Institutes limits, or manufacturer limits, if more stringent.

   c. The pumps can meet the specified operating conditions. All pumps shall be checked at maximum speed for a minimum of four points on the pump curve for capacity, head, and amperage. The rated motor nameplate current shall not be exceeded at any point.

1.07 Warranty

A. Performance warranty shall be provided for a period of no less that twenty-four (24) months.

B. Warranty data shall include contact phone numbers and addresses for warranty issues.

C. Warranty will begin once the equipment has been installed and demonstrates functionality and training and startup has been approved by the Owner.

B. Waste Activated Sludge Pumps (WAS) & Motors

1.02 General

1. The pumps shall replace the three (3) existing WAS rotary lob pumps located in the Pump Building at the Suffield WWTP. The existing 3 pumps are rotary lobe and manufactured by Tutill.
2. The Rotary Lobe Pumps shall be designed to be abrasion resistant for applications in wastewater treatment plants. The pump shall have a minimum displacement of 103 gal / 100 rev.
3. The ratio of the axial length of the lobe as compared to the lobe diameter (length/diameter) shall not exceed 1.0.
4. The pumps shall be of the positive displacement, rotary lobe type, designed to pump wastewater sludge.
5. All fluid-wetted parts including the mechanical seal shall be replaceable through the quick release front cover without disassembly of coupling, drive unit or the pipe system.
6. The pumps shall be designed to temporarily run dry and to operate in either direction. Oil-quench for protection of the mechanical seal is mandatory. Seal water flush systems are not acceptable.
7. The pumps shall be constructed with a non-pressurized oil-filled intermediate chamber between the pump casing and the gearbox with the following functions:
   a. Oil-Quench (Lubrication and cooling) of the mechanical seals
   b. Detection of seal failures
   c. Buffer zone to the sealed timing gear
8. Oil drain of gearbox and intermediate chamber shall be easily accessible with side mounted drain screw. Oil drain under the pump is not acceptable.
9. The rotor/shaft connection shall be oil-lubricated fed by an intermediate chamber and shall not come in contact with the pumped fluid.

A. System and Fluid Conditions

Fluid Name	Sludge
Solids Content	1-2%
Capacity	50-250 GPM
Discharge Pressure	17 PSI @ 100 gpm
Suction Condition	Flooded
Temperature	Ambient
pH Value	Neutral
Specific Gravity	1.0
Duty	Continuous

B. Pump Unit

Drive Type	Geared Motor
Drive Configuration	Inline
Desired Motor Power	7.5 HP
Pump Speed	83-253 RPM
Suction Flange	6”
Discharge Flange	6”

C. Pump Construction

1. The pump casing and end cover shall be fabricated of gray cast iron with a 230-260 Brinell hardness. The end cover shall permit removal of the rotors without disturbing the suction and discharge piping, bearings, or mechanical seals. Provide the surface of the pump wet end fitted with removable radial and axial wear plates constructed of Hardox 400 material (or equal) with a minimum 400 Brinell hardness. The end cover shall be machined to accept a reversible wear plate. The pump casing shall be manufactured in a single block construction (Cast iron ASTM A48 grade 40, Brinell hardness 264 Brinell). Multiple Piece Design Pump Casings held together by screw connections are not acceptable.
2. The quick release cover shall be held in place by four (4) individual bolts. The stationary threaded studs shall keep the front cover on the same level as the pump casing in the process of opening the pump for easy handling.
3. Rotors shall be tri-lobe screw design with individually replaceable tips and the tips shall consist of a cast iron core coated with abrasion-resistant Buna-N. The length of the rotor shall not exceed its diameter. Rotors shall be keyed to the shaft with a cylindrical bore. Rotors without removable tips are not acceptable.
4. The shafts shall be non-sludge-wetted. The rotor/shaft connection shall be lubricated with quench fluid of the intermediate chamber. The shafts shall be timed in their rotation by straight cut timing gears running in a separate oil chamber, which also contains the ball and roller bearings for each shaft. The shafts shall be constructed from AISI 4140 carbon steel.
5. The pumps shall be fitted with maintenance free, quenched mechanical seals with Duronite seal faces. The seals shall be operating in a non-pressurized common oil-filled intermediate chamber (Quench for lubrication and cooling). The rotating holding bush shall be locked in a fixed radial position by a keyway that holds the rotor in place. Design of the pump shall allow removal and replacement of the seal via the front cover.
6. Bearings and timing gear shall be located in a common oil-filled cast iron gearbox, fitted with a built in sight glass to monitor oil level. The timing gear shall maintain non-contact between the rotors. Bearing life to be designed for L-10 bearing life rating of 100,000 hours at design conditions.
7. Suction and discharge connections from galvanized steel shall be ANSI 150-lb flanges.

8. Pump and drive fitted on common base, made of galvanized steel.

1.02 Spare Parts

C. One (1) set of mechanical seals and O-rings for each pump model.
D. One (1) set of rotor tips and O-rings for each pump model.
E. One (1) set of axial protection plates for each pump model.
F. One (1) set of radial liners for each pump model. (removed “if provided”)
G. One (1) set of special tools for each pump model.

1.03 Motors

C. Each unit shall consist of a pump with a gear reducer and 1800 rpm premium efficiency electric motor.
D. The motor shall be 3-phase, 60 Hz, 460 V with 1.15 SF and Class F Insulation.
E. All motors shall be built in accordance with latest NEMA, IEEE, ANSI and AFBMA standards.
F. Motors shall be inverter duty rated.
G. Motors shall conform to standards of NEMA Class B Insulation System.
H. Motors shall have a service factor rating of 1.15.
I. Motors shall be TEFC rated.

1.04 Manufacturers

C. Pumps shall be manufactured by Boerger or approved equal.
D. Motors shall be provided based on the recommendations of the Manufacturer as compatible with the pumps.

1.05 Factory/Shop Testing

E. All equipment shall be tested in the shop of the manufacturer in a manner which shall conclusively prove that its characteristics comply fully with the requirements of these Contract Documents and it will operate in the manner specified or implied.
F. Equipment will not be fully accepted until certified copies of the test results have been provided to the Owner.
G. Three (3) certified copies of the manufacturer’s actual test data and interpreted test results shall be submitted to the Owner for review.

H. Shop testing of the three phase electric motors shall be factory tested to determine compliance with the requirements of the IEEE, ANSI, and NEMA.

1.06 Submittals

B. Operation & Maintenance Manuals

1. Preliminary Submittal – Two (2) hard copies and one (1) electronic copy of the Operation and Maintenance Manuals shall be furnished to the Owner for review. Owner shall review and submit comments and modifications to be provided by the Manufacturer.
2. Final Submittal – Two (2) hard copies and one (1) electronic copy of the Operation and Maintenance Manuals addressing all Owner comments and modifications shall be provided.
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4. Do not overfill binders.
5. Covers shall be oil-, moisture-, and wear-resistant, including identifying information on cover and spine of each volume.
6. Provide the following information on cover of each volume:
   i. Title: "OPERATING AND MAINTENANCE INSTRUCTIONS".
   ii. Name or type of material or equipment covered in the manual.
   iii. Volume number, if more than one volume is required, listed as "Volume __ of __", with appropriate volume-designating numbers filled in.
   iv. Name of Project and, if applicable, Contract name and number.
7. Print pages in manual on 30-pound (minimum) paper, 8.5 inches by 11 inches in size.
8. Reinforce binding holes in each individual sheet with plastic, cloth, or metal. When published, separately-bound booklets or pamphlets are part of the manual, reinforcing of pages within booklet or pamphlet is not required.
9. Provide each page with binding margin at least one inch wide. Punch each page with holes suitable for the associated binding.
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11. Contents shall be original-quality copies. Documents in the manual shall be either original manufacturer-printed documents or first-generation photocopies indistinguishable from originals. If original is in color, copies shall be in color. Manuals that contain copies that are unclear, not completely legible, off-center, skewed, or where text or drawings are cut by binding holes, are unacceptable. Pages that contain approval or date stamps, comments, or other markings that cover text or drawing are unacceptable. Faxed copies are unacceptable.
12. Table of Contents:

i. Provide table of contents in each volume of each operations and maintenance manual.

ii. In table of contents and at least once in each chapter or section, identify material and equipment by their functional names. Thereafter, abbreviations and acronyms may be used if their meaning is clearly indicated in a table bound at or near beginning of each volume. Using material or equipment model or catalog designations for identification is unacceptable.

iii. Use dividers and indexed tabs between major categories of information, such as operating instructions, preventive maintenance instructions, and other major subdivisions of data in each manual.

13. Electronic Copies

i. Each electronic copy shall include all information included in printed copy.

ii. File Format:

1. Files shall be in "portable document format (PDF)". Files shall be electronically searchable.
2. Submit separate file for each separate document in the printed copy.
3. Within each file, provide bookmarks for the following:
    a. Each chapter and subsection listed in the printed copy document's table of contents.
    b. Each figure.
    c. Each table.
    d. Each appendix.

14. Content

i. Submit complete, detailed written operating instructions for each material or equipment item including: function; operating characteristics; limiting conditions; operating instructions for start-up, normal and emergency conditions; regulation and control; operational troubleshooting; and shutdown. Also include, as applicable, written descriptions of alarms generated by equipment and proper responses to such alarm conditions.

ii. Submit written explanations of all safety considerations relating to operation and maintenance procedures.

iii. Submit complete, detailed, written preventive maintenance instructions including all information and instructions to keep materials, equipment, and systems properly lubricated, adjusted, and maintained so that materials, equipment, and systems function economically throughout their expected service life.

iv. Complete bills of material or parts lists for materials and equipment furnished. Lists or bills of material may be furnished on a per-drawing or per-equipment assembly basis.

v. Submit complete electrical schematics and wiring diagrams, including complete point-to point wiring and wiring numbers or colors between all terminal points.

vi. Programmable Logic Controllers including ladder diagrams.

vii. Submit complete programmable logic controller listing of all input/output address assignments, tag assignments, and pre-set constant values, with functional point descriptions.

viii. Submit complete manufacturer's programming manuals.

ix. Dimensional Drawings specific to the equipment installed at the plant.

x. Pump Curves – Factory developed pump curves shall be submitted for each pump. Generic pump curves will not be acceptable.

xi. Motor Data Sheets – Motor data sheets including General Specifications, Performance data, and dimensional drawings shall be provided.

xii. Copy of warranty bond and service contract as applicable.

xiii. Copy of appropriate training material.

1.07 Start-up and Training / Manufacturer Field Services

E. Installation check-out shall be conducted for each pump and the system as a whole provided by the manufacturer's authorized representative.

F. Startup and Testing shall be conducted for each pump and the system as a whole provided by the manufacturer's authorized representative.

G. Training shall be conducted in two (2) sessions by the manufacturer's authorized representative.

   a. Training and all travel costs shall be covered through the contract price.

H. Installation, Check-out, Start-up Testing, and Training shall be conducted by an authorized representative of the equipment manufacturer. The manufacturer's representative shall be fully knowledgeable in the operation and maintenance of equipment.

I. Equipment shall not be accepted by the Owner until the following has been demonstrated:

   a. Pumps have been properly installed and aligned.

   b. Pumps operate without overheating of overloading of any parts, and without objectionable vibration. Vibration shall be within the Hydraulic Institutes limits, or manufacturer limits, if more stringent.

   c. The pumps can meet the specified operating conditions. All pumps shall be checked at maximum speed for a minimum of four points on the pump curve for capacity, head, and amperage. The rated motor nameplate current shall not be exceeded at any point.

1.08 Warranty

D. Performance warranty shall be provided for a period of no less that twenty-four (24) months.

E. Warranty data shall include contact phone numbers and addresses for warranty issues.

Warranty will begin once the equipment has been installed and demonstrates functionality, and training and startup has been approve

C. Package Plant Water System (PWS)

1.0 VARIABLE SPEED PACKAGED PUMPING SYSTEM

A. Furnish and install a pre-fabricated and tested variable speed packaged pumping system to maintain constant pressure at variable flow demands.

B. The packaged pump system may be provided by a single manufacturer or group of manufacturers. The entire pump system including pumps and pump logic controller, shall be designed, built, and tested by the respective manufacturer.

B. System shall be completely skid mounted containing all necessary valves, gauges and fittings as required for complete operation and automation.

C. Equipment shall be pre-assembled and tested in the factory. The equipment shall be provided in one shipment unless approved by the customer.

D. Skid shall arrive on site as required to be placed in the lower level of the Pump Building without requiring disassembly or having pieces exceeding 4,000 pounds. The largest component of the system shall be able to be lowered through the existing access hatch to the lower level of the building, which is 50 inches by 77 inches. System components shall arrive in the fewest pieces as possible to accommodate access to the building.

E. System skid requirements shall come complete with all necessary pipe supports, wiring, valves etc. for a complete package and operation. Skid system shall include but is not limited to the following:
   1. Three (3) Pumps
   2. Motors (Integral VFD/Motors are acceptable)
   3. VFDs (Integral VFD/Motors are acceptable)
   4. PLC Controller
   5. 8-inch diameter header
      a. Class 150 flanged fittings
      b. Reducer shall be provided by the manufacturer to accommodate the existing 8-inch header, if required.
   6. Control Panel with HMI screen
   7. Pressure Gauges (influent and effluent)
   8. Valves & Fittings

H. Manufacturers – Acceptable manufacturers include QuantumFlo, Grundfos, and Tigerflow or approved equal.

SYSTEM CONSTRUCTION

A. Suction and discharge manifold construction shall be in way that ensures minimal pressure drops, minimize potential for corrosion, and prevents bacteria growth at intersection of piping into the manifold. Manifold construction that includes sharp edge transitions or interconnecting piping protruding into manifold is not acceptable. Manifold construction shall be such that water stagnation cannot exist in manifold during operation to prevent bacteria growth inside manifold.

B. The suction and discharge manifolds material shall be 316 stainless steel. Manifold connection sizes shall be as follows:

3 inch and smaller:	Male NPT threaded
4 inch through 8 inch:	ANSI Class 150 rotating flanges
10 inch and larger:	ANSI Class 150 flanges

C. Pump Isolation valves shall be provided on the suction and discharge of each pump. Isolation valve sizes 2 inch and smaller shall be nickel plated brass full port ball valves. Isolation valve sizes 3 inch and larger shall be a full lug style butterfly valve. The valve disk shall be of stainless steel. The valve seat material shall be EPDM and the body shall be cast iron, coated internally and externally with fusion-bonded epoxy.

D. A spring-loaded non-slam type check valve shall be installed on the discharge of each pump. The valve shall be a wafer style type fitted between two flanges. The head loss through the check valve shall not exceed 5 psi at the pump design capacity. Check valves 1-1/2" and smaller shall have a POM composite body and poppet, a stainless steel spring with EPDM or NBR seats. Check valves 2" and larger shall have a body material of stainless steel or epoxy coated iron (fusion bonded) with an EPDM or NBR resilient seat. Spring material shall be stainless steel. Disk shall be of stainless steel or leadless bronze.

E. A pressure transducer shall be factory installed on the discharge manifold. Systems with positive inlet gauge pressure shall have a factory installed pressure transducer on the suction manifold for water shortage protection. Pressure transducers shall be made of 316 stainless steel. Transducer accuracy shall be +/- 1.0% full scale with hysteresis and repeatability of no greater than 0.1% full scale. The output signal shall be 4-20 mA with a supply voltage range of 9-32 VDC.

F. A bourdon tube pressure gauge, 2.5 inch diameter, shall be placed on the suction and discharge manifolds. The gauge shall be liquid filled and have copper alloy internal parts in a stainless steel case. Gauge accuracy shall be 2/1/2 %. The gauge shall be capable of a pressure of 30% above its maximum span without requiring recalibration.

G. Systems with a flooded suction inlet or suction lift configuration shall have a factory installed water shortage protection device on the suction manifold.

H. The base frame shall be constructed of corrosion resistant 304 stainless steel. Rubber vibration dampers shall be fitted between each pumps and base frame to minimize vibration.

I. Depending on the system size and configuration, the control panel shall be mounted on a 304 stainless steel fabricated control cabinet stand attached to the system skid.

2.0 PUMPS

A. The pumps shall be of the in-line design, motor may be horizontally or vertically mounted and pumps shall be single or multiple stage centrifugal type.

B. The head-capacity curve shall have a steady rise in head from maximum to minimum flow within the preferred operating region. The shut-off head shall be a minimum of 20% higher than the head at the best efficiency point (BEP).

C. The packaged system shall contain a minimum of three (3) pump. Potentially two (2) to three (3) different pump sizes to accommodate the following flows and pressures:
   a. Minimum Flow of 20 gpm at 70 psi.
   b. Maximum flow of 350 gpm at 85 psi.

D. Pump Manufacturers shall be Grundfos, Aurora, or approved equal.

E. To ensure stable operation, the pump curve shall be constantly rising from run out to shut off. To ensure cavitation free operation, each pump NPSHr must be low enough to permit stable continuous operation at 120% of greater of the BEP (best efficiency point). Each pump shall be capable of continuous operation without producing noise in excess of Hydraulic Institute and OSHA guidelines.

F. Pumps shall be designed to deliver the scheduled flow rate at the specified total dynamic head (in feet).

G. Pumps shall be designed so that removal can take place without disturbing the suction and discharge pressure piping.

H. Pump impeller shall be of the enclosed type stainless and shall be statically and dynamically balanced.

I. Shaft shall be cartridge type mechanical seal, suitable for the pressures and temperatures scheduled.

3.0 MOTORS

A. The motors shall be sized to operate continuously without exceeding the horsepower rating as outlined on the equipment schedule regardless of the flow and head throughout the operating range of the “System Curve”.

B. Motors shall be of the horsepower and speed shown on the pump schedule. Pumps requiring a larger horsepower(s) shall not be acceptable. Pumps shall be (3) phase, (60) hertz, (460) Volt, TEFC, inverter duty ready, premium efficiency motor with a 1.15 service factor, 400 C ambient.

C. Motors shall be equipped with grounding rings to prevent electro-mechanical-grounding (EMD), fusion craters and pitting of the bearings. The grounding rings shall safety divert shaft and bearing currents to ground increasing the motor and bearing life.

4.0 VARIABLE SPEED DRIVES

A. Description

1. This specification is to cover a complete Variable Frequency motor Drive (VFD) consisting of a pulse width modulated (PWM) inverter designed for use on a standard NEMA Design B induction motor.
2. The drive manufacturer shall supply the drive and all necessary options as herein specified. VFD's that are manufactured by a third party and "brand labeled" shall not be acceptable. All VFDs installed on this project shall be from the same manufacturer.
3. VFD shall be provided with harmonic filter or line reactor.
4. VFD manufacturer will provide programming software to the Owner or shall be provided with Ethernet communication cards.
5. VFDs shall be ABB or approved equal.

B. Referenced Standards:

- UL508C
- ICS 7.0, AC Adjustable Speed Drives
- IEC 16800 Parts 1, 2 and 3
- NEC 430.120, Adjustable-Speed Drive Systems
- IBC 2006 Seismic – referencing ASC 7-05 and ICC AC-156

C. The VFD package as specified herein shall be enclosed in a UL Listed Type enclosure, (enclosures with only NEMA ratings are not acceptable).

1. Environmental operating conditions: 0 to 40° C (32 to 104° F) continuous. Altitude 0 to 3300 feet above sea level, less than 95% humidity, non-condensing. All circuit boards shall have conformal coating.
2. Enclosure shall be UL rated and shall be UL listed as a plenum rated VFD.

D. All VFDs shall have the following standard features:

1. All VFDs shall have the same customer interface, including digital display, and keypad, regardless of horsepower rating. The keypad shall be removable, capable of remote mounting and allow for uploading and downloading of parameter settings as an aid for start-up of multiple VFDs.
2. The keypad shall include Hand-Off-Auto selections and manual speed control. There shall be fault reset and "Help" buttons on the keypad. The Help button shall include "on-line" assistance for programming and troubleshooting.
3. VFD shall be Sub Micro design for space savings

E. All VFDs to have the following adjustments:

1. Run permissive circuit - There shall be a run permissive circuit for damper or valve control. Regardless of the source of a run command (keypad command, input contact closure, time-clock control, or serial communications), the VFD shall provide a dry contact closure that will signal the damper to open (VFD motor does not operate). When the damper is fully open, a normally open dry contact (end-switch) shall close. The closed end-switch is wired to a VFD digital input and allows VFD motor operation. A minimum of two separate safety interlock inputs shall be provided. When any safety is

opened, the motor shall be commanded to coast to stop and the damper shall be commanded to close.

2. The VFD control shall include a programmable time delay for VFD start and a keypad indication that this time delay is active. A Form C relay output provides a contact closure to signal the VAV boxes open. This will allow VAV boxes to be driven open before the motor operates.

F. Warranty

The VFD Product Warranty shall be 24 months from the date of certified start-up. The warranty shall include all parts, labor, travel time and expenses. A toll free technical support line shall be provided.

5.0 INTEGRAL VARIABLE FREQUENCY DRIVE MOTORS

A. Integral motors and VFD shall be ABB or approved equal.

B. The VFD shall be of the PWM (Pulse Width Modulation) design using current IGBT (Insulated Gate Bipolar Transistor) technology.

C. The VFD shall convert incoming fixed frequency three-phase AC power into a variable frequency and voltage for controlling the speed of motor. The motor current shall closely approximate a sine wave. Motor voltage shall be varied with frequency to maintain desired motor magnetization current suitable for centrifugal pump control and to eliminate the need for motor de-rating.

D. The VFD shall utilize an energy optimization algorithm to minimize energy consumption. The output voltage shall be adjusted in response to the load, independent of speed.

E. The VFD shall automatically reduce the switching frequency and/or the output voltage and frequency to the motor during periods of sustained ambient temperatures that are higher than the normal operating range. The switching frequency shall be reduced before motor speed is reduced.

F. An integral RFI filter shall be standard in the VFD.

G. The VFD shall be supplied with an Ethernet communications card.

H. The VFD shall have a minimum of two skip frequency bands which can be field adjustable.

I. The VFD shall have internal solid-state overload protection designed to trip within the range of 125-150% of rated current.

J. The integrated VFD motor shall include protection against input transients, phase imbalance, loss of AC line phase, over-voltage, under-voltage, VFD over-temperature, and motor over-temperature. Three-phase integrated VFD motors shall be capable of providing full output voltage and frequency with a voltage imbalance of up to 10%.

K. The integrated VFD motor shall have, as a minimum, the following input/output capabilities:
   1. Speed Reference Signal: 0-10 VDC, 4-20mA
   2. Digital remote on/off
   3. Fault Signal Relay (NC or NO)
   4. Fieldbus communication port (RS485)

L. The motor shall be Totally Enclosed Fan Cooled (TEFC) with a standard NEMA C-Face, Class F insulation with a temperature rise no higher than Class B.

M. The cooling design of the motor and VFD shall be such that a Class B motor temperature rise is not exceeded at full rated load and speed at a minimum switching frequency of 9.0 kHz.

N. Motor drive end bearings shall be adequately sized so that the minimum L10 bearing life is 17,500 hours at the minimum allowable continuous flow rate for the pump at full rated speed.

O. Warranty – The VFD Product Warranty shall be 24 months from the date of certified start-up. The warranty shall include all parts, labor, travel time and expenses. A toll free technical support line shall be provided.

6.0 PUMP SYSTEM CONTROLLER

A. The pump system controller shall be Allen Bradley MicroLogix 1400 (catalog number 1766-L32AWA) with Automation Direct C-More OIT (catalog number EA9-T6CL with Ethernet), or equal.

B. Proprietary technology shall be indicated as such. If proprietary, the programs shall be provided on CD, full programming with offline software license to the Owner. Code shall have no OEM locks. PLC shall be Ethernet/IP compliant.

C. The controller shall display the following as status readings from a single display on the controller (this display shall be the default):
   1. Current value of the control parameter, (typically discharge pressure)
   2. Most recent existing alarm (if any)
   3. System status with current operating mode
   4. Status of each pump with current operating mode and rotational speed as a percentage (%)
   5. Estimated flow-rate, (not requiring flow meter connection)

D. The controller shall have as a minimum the following hardware inputs and outputs:
   - Three analog inputs (4-20mA or 0-10VDC)
   - Three digital inputs
   - Two digital outputs
   - Ethernet connection
   - Field Service connection to PC for advanced programming and data logging

E. The system controller shall be able to accept up to seven programmable set-points via a digital input, (additional input/output module may be required).

F. The controller shall be capable of receiving a remote analog set-point (4-20mA or 0-10 VDC) as well as a remote system on/off (digital) signal.

G. The controller shall be able to adjust the ramp time of a change in set point on both an increase or decrease change in set point.

H. The pump system controller shall be mounted in a UL Type 3R rated enclosure or equal. The control panel shall include a main disconnect, circuit breakers for each pump and the control circuit and control relays for alarm functions.

I. The controller shall be capable of changing the number of pumps available to operate or have the ability limit the maximum power consumption.

J. The controller shall include indication of individual pump run times.

K. The controller shall have the ability to communicate common field-bus protocols (Modbus), via optional communication expansion card installed inside controller.

7.0 SEQUENCE OF OPERATION

A. The system controller shall operate variable speed pumps to maintain a constant discharge pressure (system set-point). The system controller shall receive an analog signal [4-20mA] from the factory installed pressure transducer on the discharge manifold, indicating the actual system pressure. The pump system controller shall adjust pump speed as necessary to maintain system set-point pressure as flow demand increases. As flow demand increases the pump speed shall be increased to maintain the system set-point pressure. When the operating pump(s) reach 96% of full speed (adjustable), an additional pump will be started and will increase speed until the system set-point is achieved. When the system pressure is equal to the system set-point pumps will shut down and/or reduce speed to maintain the pressure with the minimum amount of pump sin operation. If multiple pump sizes are used, the smallest pump possible shall be used to maintain the system pressure. The pump system controller shall have field adjustable settings for system optimization.

B. The system controller shall be capable of switching pumps on and off to satisfy system demand without the use of flow switches, motor current monitors or temperature measuring devices.

C. Process control descriptions shall be submitted for review by the Owner. Owner or owners controls engineer shall have the ability to modify the control program settings, sequence of operations, max. Speed, minimum speed, start up conditions and shut down conditions.

8.0 SUBMITTALS

C. Operation & Maintenance Manuals

1. Preliminary Submittal – Two (2) hard copies and one (1) electronic copy of the Operation and Maintenance Manuals shall be furnished to the Owner for review. Owner shall review and submit comments and modifications to be provided by the Manufacturer.
2. Final Submittal – Two (2) hard copies and one (1) electronic copy of the Operation and Maintenance Manuals addressing all Owner comments and modifications shall be provided.
3. Binding and Cover – Binders shall be locking three-ring/"D"-ring type, or three-post type. Three-ring binders shall be riveted to back cover and include plastic sheet lifter (page guard) at front of each volume.
4. Do not overfill binders.
5. Covers shall be oil-, moisture-, and wear-resistant, including identifying information on cover and spine of each volume.
6. Provide the following information on cover of each volume:
    i. Title: "OPERATING AND MAINTENANCE INSTRUCTIONS".
    ii. Name or type of material or equipment covered in the manual.
    iii. Volume number, if more than one volume is required, listed as "Volume __ of __", with appropriate volume-designating numbers filled in.
    iv. Name of Project and, if applicable, Contract name and number.
7. Print pages in manual on 30-pound (minimum) paper, 8.5 inches by 11 inches in size.
8. Reinforce binding holes in each individual sheet with plastic, cloth, or metal. When published, separately-bound booklets or pamphlets are part of the manual, reinforcing of pages within booklet or pamphlet is not required.
9. Provide each page with binding margin at least one inch wide. Punch each page with holes suitable for the associated binding.
10. Bind into the manual drawings, diagrams, and illustrations up to and including 11 inches by 17 inches in size, with reinforcing specified for pages.
11. Contents shall be original-quality copies. Documents in the manual shall be either original manufacturer-printed documents or first-generation photocopies indistinguishable from originals. If original is in color, copies shall be in color. Manuals that contain copies that are unclear, not completely legible, off-center, skewed, or where text or drawings are cut by binding holes, are unacceptable. Pages that contain approval or date stamps, comments, or other markings that cover text or drawing are unacceptable. Faxed copies are unacceptable.

12. Table of Contents:
    i. Provide table of contents in each volume of each operations and maintenance manual.
    ii. In table of contents and at least once in each chapter or section, identify material and equipment by their functional names. Thereafter, abbreviations and acronyms may be used if their meaning is clearly indicated in a table bound at or near

beginning of each volume. Using material or equipment model or catalog designations for identification is unacceptable.

iii. Use dividers and indexed tabs between major categories of information, such as operating instructions, preventive maintenance instructions, and other major subdivisions of data in each manual.

13. Electronic Copies

i. Each electronic copy shall include all information included in printed copy.

ii. File Format:

1. Files shall be in "portable document format (PDF)". Files shall be electronically searchable.
2. Submit separate file for each separate document in the printed copy.
3. Within each file, provide bookmarks for the following:
    a. Each chapter and subsection listed in the printed copy document's table of contents.
    b. Each figure.
    c. Each table.
    d. Each appendix.

14. Content

i. Submit complete, detailed written operating instructions for each material or equipment item including: function; operating characteristics; limiting conditions; operating instructions for start-up, normal and emergency conditions; regulation and control; operational troubleshooting; and shutdown. Also include, as applicable, written descriptions of alarms generated by equipment and proper responses to such alarm conditions.

ii. Submit written explanations of all safety considerations relating to operation and maintenance procedures.

iii. Submit complete, detailed, written preventive maintenance instructions including all information and instructions to keep materials, equipment, and systems properly lubricated, adjusted, and maintained so that materials, equipment, and systems function economically throughout their expected service life.

iv. Complete bills of material or parts lists for materials and equipment furnished. Lists or bills of material may be furnished on a per-drawing or per-equipment assembly basis.

v. Submit complete electrical schematics and wiring diagrams, including complete point-to point wiring and wiring numbers or colors between all terminal points.

vi. Programmable Logic Controllers including ladder diagrams.

vii. Submit complete programmable logic controller listing of all input/output address assignments, tag assignments, and pre-set constant values, with functional point descriptions.

viii. Submit complete manufacturer's programming manuals.

ix. Dimensional Drawings specific to the equipment installed at the plant.

x. Pump Curves – Factory developed pump curves shall be submitted for each pump. Generic pump curves will not be acceptable.

xi. Motor Data Sheets – Motor data sheets including General Specifications, Performance data, and dimensional drawings shall be provided.

xii. Copy of warranty bond and service contract as applicable.

xiii. Copy of appropriate training material.

9.0 TESTING & FIELD VISITS

A. The entire packaged pumping system shall be factory tested for functionality. Functionality testing shall include the following parameters: Dry Run Protection, Minimum Pressure and Maximum Pressure alarms (where applicable), Set point Operation, and Motor Rotation.

B. The system shall undergo a factory hydrostatic test at the end of the production cycle. The system shall be filled with water and pressurized to 1.5 times the nameplate maximum pressure. The pressure shall be maintained for a minimum of 15 minutes with no leakage prior to shipment.

C. Installation check-out shall be conducted for each pump and the system as a whole provided by the manufacturer's authorized representative.

D. Startup and Testing shall be conducted for each pump and the system as a whole provided by the manufacturer's authorized representative.

E. Training shall be conducted in two (2) sessions by the manufacturer's authorized representative.

i. Training and all travel costs shall be covered through the contract price.

F. Installation, Check-out, Start-up Testing, and Training shall be conducted by an authorized representative of the equipment manufacturer. The manufacturer's representative shall be fully knowledgeable in the operation and maintenance of equipment.

G. Equipment shall not be accepted by the Owner until the following has been demonstrated:

1. Pumps have been properly installed and aligned.
2. Pumps operate without overheating of overloading of any parts, and without objectionable vibration. Vibration shall be within the Hydraulic Institutes limits, or manufacturer limits, if more stringent.
3. The pumps can meet the specified operating conditions. All pumps shall be checked at maximum speed for a minimum of four points on the pump curve for capacity, head, and amperage. The rated motor nameplate current shall not be exceeded at any point.
4. Automatic control sequence has been appropriately demonstrated over a period of no less than fourteen days (14).

9.0 WARRANTY

A. The warranty period shall be a minimum of 24 months from date of installation.

B. Warranty data shall include contact phone numbers and addresses for warranty issues.

C. Warranty will begin once the equipment has been installed and demonstrates functionality and training and startup has been approved by the Owner.

D. Automatic Duplex Strainer for PWS

1.0 The strainer shall be an automatic type sized according to the maximum flows provided in the PWS specification above and employing 2 cylindrical straining screens of the peripheral inflow design. If the inlet and discharge flanges are smaller than the existing 8” pipe, then reducers shall be provided. The straining screen shall have 0.125” (1/8”) perforated holes and be of type 316 Stainless Steel material. Adjustable rigid scraper bars shall be mounted adjacent to the screens to accommodate scraping of accumulated solids from the screen when the straining screen is rotated with an electric motor and suitable gear reduction. The motors shall be 1/3 horsepower, 460 Volt, 3 Ph, 60 Hz, 1.15 SF Class “F” Insulation, TEFC, 56C-Face, Footless. Removable inspection covers shall give access to the scraper bars for inspection and adjustment and shall not require the disassembly of the strainer to accomplish those tasks. The strainer shall be capable of handling flows as much as 500 gallons per minute through the 1/8” screen at 1” differential pressure. Any variation to the specification above shall be explained completely and included in the bid.

2.0 Storage Sump – The strainer shall also have a sump for storage of strained solids. One 2” ball valve & actuator is supplied with the strainer.

3.0 Construction – The strainer body shall be of cast iron construction per ASTM A278 Class 30 and have integral, in-line 6" inlet and outlet flanges. Flanges shall be Class 125 (rated to 175 PSI) Flat Face, ANSI Class B16.1.

4.0 Testing – The assembled strainer shall be hydrostatically pressure tested to 1-1/2 times the maximum allowable working pressure for a period of 10 minutes.

5.0 Control Panel – An electric control panel furnished by the Manufacturer shall control the strainer cleaning cycle. The panel shall include all motor starters, control relays, fuse and overload protection, control transformer, operation lights, etc., and shall be mounted in a NEMA 3R or 4X wall mounted polycarbonate enclosure equipped with a door disconnect switch. The control panel shall conform to current NEMA, NEC, and OSHA codes and regulations. The strainer control panel shall be equipped with a programmable solid state timer to initiate cleaning cycles at predetermined intervals, a hand/off/automatic selector switch, and a push-button for manual starting. An adjustable cycle duration timer shall also be furnished to allow for control of the cleaning cycle duration. An adjustable pressure differential switch shall be mounted on the strainer and shall be used to initiate a cleaning cycle if the pressure drop reaches a predetermined set point. The control panel shall be equipped with all the components/controls necessary to integrate on/off indication, auto/remote indication, failure alarms, excessive Differential

pressure, backflush valve state (open/close) and backflush valve failure alarms. The control panel shall include the controls necessary to initiate a remote command for strainer backflush, off/on commands from plc (provided by others).

6.0 Manufacturer – The strainer shall be a Hellan Strainer manufactured by The Hellan Strainer Company, Cleveland, Ohio or approved equal.

7.0 Factory/Shop Testing

I. All equipment shall be tested in the shop of the manufacturer in a manner which shall conclusively prove that its characteristics comply fully with the requirements of these Contract Documents and it will operate in the manner specified or implied.

J. Equipment will not be fully accepted until certified copies of the test results have been provided to the Owner.

K. Three (3) certified copies of the manufacturer's actual test data and interpreted test results shall be submitted to the Owner for review.

L. Shop testing of the three phase electric motors shall be factory tested to determine compliance with the requirements of the IEEE, ANSI, and NEMA.

8.0 Submittals

D. Operation & Maintenance Manuals

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operating instructions for start-up, normal and emergency conditions; regulation and control; operational troubleshooting; and shutdown. Also include, as applicable, written descriptions of alarms generated by equipment and proper responses to such alarm conditions.

ii. Submit written explanations of all safety considerations relating to operation and maintenance procedures.

iii. Submit complete, detailed, written preventive maintenance instructions including all information and instructions to keep materials, equipment, and systems properly lubricated, adjusted, and maintained so that materials, equipment, and systems function economically throughout their expected service life.

iv. Complete bills of material or parts lists for materials and equipment furnished. Lists or bills of material may be furnished on a per-drawing or per-equipment assembly basis.

v. Submit complete electrical schematics and wiring diagrams, including complete point-to point wiring and wiring numbers or colors between all terminal points.

vi. Programmable Logic Controllers including ladder diagrams.

vii. Submit complete programmable logic controller listing of all input/output address assignments, tag assignments, and pre-set constant values, with functional point descriptions.

viii. Submit complete manufacturer's programming manuals.

ix. Dimensional Drawings specific to the equipment installed at the plant.

x. Motor Data Sheets – Motor data sheets including General Specifications, Performance data, and dimensional drawings shall be provided.

xi. Copy of warranty bond and service contract as applicable

9.0 Start-up and Training / Manufacturer Field Services

J. Installation check-out shall be conducted in a single trip over a maximum of three (3) days provided by the manufacturer.

K. Startup and Testing shall be conducted in a single trip for a maximum of one (1) day provided by the Manufacturer.

L. Training shall be conducted in a single trip for a maximum of two (2) days provided by the manufacturer.

M. Equipment shall not be accepted by the Owner until the following has been demonstrated:

a. Proper installation and alignment.

b. Ease of automatic operation as described above.

10.0 Warranty

F. Performance warranty shall be provided for a period of no less than twenty-four (24) months.

G. Warranty data shall include contact phone numbers and addresses for warranty issues.

H. Warranty will begin once the equipment has been installed and demonstrates functionality and training and startup has been approved by the Owner.

END OF SPECIFICATIONS