

LAKESIDE EQUIPMENT CORPORATION
Water and Wastewater Treatment Equipment
P.O. Box 8448
Bartlett, IL 60103

SPS-75

REPRESENTATIVES
PRINCIPAL CITIES

TELEPHONE: 630-837-5640
FAX: 630-837-5647

SECTION 43 24 41 - OPEN SCREW PUMP EQUIPMENT

INDIAN RIVER COUNTY, FLORIDA
JONES' PIER CONSERVATION AERA
AUGUST 13, 2019

PART 1 - GENERAL

1.01 SUMMARY

- A. The CONTRACTOR shall furnish, install and place in satisfactory operating condition open screw pump assemblies and appurtenances as shown on the Drawings and described in the Specifications.
- B. Related Sections
 - 1. General Conditions, Supplementary Conditions, and General Requirements sections apply to work of this Section.

1.02 REFERENCES

- A. American Gear Manufacturers Association (AGMA)
- B. American Institute of Steel Construction (AISC)
- C. American Society of Testing and Materials (ASTM)
- D. American Society of Civil Engineers (ASCE)
- E. American Welding Society (AWS)
- F. National Electrical Manufacturers Association (NEMA)
- G. Steel Structures Painting Council (SSPC)

1.03 SYSTEM DESCRIPTION

- A. Each open screw pump shall be furnished complete with spiral steel flighted screw, upper and lower stub shafts, upper dual radial and thrust bearing, lower heavy-duty bearing, flow deflection plates, shaft-mounted speed reducer, V-belts and sheaves, drive motor, spare parts, and all necessary

anchorage materials. Electrical controls are not included in these specifications and are provided by others.

B. Design Parameters For Each Unit:

1. Number of Open Screw Pumps	-
2. Project Open Screw Pump Design Capacity, gal/min	100
3. Maximum Open Screw Pump Capacity, gal/min	300
4. Hydraulic Lift (H), feet.....	6
5. Angle of Inclination, degrees	38
6. Project Open Screw Pump Design Rotational Speed, rev/min.....	23
7. Maximum Open Screw Pump Rotational Speed, rev/min.....	79
8. Pump Minimum Outside Diameter, inches	20
9. Minimum Number of Flights.....	1
10. Flight Thickness, inches	0.25
11. Torque Tube Diameter, inches	10.75
12. Torque Tube Wall Thickness, inches	0.365
13. Minimum Lower Bearing Diameter, inches	2.75
14. Minimum Upper Bearing Diameter, inches	3.0
15. Project Design Minimum Speed Reducer Torque Rating, inch-lb.....	6,163
16. Minimum Motor Size, hp	1.5
17. Electrical Power Characteristics, VAC – Hertz – Phase	460 – 60 – 3
18. Electrical Classification.....	Non-rated

1.04 PRE-QUALIFICATION

- A. All open screw pump equipment manufacturers not listed in the paragraph 2.01 shall submit at least 15 days prior to the advertised date for receipt of bids a “Qualification Package” for the substitute or “or equal” equipment which the manufacturer proposes to furnish in lieu of products identified in the Contract Documents. The Bidder shall submit the Qualification Package under separate cover. Each Qualification Package shall be bound with protective cover, identify the specification section number and title, and the product manufacturer’s name on a cover sheet. The manufacturer shall submit the Qualification Package in a sealed sturdy box or suitable container. This section outlines the procedures for proposal of substitute or “or equal” items by “Alternate” manufacturers.
- B. The use of this pre-qualification requirement is intended to protect the OWNER and Bidders so that no one Bidder gains an unfair bid price advantage by quoting a lower price for an open screw pump that does not comply with the minimum performance and salient features set for by Section 43 24 41.
- C. The “Qualification Package” for the substitute or “or equal” equipment item of products the manufacturer proposes to furnish shall include but not be limited to, the following information as defined in 1.04.D.
- D. The Qualification Package submittal requirements for the equipment shall be as follows:
 - 1. The quality assurances set forth in Section 43 24 41-1.07 for the substitute or “or equal” equipment item.

2. A complete set of drawings, specifications, catalogue cut-sheets, and detailed descriptive material of proposed equipment items or products. This information shall identify all technical and performance requirements stipulated on each drawing and in each specification section.
3. Detailed vendor information shall be submitted for all buy-out items such as hardware, motors, bearings, reducers, belts, and sheaves.
4. List showing materials of construction of all components, including all buy-out items.
5. AFBMA L10 theoretical design life calculations of the upper bearing radial and thrust bearing at the maximum design capacity of the open screw pump
6. Certification that the drive speed reducer manufacturer is a member of AGMA and that the torque rating is in accordance with AGMA standards.
7. Confirmation that the open screw pumps will be manufactured in the United States in accordance with paragraph 2.16.A.
8. AISC category certification and AWS welding inspector certifications in accordance with paragraph 2.16.C.
9. Manufacturer's recommended spare parts, including all buy-out items.
10. Information on equipment field erection requirements including weight of assembled components and weight of each sub-assembly.
11. A maintenance schedule showing the required maintenance, frequency of maintenance, lubricants and other items required at each regular preventative maintenance period, including all buy-out items.
12. Process equipment electrical requirements and schematic diagrams
13. Provide a copy of this specification with a check next to each item to which the proposed equipment meets the specified standard. Where the proposed equipment does not strictly meet the requirements of this specification, provide information on the proposed exception to the specification that would bring the proposed, equipment into compliance with the requirements of this section.
14. Confirmation that the manufacturer has regularly engaged in the manufacturing and production of open screw pump equipment in the United States for a minimum of ten (10) years. No equipment shall be supplied by any manufacturer with less than ten years experience.

The manufacturer must have installed and had in satisfactory use in this application a minimum of twenty (25) installations of identical (20-inch diameter) or larger size units as noted in paragraph 1.03.B.5. Provide a list of twenty-five (25) U.S. installations of similar type equipment comparable to the units specified.

The term "installations" shall mean individual projects/contracts. Multiple equipment units for a project will be considered as one (1) installation toward meeting the experience requirements.

Installations shall be only those in the United States (fifty states). The installation shall include, but not be limited to, the following:

- a. Name and location of installation.
- b. Name of person in direct responsible charge for the equipment.
- c. Address and phone number of person in direct responsible charge.
- d. Month and year the equipment was placed in operation.
- e. Brief description of equipment
- f. Provide the name, address, and phone number of the contact person at the company that will provide service (both warranty period and post-warranty period) for the unit to the OWNER.

Bids from manufacturers lacking the U.S. experience requirements, but meeting all technical and performance requirements of the Contract Documents, can be considered if the manufacturer provides a satisfactory two (2) year maintenance bond in lieu of evidence of experience and operation. Maintenance bond shall be for 150 percent of the replacement value of the equipment. The bonding company shall have a policy-holder rating of A+ and a financial rating of "Class XV" in the most recent edition of "Best Key Rating Guide". The bonding company shall be licensed to do business in the State of Florida.

15. Computations showing all structural and mechanical open screw pump design computations. The computations shall clearly indicate the following design parameters.
 - a. Brake horsepower at the maximum capacity and lift.
 - b. Required reducer torque at the maximum capacity and lift.
 - c. Radial bearing load and thrust bearing load at the maximum capacity and lift.
 - d. Bearing center distance.
 - e. Maximum open screw deflection at the maximum capacity and lift.
 - f. AFBMA L-10 theoretical design life calculations for the upper bearing assembly thrust bearing and radial bearing

These design calculations shall be certified by the manufacturer and signed by a Professional Engineer registered in the United States in direct employment of the manufacturer.

16. Itemized list of all deviations from the specifications and drawings.
- E. Submittal Review Deposit, in the form of a certified bank check in the amount of \$4,000 made payable to the OWNER. This deposit will be used for ENGINEER's review of substitute equipment. The ENGINEER's review time will be deducted at a rate of \$250.00 per hour for reviewing substitution requests, regardless of whether the substitution is approved or rejected. The OWNER will return any unused funds to the petitioner within 30 days of the bid date.
 - F. If the Bidder fails to furnish all of the preceding information which has been deemed necessary by the ENGINEER to evaluate a proposed substitute or "or equal" equipment, the proposed substitute or "or equal" qualification package will be rejected by the ENGINEER.
 - G. The ENGINEER shall be the sole authority for determining conformance of a proposed substitute or "or equal" equipment item or product with the minimum requirements of the Contract Documents.

Under no circumstances will the ENGINEER be required to prove that an "Alternate" major equipment item or product is not equal to the specified equipment item or product.

- H. Failure to furnish the preceding information shall be cause for rejection of a proposed substitute or "or equal" equipment item or product for use on this project.

1.05 PERFORMANCE

- A. Each open screw pump shall be able to pump the project design capacity as noted in paragraph 1.03.B.2. at the hydraulic lift (H) noted in paragraph 1.03.B.4., an angle of inclination as noted in paragraph 1.03.B.5., and the project design rotational speed as noted in paragraph 1.06.B.6.
- B. Each open screw pump body, upper bearing and stub shaft, and lower bearing and stub shaft shall be structurally designed to handle the maximum open screw pump design capacity as noted in paragraph 1.03.B.3. at the hydraulic lift (H) noted in paragraph 1.03.B.4., an angle of inclination as noted in paragraph 1.03.B.5., and the maximum rotational speed as noted in paragraph 1.06.B.7.

1.06 MATERIALS QUALITY

- A. All steel components including the open screw pump body, flow deflection plates, upper bearing and stub shaft, lower bearing and stub shaft and drive-bearing mounting plates shall be fabricated in the United States. Materials thicknesses identified in PART 2 - PRODUCTS are the minimum requirements for this project. Materials with increased thicknesses will be acceptable.
- B. All fabricated components shall be manufactured in the United States. To ensure prompt service and to ensure spare parts availability in a timely manner and at a reasonable cost, foreign fabricated materials of construction for the components identified in paragraph 1.06.A. shall not be acceptable for this project.
- C. If metric materials are utilized for fabrication of the screw pump components, the manufacturer shall utilize materials that are equal to or larger for unit sizes noted and shall utilize material thicknesses that are equal to or greater than specified.

1.07 QUALITY ASSURANCE

- A. In order to assure uniform quality, ease of maintenance and minimal parts storage, it is the intent of these Specifications that all equipment called for under this Section shall be supplied by a single manufacturer.
- B. Naming a manufacturer in paragraph 2.01.A. does not relieve them from complying with the performance features, the salient features, and the Made in the U.S.A. requirements of the Contract Documents. The Contract Documents represent the minimum acceptable standards for the open screw pump equipment for this project. All equipment shall conform fully in every respect to the requirements of the respective parts and sections of the drawings and specifications. Equipment which is a "standard product" with the manufacturer shall be modified, redesigned from the standard mode, and shall be furnished with special features, accessories, materials of construction or finishes as may be necessary to conform to the quality mandated by the technical and performance requirements of the specification.

PART 2 - PRODUCTS

2.01 MANUFACTURER

- A. The open screw pump assemblies shall include all necessary equipment and appurtenances as manufactured by Lakeside Equipment Corporation of Bartlett, Illinois, or pre-approved equal.

2.02 SPIRAL SCREW

- A. The spiral screw shall be fabricated of Type 316 stainless steel. Each spiral screw shall have a minimum outside diameter as noted in paragraph 1.03.B.8. with the minimum number of flights as noted in paragraph 1.03.B.9. Flights shall be die formed with a 1:1 pitch-to-diameter ratio and shall have a minimum thickness as noted in paragraph 1.03.B.10. The distance between flight pitches shall be no more than the pump diameter \pm 0.25-inch. Flights shall be helical shaped and continuously welded on both sides to the torque tube. There shall be no more than one flight butt welds per pitch, and all flight butt welds shall be full penetration joints. The screw shall be designed to rotate counter-clockwise when viewed from the lower bearing end up toward the drive assembly.
- B. Each torque tube shall have a minimum pipe diameter as noted in paragraph 1.03.B.11. with a minimum wall thickness as noted in paragraph 1.03.B.12., so that screw deflection shall not be greater than the bearing center distance divided by 2,000. Calculations for deflection and bearing loads shall be based on the dead weight of the screw plus the full weight of liquid being pumped at the maximum open screw pump capacity as noted in paragraph 1.03.B.3. Decreased loading from buoyance effects shall not be considered in the design calculations.
- C. The torque tube shall be sealed watertight with a welded steel plate at each end. All surfaces of the end plates mating with the bolted stub shafts shall be finish machined while the pump is supported between centers in a lathe after welding to the support tube and after all flight welding is complete to assure alignment and parallelism.
- D. A solid steel upper drive shaft and lower stub shaft fitted with machine faced steel plate flange shall be fastened to the upper and lower ends of the fabricated spiral screw with ASTM high-strength alloy bolts.

2.03 LOWER BEARING ASSEMBLY

- A. The lower bearing assembly shall be a sealed, food grade grease lubricated design that is fully self-aligning in all three axis. No thrust load shall be carried by the lower bearing.
- B. The lower bearing assembly shall consist of a radial spherical roller bearing element and a stationary lower stub shaft. The bearing housing shall contain a minimum of two (2) spring loaded lip seals at the bottom of the bearing assembly. The seals shall be arranged to exclude wastewater and contaminants from the bearing and to contain the food grade grease within the housing. The use of less than two lip seals will not be acceptable.
- C. The bearing assembly shall accommodate thermal expansion and contraction of the screw shaft within the bearing housing on fully lubricated surfaces not subject to corrosion or seizure.

- D. The housing shall be designed for continuous or intermittent operation and shall be suitable for operation in submerged or non-submerged conditions.
- E. The bearing assembly shall permit precise angular (vertical) and lateral (horizontal) field adjustment to eliminate misalignment between the upper and lower bearings without the use of shims.
- F. The bearing assembly shall be supplied with a split non-rotating shield installed between the housing and rotating screw for operation of the shaft and seals.
- G. The bearing assembly shall be designed to accommodate all static and operating deflections of the screw and to resist all loads including buoyant forces which may occur under maximum wet well conditions.

2.04 UPPER BEARING ASSEMBLY

- A. The upper stub shaft shall be a one-piece fabricated steel or forged steel design. Two-piece stub shaft designs (shaft and mating flange) will not be acceptable for this project. The upper stub shaft shall be designed based on the dead weight of the screw plus the full weight of the liquid being pumped at the maximum screw pump capacity as noted in paragraph 1.03.B.3.
- B. The upper stub shaft shall extend through a grease lubricated upper bearing assembly which shall consist of a split housing fitted with dual bearings, lower spring loaded lip seal, bearing spacer and upper spring loaded lip seal. The minimum upper bearing nominal diameter shall be as noted in paragraph 1.03.B.14.
- C. All of the thrust load from the pump shall be carried by a spherical thrust-type bearing assembly and the upper open screw pump radial load shall be carried by a spherical roller bearing. A single dual-purpose bearing to handle both the radial load and the thrust load shall not be acceptable for this project.
- D. The two (2) bearings (radial and thrust) shall be positioned in the bearing housing so that the pressure center of the thrust bearing and radial bearing intersects the axis of the screw at the same point to provide true self-alignment in all planes.
- E. The radial bearing shall be rated at a minimum of AFBMA L10 theoretical design life as noted in paragraph 1.03.B.16., based on the dead weight of the screw plus the full weight of the liquid being pumped at the maximum open screw pump capacity at noted in paragraph 1.03.B.3.
- F. The upper stub shaft shall be grooved and positively locked into the upper bearing assembly by a split collar and locking halter ring. Use of threaded nuts to lock bearings and shafts for support of thrust loading shall not be acceptable for this project.
- G. A split bearing housing shall be provided to allow removal of the cover for inspection of the bearings without removal of the stub shaft or the entire bearing assembly.

2.05 DRIVE ASSEMBLY

- A. The drive assembly shall be designed and constructed for the project design screw rotational speed as noted in paragraph 1.03.B.6. The drive assembly shall consist of a shaft-mounted speed reducer, belts and sheaves, and motor.
- B. A shaft-mounted, double-reduction reducer in a cast iron housing with alloy steel high hardness helical gearing, positive splash-type lubrication, and double lip oil seals, shall be keyed to the open screw pump stub shaft. Speed reducer manufacturer shall be a member of the AGMA and the reducer shall be designed in accordance with the latest AGMA standards.
- C. The open screw pump stub shaft shall be supported by the upper bearing, extended through the reducer hollow bore, and centered and held firmly in place by tapered bushings on each side of the reducer. The use of setscrews and collar to lock gear reducer to shaft will not be acceptable.
- D. The speed reducer shall be designed with a service factor of not less than 1.5 based on the torque requirements of the screw or 1.0 based on the motor horsepower, whichever is greater. The speed reducer shall have a minimum torque rating as noted in paragraph 1.03.B.15. at the project design rotational speed as noted in paragraph 1.03.B.6.
- E. Reducer shall be held in position by a torque arm and torque arm bracket. Torque arm bracket shall be fastened with cast-in-place anchors. Expansion anchors shall not be acceptable for this project.
- F. A visual oil level gauge and oil filler tube for the reducer shall be mounted on the reducer.
- G. A backstop shall be provided with the reducer to prevent reverse rotation of the screw.

2.06 BELTS AND SHEAVES

- A. Power transmission from the motor to the reducer shall be by means of a set of V-belts and sheaves. Belts and sheaves shall be designed with a 1.5 service factor based on full motor horsepower.
- B. Sheaves shall be two section units for both drive and driven sheaves and shall consist of a tapered split shaft bushing with three tapped holes to which the sheave is attached by three cap screws. Changing sheaves shall not require a wheel puller.
- C. Belts and sheaves shall be covered with a fabricated AISI Type 316 stainless steel belt guard in accordance with OSHA standards. Belt guard shall be designed with the expanded metal front hinged to the main enclosure for ease of inspection and access. Hinged front panel shall be held in place via stainless steel captive fasteners.

2.07 MOTOR

- A. Each unit shall be driven by an 1,800 rev/min, 1.15 service factor, horizontal, ball bearing, continuous duty, constant speed, Design B, normal starting torque, totally-enclosed fan-cooled, premium-efficiency, foot-mounted motor with leads to gasketed conduit box for outdoor operation.
- B. The minimum motor size shall be as noted in paragraph 1.03.B.18., shall be rated for electrical power characteristics as noted in paragraph 1.03.B.17., and shall be rated for an electrical environment as noted in paragraph 1.03.B.18.

- C. Motor shall be mounted on a fabricated steel plate, which provides adjustment of belt slack.

2.08 DEFLECTION PLATES

- A. A flow deflection plate shall be provided to curve around the upper section on the uptake side of the screw to deflect the liquid as the screw rotates.
- B. The flow deflection plate shall be fabricated of not less than 1/8-inch thick AISI Type 316 stainless steel plate complete with stiffeners where required and stainless steel anchors on 2-foot centers at the bottom edge.
- C. The deflection plate top edge shall have adjustable stainless steel anchors at not more than 8-foot centers.

2.09 GROUTING MATERIALS

- A. Equipment manufacturer shall furnish a radius screed for the CONTRACTOR to place the finishing grout in the trough with the screw after the unit has been installed.
- B. Equipment manufacturer shall loan to the CONTRACTOR additional sheave(s) and belts as required to operate the screw at a reduced speed for grouting the trough with the open screw pump drive.

2.10 SCREW PUMP COVERS (OPTIONAL)

- A. The open screw pump cover sections shall be molded fiberglass reinforced polyester laminate of 3/16-inch minimum thickness, with the exterior surface gel coated for ultraviolet radiation protection. Cover supplier shall certify with approval specifications that fiberglass shall have a glass content of not less than 30%, a tensile strength of not less than 22,000 psi, a flexural strength of not less than 25,000 psi and Barcol hardness of not less than 40. Finished fiberglass must withstand a temperature of 200°F without blistering, pinholes, warping or other defects. Gel coat shall be provided with impregnated pigment for exterior light brown color. Each section shall have a 1/4-inch per foot of width crown.
- B. The covers and support structure shall be designed to support a wind load of 30 lb per square foot.
- C. Cover sections shall be no more than 48 inches wide by the length of the open screw pump trough. Each section shall have an overlapping flange to connect to the next section. A stabilizing flange shall be provided along one end of each cover section.
- D. Each cover section shall have holes every 12 inches to connect to structural supports as well as each cover section. All bolts, washers, and well nuts to assemble cover components shall be stainless steel. Fasteners to mount cover to structural supports shall be stainless steel.

2.11 ANCHOR BOLTS

- A. Equipment manufacturer shall furnish all anchor bolts of ample size and strength required to securely anchor each item of equipment. Anchor bolts, hex nuts, and washers shall be AISI Type

316 stainless steel unless noted otherwise. Anchor bolts shall be J-type embedded, or L-type embedded. Expansion-type anchors will not be acceptable.

- B. Anchor bolts shall be set by the CONTRACTOR. Equipment shall be placed on the foundations, leveled, shimmed, bolted down, and grouted with a non-shrinking grout.

2.12 SPARE PARTS

- A. The following spare parts shall be provided:

- 1. One (1) set of V-belts

- B. Spare parts shall be individually boxed with the project name and part number clearly identified on each individual box. All spare parts shall be shipped in a separate crate and clearly labeled. Spare parts shall be stored indoors by the CONTRACTOR in a temperature-controlled environment.

2.13 SHOP SURFACE PREPARATION AND PAINTING

- A. All fabricated carbon steel or cast iron components for submerged service shall be near-white blast cleaned per SSPC-SP10 and given a 2.5 to 3.5-mil dry film thickness (DFT) coat of Tnemec Series 1 Omnithane Primer.
- B. All fabricated carbon steel or cast iron components for non-submerged service shall be commercial blast cleaned per SSPC-SP6 and given a 2.5 to 3.5-mil dry film thickness (DFT) coat of Tnemec Series 1 Omnithane Primer.
- C. Electric motors, speed reducers, and other self-contained or enclosed components shall be supplied with the manufacturer's standard finish coating.
- D. Rust preventative compound shall be applied to all machined, polished, and nonferrous surfaces, which are not to be painted.

2.14 SOURCE QUALITY CONTROL

- A. All structural steel components shall be fabricated in the United States and shall conform to the requirements of the "Specification for the Design, Fabrication and Erection of Structural Steel for Buildings" published by the American Institute of Steel Construction. Except where specifically indicated otherwise, all plates and structural members shall have a minimum thickness of 1/4-inch.
- B. The equipment manufacturer's shop welds and welding procedures shall be in accordance with the requirements of the latest edition of ANSI/AWS D1.1 "Structural Welding Code - Steel" published by the American Welding Society.
- C. Design and fabrication of structural steel members shall be in accordance with AISC and AWS Standards. The manufacturer shall comply with the American Welding Society (AWS) and the American Institute of Steel Construction (AISC) most current listed standards and qualifications in 2004 D1.1, the criteria per the requirements of Section 6 - Inspection - Structural Welding Code.

Evidence of such AWS and AISC compliance shall be submitted with shop drawing submittals as follows:

1. The fabrication facility shall successfully meet the quality certification requirements of the AISC Quality Certification Program with a Category I or higher. The AISC Quality Certification Program will confirm that the AISC certified shop has the personnel, organization, experience, procedures, knowledge, equipment, capability and commitment to produce fabricated steel or stainless steel of the required quality for the wastewater treatment equipment.
2. AWS Certified Welding Inspectors (minimum 2 on staff) shall conform to all standards, current or previous as listed in section 6.1.4 AWS QC1, Standard and Guide for Qualification and Certification of Welding Inspectors.
3. AWS Non Destructive Testing Inspectors (Level I, II, III) for Magnetic Particle and Ultra-Sonic testing (minimum 2 on staff) shall conform to all standards, current or previous as listed in and in conformance with The American Society for Non-Destructive Testing (ASNT-TC-1A).

PART 3 - EXECUTION

3.01 FIELD PREPARATION AND PAINTING

- A. Finish field preparation and painting of non-stainless steel components shall be performed by the CONTRACTOR as specified in Section .
- B. The CONTRACTOR shall touch-up all shipping damage to the paint as soon as the equipment arrives on the job site.
- C. The CONTRACTOR shall finish paint electrical motors, speed reducers, and other self-contained or enclosed components with oil-resistance enamel.
- D. Prior to assembly, the CONTRACTOR shall coat all stainless steel bolts and nut threads with a non-seizing compound.

3.02 INSTALLATION

- A. The manufacturer shall schedule one (1) trip to the project site for equipment start-up assistance as noted in paragraph 3.02.B. for the CONTRACTOR and for operating training as noted in paragraph 3.03.A. for OWNER personnel.
- B. After the CONTRACTOR has installed the screw pumps and the equipment is capable of being operated, the equipment manufacturer shall furnish a qualified representative for a minimum of two (2) days (up to 16 hours) to inspect the equipment and to supervise field-testing and start-up for the CONTRACTOR.
- C. After the equipment has been placed into operation, the manufacturer's representative shall make all final adjustments for proper operation.

3.03 OPERATOR TRAINING

- A. Provide operator training for OWNER'S personnel after system is operational. Training will take place while manufacturer's representative is at the job site for inspection.

END SECTION 43 24 41