Enprotec | Hibbs & Todd

October 7, 2024

CITY OF TOLAR, TEXAS
WASTEWATER TREATMENT PLANT IMPROVEMENTS

Addendum No. 3

Attention is called to the following modifications to the referenced Plans, Specification and Contract Documents for the above referenced project. The City of Tolar (City) will receive sealed Bids for the Wastewater Treatment Plant Improvements Project at **Tolar City Hall** located at **8712 W. Highway 377, Tolar, Texas 76476**, until **Tuesday, October 15, 2024**, at **2:00 p.m**. local time. We hereby modify the documents as follows:

BID DOCUMENTS:

1. **REPLACE** Bid Form in its entirety with the attached.

SPECIFICATIONS:

1. **REPLACE** 02725 *Access Covers - Hatches* in its entirety with the attached.
2. **REPLACE** 09800 *Painting* in its entirety with the attached.
3. **REPLACE** 11075 *Mechanical Coarse Screen* in its entirety with the attached.
4. **REPLACE** 11144 *Sludge Dewatering Screw Press* in its entirety with the attached.
5. **REPLACE** 13442 *Primary Elements* in its entirety with the attached.
6. **REPLACE** 15101 *Gate Valves* in its entirety with the attached.
7. **REPLACE** 15103 *Butterfly Valves* in its entirety with the attached.
8. **REPLACE** 15104 *Ball Valves* in its entirety with the attached.
9. **REPLACE** 15106 *Check Valves* in its entirety with the attached.
10. **REPLACE** 15115 *Water Control Gates* in its entirety with the attached.
11. **REPLACE** 16100 *Sewage Lift Station Control Panel Primary and Backup Three Pump* in its entirety with the attached.

DRAWINGS:

1. **REPLACE** drawing 00D-02 *Proposed Process Flow Diagram* with attached.
2. **REPLACE** drawing 01C-04 *Modified Site Plan* with attached.
3. **REPLACE** drawing 01C-05 *Modified Site Piping Plan* with attached.
4. **REPLACE** drawing 01C-06 *Modified Site Grading Plan* with attached.
5. **REPLACE** drawing 01C-08 *6-DR (1) & (2) Plan and Profile* with attached.
6. **REPLACE** drawing 01C-09 *6-DR (3), (4), & (5) Plan and Profile* with attached.
7. **REPLACE** drawing 01X-01 *Demolition Site & Piping Plan* with attached.
8. **REPLACE** drawing 02D-01 *Influent Lift Station Plan* with attached.
9. **REPLACE** drawing 02D-02 *Influent Lift Station Section* with attached.
10. **REPLACE** drawing 02D-03 *Coarse Screening System Plan* with attached.

11. **REPLACE** drawing 02D-04 *Coarse Screening System Sections* with attached.
12. **REPLACE** drawing 03D-01 *SBR Basin – Overall Plan* with attached.
13. **REPLACE** drawing 03D-02 *SBR Basin - Section* with attached.
14. **REPLACE** drawing 03D-03 *SBR Basin - Sections* with attached.
15. **REPLACE** drawing 03D-04 *SBR Basin - Sections* with attached.
16. **REPLACE** drawing 04D-01 *Chlorine Contact Basin Plan* with attached.
17. **REPLACE** drawing 04D-02 *Chlorine Contact Basin Sections* with attached.
18. **REPLACE** drawing 04D-03 *Disinfection Feed System Plan and Section* with attached.
19. **REPLACE** drawing 04S-01 *Chlorine Contact Basin Structural Plan* with attached.
20. **REPLACE** drawing 04S-01 *Chlorine Contact Basin Structural Section* with attached.
21. **REPLACE** drawing 05D-01 *Sludge Storage Basin Plan* with attached.
22. **REPLACE** drawing 05D-02 *Sludge Storage Basin Section* with attached.
23. **REPLACE** drawing 05D-03 *Solids Transfer System Plan* with attached.
24. **REPLACE** drawing 05D-04 *Solids Dewatering System Plan* with attached.
25. **REPLACE** drawing 06D-01 *Non-Potable Reuse Plant Water System Plan & Sections* with attached.

CLARIFICATIONS

1. **ADD** Xylem Sanitaire SBR Award Scope and Price Clarification.
2. **ADD** Xylem RFP Equipment Submittal.

This addendum consists of three hundred seventy nine (379) pages and becomes a part of the referenced plans, specifications and contract documents and shall be acknowledged by the proposer and attached to the sealed proposal submitted.

Brittany D. White

By Brittany White, P.E.
Project Engineer

10/7/2024

BID DOCUMENTS

BID FORM FOR CONSTRUCTION CONTRACT

The terms used in this Bid with initial capital letters have the meanings stated in the Instructions to Bidders, the General Conditions, and the Supplementary Conditions.

ARTICLE 1—OWNER AND BIDDER

1.01 This Bid is submitted to: **City of Tolar**
8712 W. Highway 377
Tolar, Texas 76476

Project: **Wastewater Treatment Plant Improvements**
Project Number: **8434**

1.02 The undersigned Bidder proposes and agrees, if this Bid is accepted, to enter into an Agreement with Owner in the form included in the Bidding Documents to perform all Work as specified or indicated in the Bidding Documents for the prices and within the times indicated in this Bid and in accordance with the other terms and conditions of the Bidding Documents.

ARTICLE 2—ATTACHMENTS TO THIS BID

2.01 The following documents are submitted with and made a condition of this Bid:

A. Required Bid security;

B. List of Proposed Subcontractors;

C. List of Proposed Suppliers;

D. Evidence of authority to do business in the state of the Project; or a written covenant to obtain such authority within the time for acceptance of Bids;

E. Contractor's license number as evidence of Bidder's State Contractor's License or a covenant by Bidder to obtain said license within the time for acceptance of Bids;

F. Required Bidder Qualification Statement with supporting data; and

ARTICLE 3—BASIS OF BID—LUMP SUM BID AND UNIT PRICES

3.01 *Unit Price Bids*

A. Bidder will perform the following Work at the indicated unit prices:

BASE BID
Asphalt Pavement

Item No.	Estimated Quantity Total	Description and Unit Price (Price to be written in words)	Unit Price	Total Amount
1	1 LS	Mobilization, Bonds, and Insurance (not to exceed 5% of total base bid), for _____ _____ _____ Dollars and _____ Cents per lump sum.		$_____

Item No.	Estimated Quantity Total	Description and Unit Price (Price to be written in words)	Unit Price	Total Amount
2	1 LS	Furnish and install new Triplex influent lift station, including all related appurtenances, as shown and as specified, complete and in place, _____ _____ _____ Dollars and _____ Cents per lump sum.		$_____
3	1 LS	Furnish and install new mechanical coarse screening system per Specification 11075, including all related appurtenances, as shown and as specified, complete and in place, _____ _____ Dollars and _____ Cents per lump sum.		$_____
4	1 LS	Furnish and install new Sequencing Batch Reactor system per Specification 11375 with OIS SCADA, including all related appurtenances, as shown and as specified, complete and in place, Seven hundred ninety-one thousand five hundred Dollars and Zero Cents per lump sum.		$ 791,500.00
5	1 LS	Furnish and install new Sequencing Batch Reactor Basin including all related appurtenances, as shown and as specified, complete and in place, _____ _____ _____ Dollars and _____ Cents per lump sum.		$_____
6	1 LS	Furnish and install new SBR Blower covered area including all related appurtenances, as shown and as specified, complete and in place, _____ _____ Dollars and _____ Cents per lump sum.		$_____
7	1 LS	Furnish and install new effluent disinfection system including all related appurtenances, as shown and as specified, complete and in place, _____ _____ _____ Dollars and _____ Cents per lump sum.		$_____

Item No.	Estimated Quantity Total	Description and Unit Price (Price to be written in words)	Unit Price	Total Amount
8	1 LS	Furnish and install solids holding system with concrete basin, decanter, and solids transfer pump and including all related appurtenances, as shown and as specified, complete and in place, _____ _____ _____ Dollars and _____ Cents per lump sum.		$_____
9	1 LS	Furnish and install new mechanical solids dewatering system per Specification 11144, including all related appurtenances, as shown and as specified, complete and in place, _____ _____ Dollars and _____ Cents per lump sum.		$_____
10	1 LS	Furnish and install new Supervisory Control and Data Acquisition (SCADA) system, including all related appurtenances, as shown and as specified, complete and in place, _____ _____ Dollars and _____ Cents per lump sum.		$_____
11	950 LF	Accommodate Trench Safety requirements for 950 linear feet of PVC, as shown and as specified, for _____ _____Dollars and _____Cents per linear foot.		$_____
12	1 LS	Owners Allowance for work directed in writing by the City for legitimate project related issues at the direct cost for such work, at a lump sum amount of _____ Twenty-Five Thousand Dollars and Zero Cents per lump sum.		$ 25,000.00
13	1 LS	Demolition and disposal of existing structures, piping, equipment, and appurtenances, as shown and as specified, for _____ _____Dollars and _____Cents per linear foot.		$_____
TOTAL BASE BID (Items 1 thru 13)			$_____	

ALTERNATE BID ITEMS

Item No.	Estimated Quantity Total	Description and Unit Price (Price to be written in words)	Unit Price	Total Amount
A1 **In lieu of Base Bid Item 9**	1 LS	Furnish and install new 30 cubic yard dewatering trailers, solids holding basin, and solids transfer pump, including all related appurtenances, as shown and as specified, complete and in place, _____ _____ _____ Dollars and _____ Cents per lump sum.		$_____
A2 **In lieu of Base Bid Items 8 & 9**	1 LS	Furnish and install new 30 cubic yard dewatering trailers, including all related appurtenances, as shown and as specified, complete and in place, _____ _____ _____ Dollars and _____ Cents per lump sum.		$_____

If Bid Alternate A1 is selected, the price for Base Bid item 9 shall be removed and replaced with the cost of item A1. If Bid Alternate A2 is selected, the prices for Base Bid items 8 and 9 shall be removed and replaced with the cost of item A2.

B. Bidder acknowledges that:

1. Each Bid Unit Price includes an amount considered by Bidder to be adequate to cover Contractor's overhead and profit for each separately identified item, and

2. Estimated quantities are not guaranteed, and are solely for the purpose of comparison of Bids, and final payment for all Unit Price Work will be based on actual quantities, determined as provided in the Contract Documents.

ARTICLE 4—TIME OF COMPLETION

4.01 Bidder agrees that the Work will be substantially complete and will be completed and ready for final payment in accordance with Paragraph 15.06 of the General Conditions on or before the dates or within the number of calendar days indicated in the Agreement.

4.02 Bidder accepts the provisions of the Agreement as to liquidated damages.

ARTICLE 5—BIDDER'S ACKNOWLEDGEMENTS: ACCEPTANCE PERIOD, INSTRUCTIONS, AND RECEIPT OF ADDENDA

5.01 *Bid Acceptance Period*

A. This Bid will remain subject to acceptance for 60 days after the Bid opening, or for such longer period of time that Bidder may agree to in writing upon request of Owner.

5.02 *Instructions to Bidders*

Bidder accepts all of the terms and conditions of the Instructions to Bidders, including without limitation those dealing with the disposition of Bid security.

5.03 *Receipt of Addenda*

A. Bidder hereby acknowledges receipt of the following Addenda:

Addendum Number	Addendum Date

ARTICLE 6—BIDDER'S REPRESENTATIONS AND CERTIFICATIONS

6.01 *Bidder's Representations*

A. In submitting this Bid, Bidder represents the following:

1. Bidder has examined and carefully studied the Bidding Documents, including Addenda.
2. Bidder has visited the Site, conducted a thorough visual examination of the Site and adjacent areas, and become familiar with the general, local, and Site conditions that may affect cost, progress, and performance of the Work.
3. Bidder is familiar with all Laws and Regulations that may affect cost, progress, and performance of the Work.
4. Bidder has carefully studied the reports of explorations and tests of subsurface conditions at or adjacent to the Site and the drawings of physical conditions relating to existing surface or subsurface structures at the Site that have been identified in the Supplementary Conditions, with respect to the Technical Data in such reports and drawings.
5. Bidder has carefully studied the reports and drawings relating to Hazardous Environmental Conditions, if any, at or adjacent to the Site that have been identified in the Supplementary Conditions, with respect to Technical Data in such reports and drawings.
6. Bidder has considered the information known to Bidder itself; information commonly known to contractors doing business in the locality of the Site; information and observations obtained from visits to the Site; the Bidding Documents; and the Technical Data identified in the Supplementary Conditions or by definition, with respect to the effect of such information, observations, and Technical Data on (a) the cost, progress, and performance of the Work; (b) the means, methods, techniques, sequences, and procedures of construction to be employed by Bidder, if selected as Contractor; and (c) Bidder's (Contractor's) safety precautions and programs.
7. Based on the information and observations referred to in the preceding paragraph, Bidder agrees that no further examinations, investigations, explorations, tests, studies, or data are necessary for the performance of the Work at the Contract Price, within the Contract Times, and in accordance with the other terms and conditions of the Contract.
8. Bidder is aware of the general nature of work to be performed by Owner and others at the Site that relates to the Work as indicated in the Bidding Documents.

9. Bidder has given Engineer written notice of all conflicts, errors, ambiguities, or discrepancies that Bidder has discovered in the Bidding Documents, and of discrepancies between Site conditions and the Contract Documents, and the written resolution thereof by Engineer is acceptable to Contractor.

10. The Bidding Documents are generally sufficient to indicate and convey understanding of all terms and conditions for performance and furnishing of the Work.

11. The submission of this Bid constitutes an incontrovertible representation by Bidder that without exception the Bid and all prices in the Bid are premised upon performing and furnishing the Work required by the Bidding Documents.

6.02 *Bidder's Certifications*

A. The Bidder certifies the following:

1. This Bid is genuine and not made in the interest of or on behalf of any undisclosed individual or entity and is not submitted in conformity with any collusive agreement or rules of any group, association, organization, or corporation.

2. Bidder has not directly or indirectly induced or solicited any other Bidder to submit a false or sham Bid.

3. Bidder has not solicited or induced any individual or entity to refrain from bidding.

4. Bidder has not engaged in corrupt, fraudulent, collusive, or coercive practices in competing for the Contract. For the purposes of this Paragraph 8.02.A:

a. Corrupt practice means the offering, giving, receiving, or soliciting of anything of value likely to influence the action of a public official in the bidding process.

b. Fraudulent practice means an intentional misrepresentation of facts made (a) to influence the bidding process to the detriment of Owner, (b) to establish bid prices at artificial non-competitive levels, or (c) to deprive Owner of the benefits of free and open competition.

c. Collusive practice means a scheme or arrangement between two or more Bidders, with or without the knowledge of Owner, a purpose of which is to establish bid prices at artificial, non-competitive levels.

d. Coercive practice means harming or threatening to harm, directly or indirectly, persons or their property to influence their participation in the bidding process or affect the execution of the Contract.

BIDDER hereby submits this Bid as set forth above:

Bidder:

_____

(typed or printed name of organization)

By: _____

(individual's signature)

Name: _____

(typed or printed)

Title: _____

(typed or printed)

Date: _____

(typed or printed)

If Bidder is a corporation, a partnership, or a joint venture, attach evidence of authority to sign.

Attest: _____

(individual's signature)

Name: _____

(typed or printed)

Title: _____

(typed or printed)

Date: _____

(typed or printed)

Address for giving notices:

_____

_____

Bidder's Contact:

Name: _____

(typed or printed)

Title: _____

(typed or printed)

Phone: _____

Email: _____

Address:

_____

_____

_____

Bidder's Contractor License No.: (if applicable) _____

TECHNICAL SPECIFICATIONS

SECTION 02725

ACCESS COVERS/HATCHES

PART 1 GENERAL

1.1 SECTION INCLUDES:

A. Standard access hatches for vaults.

1.2 SUBMITTALS:

A. Provide the following information in accordance with Section 01300:

1. Manufacturer's catalog information.

2. Installation dimensional drawings indicating compliance with minimum clear open area dimensions and suitability for use on each vault, particularly adequate clearance for the pumps or other equipment in the vault to be lifted vertically out.

1.3 DELIVERY, STORAGE, AND HANDLING:

A. Storage: Store access hatches and appurtenances in accordance with the manufacturer's written instructions. Protect from damage until final acceptance by Owner.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS:

A. Hatches shall comply with minimum opening sizes depicted on Drawings.

B. Approved Hatch Manufacturers:

1. Halliday Products.
2. Bilco.
3. Ejco.
4. USF Fab.
5. Engineer approved equal.

2.2 SIZE:

A. Hatches shall have minimum opening size shown on Drawings.

2.3 FEATURES:

A. Hatches shall comply with all applicable state and federal safely requirements.

B. Unit shall have lockable cover(s).

C. Unit shall have a door support ledge on a minimum of two (2) sides.

D. Door shall incorporate enclosed stainless steel compression spring assist allowing the door to close flush with the frame.

E. Door shall open to 90 degrees and automatically lock with a stainless steel hold-open arm with corrosion-resistant release handle.

F. Where indicated on Drawings, hatches shall be water-tight, with a channel frame that prevents water infiltration into the hatch (Halliday W series).

G. Where indicated on Drawings, cover shall be H-20 rated for off-street locations that may occasionally receive vehicle wheel loads.

H. Hatches shall be equipped with an integral, latching safety grate below the hatch door(s). Safety grate shall be rated for 300 psi/ft^2.

2.4 MATERIALS:

A. Frame - Minimum ¼--inch thick, one piece, mill finish, extruded aluminum, incorporating a continuous concrete anchor.

B. Door Panel - Minimum ¼-inch thick aluminum diamond plate.

C. Hinges and fastening hardware - stainless steel.

PART 3 EXECUTION

3.1 INSTALLATION:

A. Install access hatches as per manufacturer's instructions and as indicated on Drawings.

B. Ensure that the hatch and frame are adequately anchored to the wetwell top or the valve vault, as applicable, and that both the frame and door ledge are adequately supported.

C. Location of access hatch hinges and orientation of installation shall be such that hatch does not interfere with hoisting equipment operation or pump removal, when hatch is in the open position.

END OF SECTION

SECTION 09800

PAINTING

PART 1 GENERAL

1.1 SECTION INCLUDES:

A. The work of this section includes the coating of all interior and exterior surfaces specified herein.

1.2 REFERENCES:

A. ASTM D16 – Definitions of Terms Relating to Paint, Varnish, Lacquer, and Related Products.

B. ASTM D2200 – Standard Practice for Use of Pictorial Surface Preparation Standards and Guides for Painted Steel Surfaces.

C. ASTM D4417 – Standard Test Methods for Field Measurement of Surface Profile of Blast Cleaned Steel.

D. ASTM D4263 – Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method.

E. ASTM F1869 – Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.

F. ASTM F2170 – Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes.

G. ICRI – International Concrete Repair Institute.

H. NACE (National Association of Corrosion Engineers) – Industrial Maintenance Painting.

I. NACE SP0287 – Field Measurement of Surface Profile of Abrasive Blast-Cleaned Steel Surfaces using a Replica Tape.

J. NACE SP0178 – Design, Fabrication, and Surface Finishes for Tanks and Vessels to be Lined for Immersion Service.

K. NACE SP0188 – Discontinuity (Holiday) Testing of New Protective Coatings on Conductive Substrates.

L. NAPF – National Association of Pipe Fabricators.

M. NPCA (National Paint and Coating Association) – Guide to U.S. Government Paint Specifications.

N. SSPC (Society for Protective Coatings) – Steel Structures Painting Manual.

O. SSPC-Guide 15 – Field Methods for Retrieval and Analysis of Soluble Salts on Steel and Other Nonporous Substrates.

P. SSPC-VIS 1 – Guide and Reference Photographs for Steel Surfaces Prepared by Dry Abrasive Blast Cleaning.

Q. SPC-PA1 – Shop, Field and Maintenance Painting of Steel.

R. SSPC-PA 2 – Measurement of Dry Film Thickness with Magnetic Gages.

S. Paint Manufacturer's printed instructions.

1.3 DEFINITIONS:

A. DFT - Dry film thickness.

B. mil(s) - a unit of measure equal to a thousandth of an inch (0.0254) mm.

C. VOC(s) - volatile organic compound(s).

1.4 INTERPRETATION:

A. The Engineer's decision shall be final in the interpretation and/or conflict between any of the referenced Specifications and Standards contained herein.

1.5 SUBMITTALS:

A. Painting schedule for the entire project. Schedule shall be organized and clear in a manner that is consistent with the organization of the Drawings. Schedule shall include each coating system(s) used for each component/area of the project.

B. Information to be provided: Provide a list of materials to be used under this Section. Submit the list before the materials are delivered to the job site. Cross reference the list to the coating systems identified. Furnish with the list, the coating Manufacturer's standard product data and color chart for each material to be used.

C. Manufacturer's color charts shall be submitted to the Engineer at least 30 days or prior to paint application. Coordinate work so as to allow sufficient time for paint to be delivered to the job site.

1.6 QUALITY ASSURANCE:

A. General: Use quality assurance procedures and practices to monitor all phases of surface preparation, application, and inspection throughout the duration of the project. Procedures or practices not specifically defined herein may be utilized provided they meet recognized and accepted professional standards.

B. Surface Preparation: Surface preparation will be based upon comparison with: SSPC-VIS 1, ASTM D2200, ASTM D4417 Method A and/or Method C, or NACE Standard SP0287. In all cases the written standard shall take precedence over the visual standard. In addition, NACE Standard SP0178,

along with the Visual Comparator, shall be used to verify the surface preparation of welds.

C. Application: No coating shall be applied: When the surrounding air temperature or the temperature of the surface to be coated or painted is below the minimum surface temperature for the products specified herein; or in rain; snow, fog, or mist; when the temperature is less than 5°F above the dew point; when the air temperature is expected to drop below 35°F within six hours after application of coating. Dew point shall be measured by use of an instrument such as a Sling Psychrometer in conjunction with U.S. Department of Commerce Weather Bureau Psychometric Tables. If the above conditions are forecast, coating or painting shall be completed in time to permit the film sufficient drying time prior to damage by atmospheric conditions.

D. Thickness: Thickness of coatings and paint shall be measured and checked according to the procedures outlined in SSPC-PA 2 with particular attention to section(s) 4.0, 7.8, 7.9, 7.11, 7.13, and 7.14, with a non-destructive, magnetic-type thickness gage that has been calibrated according to the procedures outlined in SSPC-PA 2 with particular attention to section(s) 3.0, 7.4, 7.5, and 7.15. Pass/fail criteria shall require that ninety (90) percent of the spot measurements (average of 3 gage readings within a 1.5-inch diameter area) be at or above the minimum specified dry film thickness. Of the remaining ten (10) percent of the spot measurements (average of 3 gage readings within a 1.5-inch diameter area) that are below the minimum specified dry film thickness, they shall be no less than ninety (90) percent of the minimum specified dry film thickness. Areas that fail to meet these criteria shall be corrected at no expense to the Owner. Use of an instrument such as a Tooke Gauge, precision groove grinder, etc. is permitted if a destructive test is deemed necessary by the Engineer and the total DFT is less than 50 mils.

E. Holiday (Pinhole) Testing: The integrity of interior coated surfaces shall be tested for holidays in accordance with NACE Standard SP0188. For dry films less than 20 mils, a non-destructive holiday detector shall not exceed 67.5 volts, nor shall destructive holiday detector exceed the voltage recommended by the Manufacturer of the coating system. A solution of 1-ounce, non-sudsing type wetting agent, such as Kodak Photo-Flo, and 1-gallon of tap water shall be used to perform the holiday testing. For coating thickness at 20 mils and greater, a high voltage Tinker & Rasor AP/W holiday tester shall be used. Contact coating Manufacturer for voltage recommendations and curing parameters. All pinholes and/or holidays shall be marked and repaired in accordance with the Manufacturer's printed recommendations and retested. No pinholes or other irregularities will be permitted in the final coating.

F. Inspection: Inspection shall consist of 'hold point' inspections. The Engineer or its representative shall inspect the surface prior to abrasive blasting, after abrasive blasting but prior to application of coating materials, and between subsequent coats of material. Final inspection shall take place after all coatings are applied, but prior to placing the equipment, piping, tank, etc. in service. Contractor shall insure that sufficient rigging is in place so that the Engineer or his representative shall be able to conduct the required inspections.

G. Inspection Devices: The Contractor shall furnish, until final acceptance of coating and painting, inspection devices in good working condition for detection of holidays and measurement of DFT of coating. The Contractor shall also furnish U.S. Department of Commerce; National Bureau of Standards certified thickness calibration plates to test accuracy of DFT gages and certified instrumentation to test accuracy of holiday detector. Dry film thickness gages and holiday detectors shall be made available for the Engineer's use at all times until final acceptance of application. Holiday detection devices shall be operated in the presence of the Engineer.

H. Warranty Inspection: Warranty inspection shall be conducted during the eleventh month following completion of all coating and painting work. All defective work shall be repaired in accordance with this specification and to the satisfaction of the Engineer/Owner.

1.7 QUALIFICATIONS:

A. The Contractor shall have three years practical experience and successful history in the application of specified products to surfaces in water treatment, wastewater treatment, or industrial facilities. The Contractor shall be a knowledgeable and experienced professional, fully aware of the methods and regulatory requirements of coating removal and application. Upon request, he shall substantiate this requirement by furnishing a list of references and job completions.

1.8 SAFETY AND HEALTH REQUIREMENTS:

A. General: The Contractor shall perform all work in accordance with applicable local, state, and federal laws and regulations, and material Manufacturer's instructions and recommendations pertaining to the methods, materials, or activities in the work. Some of these regulations are included in the following groups:

Occupational Safety and Health Act and derived regulations.

Clean Air Act and derived regulations, both federal and state.

The items listed below in the rest of this Paragraph are intended to call the Contractor's attention to some of the frequently necessary compliance activities. The Contractor is solely responsible for compliance with applicable regulations including, but not limited to, the areas identified in this Specification. The Contractor shall provide and require the use of personal protective equipment for persons working on or about the project.

B. Head and Face Protection and Respiratory Devices: Equipment shall include protective helmets which shall be worn by all persons while in the vicinity of the work. In addition, workers engaged in or near the work during sandblasting shall wear appropriate eye and face protection devices and air purifying, half mask or mouthpiece respirators with appropriate filters.

C. Ventilation: Where ventilation is used to control hazardous exposure, all equipment shall be explosion-proof. Ventilation shall reduce the concentration of air contaminants to the degree a hazard does not exist. Air circulation and exhausting of solvent vapors shall be continued until coatings have fully cured.

D. Sound Levels: Whenever the occupational noise exposure exceeds maximum allowable sound levels, the Contractor shall provide and require the use of approved ear protective devices.

E. Illumination: Adequate illumination shall be provided while work is in progress, including explosion-proof lights and electrical equipment. Whenever required by the Engineer, the Contractor shall provide additional illumination and necessary supports to cover all areas to be inspected. The level of illumination for inspection purposes shall be determined by the Engineer.

F. Temporary Ladders and Scaffolding: All temporary ladders and scaffolding shall conform to applicable safety requirements. They shall be erected where requested by the Engineer to facilitate inspection and be moved by the Contractor to locations requested by the Engineer.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS:

A. Materials specified are those that have been evaluated for the specific service. Products are listed to establish a standard of quality. Equivalent materials of other Manufacturers may be substituted on written approval of the Engineer in accordance with Section 01600 – Material and Equipment.

Requests for substitution shall include Manufacturer's literature for each product giving name, product number, and generic type, descriptive information, solids by volume, recommended DFT and certified laboratory test reports showing results to equal the performance criteria of the products specified herein. In addition, a list of five projects shall be submitted in which each product has been used and rendered satisfactory service. The listed projects shall be in the State of Texas, Oklahoma, Louisiana, or Arkansas.

2.2 DELIVERY AND STORAGE:

A. All materials shall be brought to jobsite in original sealed containers. They shall not be used until the Engineer has inspected contents and obtained data from information on containers or label. Materials exceeding storage life recommended by the Manufacturer shall be rejected.

B. All coatings and paints shall be stored in enclosed structures to protect them from weather and excessive heat or cold. Flammable coatings or paint must be stored to conform with City, County, State, and Federal safety codes for flammable coating or paint materials. At all times coatings and paints shall be protected from freezing.

2.3 MATERIALS:

The number of coats called for in this schedule shall be considered minimum. If additional coats are required for complete coverage and uniform appearance, they shall be applied. Colors will be selected by the Owner. The system numbering may not be sequential or inclusive of all numbers from the first to last system or schedule numbers. Color coding of piping to be as noted in Section 3.5, Paragraph B.

SYSTEM NO. 1 – REMOVED. Handrails and grating are aluminum.

SYSTEM NO. 2

TYPE OF SURFACE: Ferrous metals.

TYPE OF STRUCTURE: Severe moisture and chemical contact and fumes such as: chemical tanks, feeders, rotary drums, vacuum filters, valves, conveyors, pipes, slurry tanks, and lime and ferric sulfate or chloride tanks, interior and exterior.

EXPOSURE CONDITION: Non-submerged; inside or outside.

SURFACE PREPARATION: Surface shall be sandblasted to a SSPC-SP6/NACE 3 Commercial Blast Cleaning. Anchor profile shall be angular with a 1.5 to 2.0 mil profile as per ASTM D4417, Method C or NACE Standard SP0287. All surfaces to be clean and dry.

PAINTING SYSTEM:

First Coat:	
Tnemec Series N69 Hi-Build Epoxloline II	4.0–6.0 mils DFT
Second Coat:	
Tnemec Series N69 Hi-Build Epoxloline II	5.0–7.0 mils DFT
Third Coat (Interior):	
Tnemec Series N69 Hi-Build Epoxoline II	5.0–7.0 mils DFT
Third Coat (Exterior):	
Tnemec Series 1095 (Semi-Gloss)	2.0–3.0 mils
Total Thickness (Interior) =	14.0–20.0 mils DFT min.
Total Thickness (Exterior) =	11.0–16.0 mils DFT min.

SYSTEM NO. 3

TYPE OF SURFACE: Steel.

TYPE OF STRUCTURE: Piping, fittings and valves, and exposed structural steel, metal trim, and process air lines for temperatures below 250F.

EXPOSURE CONDITION: Non-submerged.

SURFACE PREPARATION: Surface shall be sandblasted to a SSPC-SP6/NACE 3 Commercial Blast Cleaning. Anchor profile shall be angular with a 1.5 to 2.0 mil profile

as per ASTM D4417, Method C or NACE Standard SP0287. All surfaces to be clean and dry.

PAINTING SYSTEM:

First Coat:	
Tnemec Series N69 Hi-Build Epoxoline II	4.0–6.0 mils DFT
Second Coat:	
Tnemec Series 1094 Endura-Shield (Gloss)	2.0–3.0 mils DFT
Alternate Second Coat:	
Tnemec Series 73 Endura-Shield (Semi-Gloss)	2.0–3.0 mils DFT
Total Thickness =	6.0–9.0 mils DFT min.

SYSTEM NO. 4

TYPE OF SURFACE: Ductile iron.

TYPE OF STRUCTURE: Piping, fittings and valves, and miscellaneous ductile iron.

EXPOSURE CONDITION: Non-submerged.
SURFACE PREPARATION: Clean all surfaces as per NAPF 500-03-01 Solvent Cleaning to remove all oil, grease, factory applied tars and/or bitumastic coatings and all other soluble contaminants. Prepare ductile iron pipe as per NAPF 500-03-04 Abrasive Blast Cleaning for Ductile Iron pipe, providing a minimum 1.5 mil angular anchor profile. Prepare ductile iron valves and fittings as per NAPF 500-03-05 Abrasive Blast Cleaning for Cast Ductile Iron Fittings. If existing ductile iron is factory coated with Tnemec Series N140, follow the recoat window listed on the current product data sheet.

PAINTING SYSTEM:

First Coat:	
Tnemec Series 133 Pro-Tuff Mastic	4.0–6.0 mils DFT
Second Coat:	
Tnemec Series 1094 Endura-Shield (Gloss)	2.0–3.0 mils DFT
Alternate Second Coat:	
Tnemec Series 1095 Endura-Shield (Semi-Gloss)	2.0–3.0 mils DFT
Total Thickness =	6.5–9.5 mils DFT min.

SYSTEM NO. 5

TYPE OF SURFACE: Factory-primed metal.

TYPE OF STRUCTURE: Piping, fittings and valves, and miscellaneous metal structures.

EXPOSURE CONDITION: Non-submerged.

SURFACE PREPARATION: All surfaces shall be dry, clean and free of all contaminants. Clean all surfaces as per SSPC-SP2 or SSPC-SP3 Hand or Power Tool Cleaning. Apply a test patch when necessary to ensure compatibility.

PAINTING SYSTEM:

First Coat:	
Tnemec Series 133 Pro-Tuff Mastic	4.0–6.0 mils DFT
Second Coat:	
Tnemec Series 1094 Endura-Shield (Gloss)	2.0–3.0 mils DFT
Alternate Second Coat:	
Tnemec Series 1095 Endura-Shield (Semi-Gloss)	2.0–3.0 mils DFT
Total Thickness =	6.0–9.0 mils DFT min.

SYSTEM NO. 6

TYPE OF LIQUID HANDLED: Non-potable water.

TYPE OF SURFACE: Steel.

TYPE OF STRUCTURE: Trickling filter arms, gates, troughs, weirs, pipes, fittings, baffles, aerators, air diffusers, pumps, flights, and skimming arms.

EXPOSURE CONDITION: Submerged or intermittently submerged.

SURFACE PREPARATION: SSPC-SP10/NACE 2 Near White Metal Blast Cleaning. Anchor profile shall be angular with a 1.5 to 2.0 mil profile as per ASTM D4417, Method C or NACE Standard SP0287. All surfaces to be clean and dry.

PAINTING SYSTEM:

First Coat:	
Tnemec Series N69-1255 Hi-Build Epoxoline II	4.0–6.0 mils DFT
Second Coat:	
Tnemec Series 21 Epoxoline	12.0–15.0 mils DFT
Total Thickness =	16.0–21.0 mils DFT min.

SYSTEM NO. 7 – REMOVED. No potable water structures.

SYSTEM NO. 8 – REMOVED. The only building is CMU.

SYSTEM NO. 9 – REMOVED. The only building is CMU.

SYSTEM NO. 10

TYPE OF SURFACE: Exterior CMU. – Plant Water/Chlorine Building.

TYPE OF STRUCTURE: Exterior building structures.

EXPOSURE CONDITION: Non-submerged.

SURFACE PREPARATION: New CMU is to be cured a minimum of 14 days and be free of all mortar splatter or other contaminants. Contractor will perform all surface preparation necessary to achieve a clean, dry surface prior to application of materials.

PAINTING SYSTEM:

Prime Coat:	
Tnemec Series 130 Envirofill	60–80 sq. ft. /gal.
First Coat:	
Tnemec Series 156 Enviro-Crete	6.0–8.0 mils DFT
Second Coat:	
Tnemec Series 156 Enviro-Crete	6.0–8.0 mils DFT
Total Thickness =	12.0–16.0 mils DFT

SYSTEM NO. 11

TYPE OF SURFACE: Interior CMU. – Plant Water/Chlorine Building.

TYPE OF STRUCTURE: Interior of building walls and ceilings, walls and ceilings in pipe galleries, pump galleries, pump and blower rooms, chlorine rooms, and control rooms.

EXPOSURE CONDITION: Non-submerged.

SURFACE PREPARATION: All loose paint, chalk, and contaminants are to be completely removed. New CMU is to be cured a minimum of 14 days and be free of all mortar splatter or other contaminants. Contractor will perform all surface preparation necessary to achieve a clean, dry surface prior to application of materials.

PAINTING SYSTEM:

Adhesion Promoter:	
Tnemec Series 130 Envirofill	60–80 sq. ft/gal.
First Coat:	
Tnemec Series N69 Hi-Build Epoxoline II	4.0–6.0 mils DFT
Second Coat:	
Tnemec Series N69 Hi-Build Epoxoline II	4.0–6.0 mils DFT
Total Thickness =	8.0–12.0 mils DFT min.

SYSTEM NO. 12 – REMOVED. The requirement for coating the concrete channels has been removed.

SYSTEM NO. 13 – REMOVED. No potable water structures.

SYSTEM NO. 14 – REMOVED. Coating of concrete structures below grade is not required.

SYSTEM NO. 15 – REMOVED. Coating is not required for concrete walkways and stairs.

SYSTEM NO. 16 – REMOVED. No wood trim required.

SYSTEM NO. 17– REMOVED. No wood trim required.

SYSTEM NO. 18 – REMOVED. No wood baffles or paddles.

SYSTEM NO. 19 – REMOVED. CMU building interior does not require finished interior walls.

SYSTEM NO. 20 – REMOVED. PVC coating is not required.

SYSTEM NO. 21

TYPE OF SURFACE: Repair of Factory-Installed Bituminous-Coated Ductile Iron Pipe.

TYPE OF STRUCTURE: Piping.

EXPOSURE CONDITION: Buried.

PAINTING SYSTEM:

First Coat:	
Tnemec Series 46H-413 Hi-Build Tneme-Tar	8.0–10.0 mils DFT
Second Coat:	
Tnemec Series N69 Color Hi-Build Epoxoline II	8.0–10.0 mils DFT
Total Thickness =	16.0–20.0 mils DFT min.

SYSTEM NO. 22 – REMOVED. No applications.

SYSTEM NO. 23

TYPE OF SURFACE: Galvanized or non-ferrous metal.

TYPE OF STRUCTURE: Throughout plant.

EXPOSURE CONDITION: Submerged.

SURFACE PREPARATION: Visible deposits of oil, grease, or other contaminants shall be removed as required by SSPC-SP1. Sweep (Abrasive) Blasting per SSPC-SP16 to achieve a uniform anchor profile (2.0 to 2.5 mils). Galvanized surfaces must be clean, dry, and contaminant free prior to application of coatings.

PAINTING SYSTEM:

First Coat:

Tnemec Series 21-1255 Beige Epoxoline	5.0–6.0 mils DFT
Second Coat:	
Tnemec Series 21 WH16 Off White Epoxoline	5.0–6.0 mils DFT
Total Thickness =	10.0–15.0 mils DFT min.

SYSTEM NO. 24

TYPE OF SURFACE: Steel piping.

TYPE OF STRUCTURE: Buried.

EXPOSURE CONDITION: Below grade.

SURFACE PREPARATION: SSPC-SP10/NACE 2: Near White Metal Blast Cleaning. A 2.0 minimum surface profile is required. Surface to be clean and dry.

PAINTING SYSTEM:

First Coat:	
Tnemec Series N69 H.B. Epoxoline II	4.0–6.0 mils DFT
Second Coat:	
Tnemec Series 46H-413 Hi-Build Tnemec-Tar	16.0–20.0 mils DFT
Total Thickness =	20.0–26.0 mils DFT min.

SYSTEM NO. 25 – Removed. No applications.

SYSTEM NO. 26 – REMOVED. Not odor control covers required on the project.

SYSTEM NO. 27

TYPE OF SURFACE: Steel or ductile iron.

TYPE OF STRUCTURE: Compressor, high temperature aeration piping (300 degress F. constant / 350 degrees F. intermittent), chilled or heated water lines and associated equipment.

EXPOSURE CONDITION: Atmospheric subject to high heat up to 300°F, pipe condensation, or pipe requiring insulation.

SURFACE PREPARATION:

Steel: Surface shall be sandblasted to a SSPC-SP6/NACE 3 Commercial Blast Cleaning. Anchor profile shall be angular with a 1.5 to 2.0 mil profile as per ASTM D4417, Method C or NACE Standard SP0287. All surfaces to be clean and dry.

Ductile Iron: Clean all surfaces as per NAPF 500-03-01 Solvent Cleaning to remove all oil, grease, factory applied tars and/or bitumastic coatings and all other soluble contaminants. Prepare ductile iron pipe as per NAPF 500-03-04 Abrasive Blast

Cleaning for Ductile Iron pipe providing a minimum 1.5 mil angular anchor profile. Prepare ductile iron valves and fittings as per NAPF 500-03-05 Abrasive Blast Cleaning for Cast Ductile Iron Fittings. If existing ductile iron is factory-coated with Tnemec Series N140, follow the recoat window listed on the current product data sheet.

PAINTING SYSTEM:

First Coat:	
Tnemec Series 1224 Epoxoline WB	6.0–8.0 mils DFT
Second Coat:	
Tnemec Series 971 Aerolon	50.0–60.0 mils DFT
Third Coat:	
Tnemec Series 1028T	2.0–3.0 mils DFT
Total Thickness =	58.0–71.0 mils DFT min.

SYSTEM NO. 28

TYPE OF LIQUID HANDLED: Sewage and sewer effluent.

TYPE OF SURFACE: Ductile iron.

TYPE OF STRUCTURE: Pipe.

EXPOSURE CONDITION: Submerged.

SURFACE PREPARATION: All surfaces shall be dry, clean, and free of all contaminants. All surfaces shall be inspected and pre-cleaned with suitable solvent to remove all traces of grease, oil, asphalt, and other soluble contaminants. Abrasive blast all surfaces with fine abrasive to remove all loose annealing oxides, rust, dirt, and other foreign matter. Only slight stains and tightly adhering oxides are allowed to remain on the surface. Any area where rust reappears before application shall be re-blasted. Any dust or other contaminants remaining after blasting shall be removed with dry, oil free compressed air or by vacuum cleaning. Anchor pattern shall be angular with profile of at least 3.0 mils.

PAINTING SYSTEM:

One Coat:	
Tnemec Series 431 Perma-Shield PL	40.0–50.0 mils DFT

SYSTEM NO. 29 – Removed. No applications.

SYSTEM NO. 30 – REMOVED. The requirement to coat the interior concrete walls of the process basins has been removed.

SYSTEM NO. 31 – REMOVED. No MBR processes on this project.

SYSTEM NO. 32 – REMOVED. No chemical containment areas.

SYSTEM NO. 33 – REMOVED. No chemical containment areas.

PART 3 EXECUTION

3.1 GENERAL:

A. All surface preparation, coating and painting shall conform to applicable standards of the Society for Protective and the Manufacturer's printed instructions. Material applied to the surface prior to the approval of the Engineer shall be removed and re-applied to the satisfaction of the Engineer at the expense of the Contractor.

B. All work shall be performed by skilled craftsmen qualified to perform the required work in a manner comparable with the best standards of practice. Continuity of personnel shall be coordinated with the Engineer.

C. The Contractor shall provide a supervisor at the work site during cleaning and application operations. The supervisor shall have the authority to sign change orders, coordinate work and make decisions pertaining to the fulfillment of the contract.

D. Dust, dirt, oil, grease, or any foreign matter that will affect the adhesion or durability of the finish must be removed by washing with clean rags dipped in an approved cleaning solvent and wiped dry with clean rags.

E. Coating and painting system include surface preparation, prime coating, and finish coatings. Unless otherwise approved by the Engineer, prime coating shall be field applied. Where prime coatings are shop applied, the Contractor shall instruct suppliers to provide the prime coat compatible with the finish coat specified. Any off-site work which does not conform to this specification or that is damaged during transportation, construction or installation shall be thoroughly cleaned and touched-up in the field as directed by the Engineer. The Contractor shall use repair procedures which insure the complete protection of all adjacent primer. The specified repair method and equipment may include wire brushing, hand or power tool cleaning, or dry-air blast cleaning. In order to prevent injury to surrounding painted areas, blast cleaning may require use of lower air pressure, smaller nozzle and abrasive particle sizes, or shorter blast nozzle distance from surface shielding and masking. If damage is too extensive or uneconomical to touch-up, then the item shall be re-cleaned and coated as directed by the Engineer.

F. The Contractor's coating and painting equipment shall be designed for application of materials specified and shall be maintained in first class working condition. Compressors shall have suitable traps and filters to remove water and oils from the air.

G. Application of the first coat shall follow immediately after surface preparation and cleaning and before rust bloom occurs. Any cleaned areas not receiving the first coat within this period shall be re-cleaned prior to application of the first coat.

H. Prior to assembly, all surfaces made inaccessible after assembly shall be prepared as specified herein and shall receive the coating or paint system specified.

3.2 SURFACE PREPARATION:

A. The latest revision of the following surface preparation specifications of the Society for Protective Coatings shall form a part of this Specification:

1. Solvent Cleaning (SSPC-SP1/NAPF 500-03-01): Removal of oil, grease, soil, and other contaminants by use of solvents, emulsions, cleaning compounds, steam cleaning or similar materials and methods which involve a solvent or cleaning action.

2. Hand Tool Cleaning (SSPC-SP2): Removal of loose rust, loose mil scale and other detrimental foreign matter to degree specified by hand chipping, scraping, sanding and wire brushing.

3. Power Tool Cleaning (SSPC-SP3): Removal of loose rust, loose mil scale and other detrimental foreign matter to degree specified by power wire brushing, power impact tools or power sanders.

4. White Metal Blast Cleaning (SSPC-SP5/NACE 1): Blast cleaning to a gray-white uniform metallic color until each element of surface area is free of all visible residues.

5. Commercial Blast Cleaning (SSPC-SP6/NACE 3): Blast cleaning until at least two-thirds of each element or surface area is free of all visible residues.

6. Brush-Off Blast Cleaning (SSPC-SP7/NACE 4): Blast cleaning to remove loose rust, loose mil scale and other detrimental foreign matter to degree specified.

7. Near White Blast Cleaning (SSPC-SP10/NACE 2): The removal of all visible oil, grease, dirt, rust, mil scale, rust, paint, oxides, corrosion products, and other foreign matter by compressed air nozzle blasting, centrifugal wheels or other specific method. Discoloration caused by certain stains shall be limited to no more than 5% of each square inch of surface area.

8. Power Tool Cleaning to Bare Metal (SSPC-SP11): The removal of all visible oil, grease, dirt, mil scale, rust, paint, oxide, corrosion products, and other foreign matter. Slight residues of rust and paint may be left in the lower portion of pits if the original surface is pitted. Differs from SSPC-SP3 in that it requires more thorough cleaning and a surface profile not less than 1 mil (25 microns). For areas where abrasive blasting is prohibited or not feasible.

9. Surface Preparation of Concrete (SSPC-SP13/NACE 6): The removal of burrs, sharp edges, fins, and concrete spatter to the degree specified.

10. Brush-Off Blast Cleaning of Coated and Uncoated Galvanized Steel, Stainless Steel, and Non-Ferrous Metals (SSPC-SP16): Blast cleaning to produce a dense and uniform anchoring profile that is suitable for the coating system to be used. For galvanized steel, the presence of

"wet storage stain" and passivating treatments shall be confirmed and addressed in accordance with the surface preparation specification prior to applying the specified coating system. Removal of "wet storage stain" from galvanized steel surfaces is not permitted by blast cleaning.

11. Abrasive Blast Cleaning of Ductile Iron Pipe (NAPF 500-03-04): The removal of all visible dirt, dust, loose annealing oxide, loose rust, loose mold coating, and other foreign matter.

12. Abrasive Blast Cleaning of Cast Ductile Iron Fittings (NAPF 500-03-05): The removal of all visible dirt, dust, loose annealing oxide, loose rust, loose mold coating and other foreign matter. Differs from NAPF 500-03-04 in that it establishes varying degrees of staining, in terms of the percentage of surface area, that are permissible dependent upon the surface prior coating. For fittings previously coated with asphaltic paint, no staining shall remain on the surface after abrasive blast cleaning. Where referenced in this Section and where asphaltic paint coatings are not present, discoloration caused by stains shall be limited to not more than 5% of each square inch of surface area.

13. (ICRI CSP 2): Visual and tactile standard for field-measuring surface profile for light service.

14. (ICRI CSP 3): Visual and tactile standard for field-measuring surface profile for moderate service.

15. (ICRI CSP 5): Visual and tactile standard for field-measuring surface profile for severe service.

B. Slag and weld metal accumulation and spatters not removed by the Fabricator, Erector, or Installer shall be removed by chipping and grinding. All sharp edges shall be penned, ground, or otherwise blunted as required by the Engineer.

C. Field blast cleaning for all surfaces shall be by dry method unless otherwise directed.

D. Particle size of abrasive used in blast cleaning shall be that which will produce a 2.0–3.0 mils (37.5 microns–50.0 microns) surface profile or in accordance with recommendations of the Manufacturer of the specified coating or paint system to be applied.

E. Abrasive used in blast cleaning operations shall be new, washed, graded and free of contaminants that would interfere with adhesion of coating or paint and shall not be reused unless specifically approved by the Engineer.

F. During blast cleaning operations, caution shall be exercised to ensure that existing coatings or paint are not exposed to abrasion from blast cleaning.

G. The Contractor shall keep the area of his work and the surrounding environment in a clean condition. He shall not permit blasting materials to accumulate as to constitute a nuisance or hazard to the accomplishment of the work, the operation of the existing facilities, or nuisance to the surrounding

environment.

H. Blast cleaned surfaces shall be cleaned prior to application of specified coatings or paint. No coatings or paint shall be applied over damp or moist surfaces.

I. Pit repair on steel tanks, clarifiers, etc. shall be accomplished by welding if pits are 1/8-inch deep or greater. Pits of less than 1/8-inch in depth may be repaired with Tnemec Series 215 Surfacing Epoxy.

J. Specific Surface Preparation: Surface preparation for the specific system shall be as noted in part 2.3.

K. Non-Visible Contaminants: Interior steel tank surfaces shall be checked in three locations for the presence of chlorides, iron, and sulfates. New tanks shall be tested prior to abrasive blasting, tanks being rehabilitated shall be tested prior to blasting. If blisters are present in existing tank, testing shall also be performed after abrasive blasting. These tests are an Iron Test (ferrous iron [Fe^{2+}]), Chloride Test and Sulfate Test. Testing shall be carried out as per SSPC- Guide 15. The maximum limits for these contaminants shall be:

1. The maximum level of chlorides is 30 milligrams per square meter or 3 micrograms per square centimeter.

2. The maximum level of sulfates is 100 milligrams per square meter or 10 micrograms per square centimeter.

3. The maximum level of ferrous ions (Fe^{2+}) is 50 milligrams per square meter or 5 micrograms per square centimeter.

4. Contamination levels above these limits will require washing and retesting in accordance with Item L (below) until the surface is under the allowable limits.

   If testing shows amounts present in the test solution to be greater than the limits listed herein, the Contractor shall clean the surface of the entire tank interior with a 5,000 psi water blast until the levels in the test solutions are below the maximum acceptable level. Alternate cleaning methods may be allowed with prior approval of the Engineer. Surface shall be re-blasted as specified in 2.3 at no additional cost to the Owner.

   Contractor shall provide a written statement from paint Manufacturer stating that the maximum acceptable levels are not less than those listed herein. Results of the testing shall be provided to the Owner before any coatings are applied.

   The following test kits are approved for use on this project:

   a. Chlor*Rid Test Kit.
   b. KTA SCAT Test Kit.
   c. Test kits from other vendors shall be submitted to the Engineer for prior approval before use.

3.3 APPLICATION:

A. Coating and paint application shall conform to the requirements of the revision of SSPC-PA1, the American Water Works Association, and the Manufacturer of the coating and paint materials.

B. Thinning shall be permitted only as recommended by the Manufacturer and approved by the Engineer.

C. Each application of coating or paint shall be applied evenly, free of brush marks, sags, runs, with no evidence of poor workmanship. Care shall be exercised to avoid lapping on glass or hardware. Coatings and paints shall be sharply cut to lines. Finished surfaces shall be free from defects or blemishes.

D. Protective coverings or drop cloths shall be used to protect floors, textures, and equipment. Care shall be exercised to prevent coatings or paints from being spattered onto surfaces which are not to be coated or painted. Report surfaces from which materials cannot be satisfactory removed to the Engineer.

E. When two coats of coating or paint are specified, where possible, the first coat shall contain sufficient approved color additive to act as an indicator of coverage or the two coats must be of contrasting color.

F. Film thickness per coat specified in part 2.3 are minimum required. If roller application is deemed necessary, the Contractor shall apply additional coats to achieve the specified thickness.

G. All material shall be applied as specified.

H. All welds and irregular surfaces shall receive a stripe coat by brushing and scrubbing into the weld seam of the specific product prior to application of the first complete coat.

I. All bolted connections on rake arms, rotary drums, and filter connections are to be fully coated with a flexible polysulfide coating after the coating system has been installed per part 2.3.

3.4 COATING SYSTEM APPLICATION:

A. After completion of surface preparation as specified for the specific system, materials shall be applied as noted in part 2.3.

3.5 COLOR SCHEME:

A. The Engineer shall select colors for the project. The Contractor shall submit a current chart of the Manufacturer's available colors to the Engineer thirty days prior to the start of coating and painting.

B. The identification of influent, effluent, waste backwash, and chemical feed lines shall be accomplished by use of labels or various colors of paint. Where labels are used, they shall be placed along the pipe at no greater than five foot intervals. Where colors are used they shall follow the color code prescribed below. Color coding must be by solid color or banding. If bands are used, they

shall be placed along the pipe at no greater than five foot intervals. The color code is as follows:

LABELS	COLOR OF PIPE
Potable Water	Light Blue
Compressed Air	Light Green
Instrument Air	Light Green with Dark Green Bands
Chlorine (gas, liquid, or vent)	Yellow
Chlorine (solution)	Yellow with Red Bands
Liquid Alum	Yellow with Orange Bands
Alum (solution)	Yellow with Green Bands
Ammonia	Yellow with Brown Bands
Chlorine Dioxide (solution)	Yellow with Blue Bands
Ferric Chloride	Brown with Red Bands
Ferric Sulfate	Brown with Yellow Bands
Polymers	White with Green Bands
Liquid caustic	White with Red Bands
Caustic (solution)	White with Orange Bands
Fluoride	White with Yellow Bands
Ozone	Stainless Steel with White Bands
Settled Water	Green
Filter Effluent	Light Blue
Backwash Supply	Light Blue
Backwash Waste	Dark Grey
Drain	Dark Gray
Raw Water	Tan

3.6 DISINFECTION:

A. Disinfection may be required for interior surfaces of tanks or systems containing potable water. Coordinate painting with disinfection requirements per Section 02675 – Water System Disinfection.

3.7 VAPOR REMOVAL:

A. All solvent vapors shall be completely removed by suction-type exhaust fans and blowers before placing tank or system in operating service.

3.8 CLEAN UP:

A. Upon completion of the work, all staging, scaffolding and containers, waste blast abrasive, or other painting debris shall be removed from the site. Coating or paint spots or oil stains upon adjacent surfaces shall be removed and the jobsite cleaned. All damage to surfaces resulting from the work of this section shall be cleaned, repaired, or refinished to the satisfaction of the Engineer at no cost to the Owner.

END OF SECTION

SECTION 11075

MECHANICAL COARSE SCREEN

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Fully automatic, self-cleaning perforated plate basket type influent screen for removing floating, particulate, and fibrous material from municipal wastewater and for conveying, washing, dewatering, compacting, and bagging the screenings.

2. Screen supports, safety devices, controls, local control panel, and all other accessories required for a complete and operable system.

3. Manufacturer representation and assistance during installation, startup, and testing.

1.2 REFERENCES

A. References: Following is a list of standards, which might be referenced in this Section:

1. American Iron and Steel Institute (AISI).

2. National Electrical Manufacturer's Association (NEMA): MG-1, Motors and Generators.

3. American Gear Manufacturers Association (AGMA).

4. American National Standards Institute (ANSI).

5. American Welding Society (AWS).

1.3 SYSTEM DESCRIPTION

A. Furnish, install, startup, and test automatic, self-cleaning screen. The screen shall be installed in an existing concrete channel as shown on Drawings. The screen shall be automatic and accomplish screening by means of a perforated plate basket.

B. The equipment shall be of manufacturer's latest design and shall be fabricated of materials and in a fashion, which will fully perform the functions described below.

C. The screen shall have ¼-inch (6 mm) screen openings.

D. The manufacturer shall be responsible for coordinating the screen components so that screened material is delivered to the container without spillage or water leakage.

E. Manufacturer shall be responsible for the adequacy and compatibility of the equipment and controls.

1.4 SUBMITTALS

A. The following submittals are required, at a minimum:

1. Product Data shall include the following:

a. Descriptive literature, brochures, catalogs, cut-sheets and other detailed descriptive material of the equipment.

b. Motor characteristics and performance information.

c. Gear reducer data including service factor, efficiency, torque rating, and materials.

d. Parts list including a list of recommended spare parts.

e. Equipment weights and lifting points.

f. Design parameters for the screen, including flow rates and head losses for clean and partially blinded conditions.

g. Wash water usage information including maximum gallons per day required.

h. Calculation of perforation flow through velocity based on peak flow.

2. Shop Drawings shall include the following:

a. Manufacturer's installation drawings including dimensions, clearances required, location and size of each connection, and proposed width of modified channel.

b. Layout, sizes, types and materials for anchor bolts to be furnished.

c. Complete wiring diagrams for power, timers, signal and control, and data on controls to be furnished, including terminals and numbers.

3. Information Submittals:

a. Special shipping, storage and protection, and handling instructions.

b. Manufacturer's instructions for installation.

c. Manufacturer's Certificate of Proper Installation.

d. Manufacturer and manufacturer's representative qualifications.

e. Location of nearest stocking distributor of spare parts.

f. Welding certificates.

4. Operation and maintenance manual covering all equipment and controls.

5. All deviations from contract documents shall be clearly identified and approved in writing by the ENGINEER.

6. Any other information necessary for the ENGINEER to determine compliance with the specifications.

7. Partial or incomplete submittals will not be reviewed by ENGINEER.

1.5 QUALITY ASSURANCE

A. All equipment of each type specified in this section shall be supplied by a single manufacturer.

B. Manufacturer shall maintain a complete stock of spare parts commonly needed for the equipment specified at a location within the State of Texas, or shall furnish spare parts within forty-eight (48) hours of request.

C. Manufacturer Qualifications: Manufacturer shall be regularly engaged in the manufacturing and production of the type of screen proposed for a minimum of five (5) years. The manufacturer must have a minimum of ten (10) installations in the United States of the type of screen proposed, each in satisfactory service. Any manufacturer that does not meet these qualifications must provide a five (5) year full parts and service warranty. All manufacturers must provide a reference list with contact names and phone numbers to verify installations.

D. Manufacturer's installation report is required prior to final acceptance.

E. Excessive vibration of equipment while operating shall be cause for rejection.

F. Each screen shall be factory assembled and shipped to the site as a complete unit.

G. Stainless steel construction:

1. All structural stainless steel components shall conform to the requirements of "Specifications for the Design, Fabrication and Erection of Structural Steel for Buildings" published by the American Institute of Steel Construction.

2. The equipment manufacturer's shop welds, welding procedures, welders and welding operators shall be qualified and certified in accordance with the requirements of the latest edition of ANSI/AWS

D1.1 "Structural Welding Code – Steel" published by the American Welding Society.

3. Fabricate all parts and assemblies from sheets and plates of 304 stainless steel with a 2D finish conforming to AISI 304 and ASTM A666, unless noted otherwise. Fabricate all rolled or extruded shapes to conform to ASTM A276. Fabricate all tubular products and fittings to conform to ASTM A269, A351 and A403.

4. Do all welding in the factory using shielded arc, inert gas, MIG or TIG method. Add filler wire to all welds to provide for a cross section and weld metal equal to or greater than the parent metal. Fully penetrate butt welds to the interior surface and provide gas shielding to interior and exterior of the joint.

5. Field welding of stainless steel will not be permitted.

6. The equipment, after its fabrication, shall undergo passivation (pickling) by immersion to ensure maximum resistance to corrosion. All stainless steel components and structures shall be submersed in a chemical bath of nitric acid and hydrofluoric acid to remove any residues that may be present on the material as a result of forming, manufacture, or handling. After removal from the pickling bath, the equipment shall be washed with a high-pressure wash of cold water to remove any remaining surface debris and promote the formation of an oxidized passive layer which is critical to the long life of the stainless steel.

   In lieu of immersive passivation, passivation by blasting per ASTM A380 shall also be acceptable.

H. If the equipment being offered differs from these specifications, all revisions in the design and construction of the structure, piping, appurtenant equipment, electrical work, etc. required to accommodate such a substitution shall be made at no additional cost to the OWNER.

1.6 DELIVERY, STORAGE AND HANDLING

A. All equipment shall be shipped and delivered fully assembled, except where partial disassembly is required in order to conform to transportation regulations or for the protection of components.

B. Delivery, storage, and handling shall be in full accordance with manufacturer's instructions. Motors, Controls and other electrical components shall be stored in a weatherproof enclosure.

1.7 WARRANTY

A. The manufacturer shall provide a warranty on equipment against manufacturer's defects for twelve (12) months, commencing on the date of Owner-accepted substantial completion of the project. If the equipment should fail during the warranty period due to a defective part, it shall be replaced and the unit restored at no cost to the owner, including both service and parts.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:

1. Huber Rotamat MicroStrainer Ro9/400/6-XL.
2. WesTech CleanFlo Spiral Screen.
3. Lakeside Raptor MicroStrainer.
4. Engineer pre-approved equal.

2.2 SYSTEM DESCRIPTION

A. General Requirements

1. The screen mechanism shall be capable of screening raw sewage and discharging the screenings into a screenings container (by others as shown).

2. Each screen shall provide positive screening up to at least the peak flow listed below.

3. The screening equipment shall produce dewatered screenings capable of passing the EPA Paint Filter Test as described in method 9095 of EPA Publication SW 486.

4. All equipment shall be designed for and capable of both continuous and intermittent operation. The complete mechanical screen device including screen frame, plate and all moving parts, shall be able to withstand the loading from a 31.56-inch water differential from upstream to downstream.

5. The structural integrity of the screening equipment shall be maintained at peak flow without causing the channel to overflow or the screening equipment to fail or cease operation.

6. All equipment provided including electrical panels, instrumentation, and controls shall be specifically designed for wastewater treatment service and the environment encountered in this installation, including corrosion resistance. The environment will be moist and corrosive, containing hydrogen sulfide and other corrosive gases encountered in municipal wastewater treatment plants.

7. All equipment, supports, anchors and fasteners shall be of adequate strength to withstand loads associated with starting, turbulence, thrusts from liquid movement, thermal expansion and contraction and other loads encountered under normal operating conditions.

8. The equipment, sizes, materials, and arrangements described in this specification section shall be considered minimum limits of acceptability. The equipment manufacturer shall be responsible for design, arrangement, and performance of all equipment supplied under

this section. Arrangements other than those shown on plans shall be subject to Engineer's approval.

2.3 PERFORMANCE AND DESIGN REQUIREMENTS

A. Number of screens: One (1).

B. Tag Number: MS-02.0001

C. Location: Outdoors in screen channel. See Drawings.

D. Ambient temperature range: 0°F to 110°F.

E. Dimensions of Screen:

1. For channel dimensions, see Drawings.
2. For discharge height, see Drawings.
3. Screen basket diameter: minimum 17".
4. Screen incline: 35° to 45°.
5. Screen opening size: 1/4-inch (6 mm).

F. Design Capacity per Screen:

1. Design flow through screen unit: 0.3 MGD.

2. Peak design flow through screen unit: 1.2 MGD.

3. Maximum upstream water level: 31.56" with 75% screen blockage, given a downstream water depth of 12".

4. Downstream water surface elevation: 21.6" at peak design flow.

5. The average clear perforation flow-through velocity shall not exceed 3.0 ft/sec at the peak clean water flow specified above.

G. The screen shall be capable of processing spherical objects with a diameter of 3-1/8". Such objects shall be conveyed through the auger and shall be discharged with the screenings.

H. Screw (auger):

1. Either a shafted or shaftless design is acceptable.
2. Wet screenings capacity of auger (minimum): 15 cubic feet per hour.
3. Minimum tube outside diameter: 8.6 inches.
4. Minimum shaft diameter (if provided): 3.4 inches.
5. Approx. rotational speed: 9 - 13 rpm.

I. Screen shall be suitable for the available wash water supply:

1. Effluent water. Manufacturer shall provide any required strainers.
2. Available pressure: 70 psi.
3. Maximum usage: 16 gallons per minute (gpm); up to 5,000 gallons per day.

4. Supply connection size: 1.25 inch. Contractor shall adapt the supply to the connection size provided on the screen.

J. Power Supply: 480 V, 60 Hz, 3 phase.

2.4 MATERIALS

A. Unless otherwise noted in these specifications, all components of the screen equipment and accessories shall be Type 304 or 316 stainless steel.

B. Brush shall be stainless steel backed Nylon or have nylon bristles molded into a plastic core.

C. Seals between the screen and the channel wall shall be neoprene.

D. Minimum material thicknesses:

1.	Upper basket flange thickness, inch	10/64
2.	Perforated plate for screen basket thickness, inch	1/8
3.	Screen body thickness, inch	1/8
4.	Auger tube thickness, inch	0.1
5.	Screw flights thickness, inch	0.2
6.	Screw flight in compaction zone thickness, inch	25/64
7.	Shaft tube thickness (if provided), inch	0.2
8.	Flange for support of the gearbox thickness, inch	0.31
9.	Bagging device	12 gauge

2.5 SCREEN EQUIPMENT

A. General:

1. The screen shall have a semi-cylindrical screen basket made of perforated plate and an integral screw conveyor and screenings press. The screw in the basket shall be provided with a brush on its flight for screen cleaning. The screen shall use a single drive for screening, conveying, dewatering and compressing the screened material.

2. The screen basket shall be attached to the screen body with bolts and nuts, permitting easy removal of the screen basket.

3. The screen shall be fitted to and sealed in the existing channel to prevent wastewater from bypassing the screen.

4. The screen shall be provided with an upper support flange and a conical transition piece between the screen basket and auger tube. The flange shall be machined after welding to ensure proper alignment of the screen basket and auger.

5. The screen shall be provided with a pivoting support stand allowing for easy removal of the screen basket from the channel for maintenance purposes.

2.6 SCREENINGS CONVEYOR AND WASH-PRESS

A. The screen shall be cleaned with a stainless steel screw conveyor with helicoid-shaped flights. The screw shall move screenings up through a compaction zone and discharge them into bags. Discharge chute shall allow debris to be transferred from discharge point into the debris container (provided by Owner).

B. To minimize odors and nuisance, the conveyance, dewatering and compaction zones shall be completely enclosed.

C. The flights of the screw in the basket shall be provided with a ¼ inch thick hardened stainless steel strip having the same width as the flights of the screw. The strip shall be welded to the face of the flight, on both sides, over the full length of the screen basket. The flights of the screw shall be machined to match the screen basket such that the face of the strip is parallel to the screen basket's inner surface.

D. A brush shall be attached to the screw flight over the entire length of the screen basket. The brush shall be attached by means of stainless steel clips or fasteners.

E. Two (2) to four (4) anti-rotation bars or wear bars shall be welded to the inside of the transport tube along its longitudinal axis. For shafted spirals, the screenings screw conveyor shall not be in contact with the anti-rotation bars during normal operation. For shaftless spirals, the wear bars shall be replaceable without requiring welding or replacement of the conveyor tube.

F. A flange shall be welded to the conical transition piece to support and allow for removal of the screen basket. A gear box support flange shall be welded to the upper end of the auger tube for support and removal of the drive assembly.

G. A stainless steel screw with helical flight shall be installed in the auger tube for conveying and compaction of the screened material.

H. After all flanges are welded to the auger tube, the faces of the flanges shall be machined on a lathe such that they are exactly perpendicular to the tube axis.

I. A compaction zone shall be provided as an integral part of the screw conveyor and tube. The compaction zone shall be designed to form a plug of screenings material and to return water released from the screened material through perforations machined into the screenings transport tube.

J. The compaction zone housing shall be split glass fiber reinforced plastic or Type 304 stainless steel. The housing shall be furnished with gaskets and bolts, and shall be easily removable for access. Designs requiring removal of the drive assembly, discharge head, or screw conveyor to gain access to the compaction zone will not be acceptable. The housing shall be provided with a drain connection at its lowest point and a clamped flexible PVC hose for drain water whose other end shall discharge to the influent channel. The housing

shall also be provided with a flush connection to allow periodic cleaning of the compaction zone.

K. The upper end of the auger tube shall be provided with a discharge chute for the screenings. The chute shall have a slope of at least 40 degrees.

L. The auger tube shall be provided with lifting lugs to facilitate installation and removal of the entire screen.

M. Manufacturer shall provide all necessary supports and braces for the screen.

2.7 SCREEN AND SCREENINGS WASH SYSTEM

A. An automatic screenings wash system shall be provided and shall be suitable for wash water parameters above.

B. The screenings wash zone of the conveyor tube shall be provided with a minimum of two nozzles at its circumference. A spray bar shall be provided above the screw in the screen basket. The compaction zone housing shall be provided with a ring flush system to ensure complete flushing of the compaction zone housing. All water access points shall be provided with solenoid valves and piping and/or flexible reinforced PVC hoses.

C. The common water connection shall be provided with a brass body Y-strainer (by manufacturer). The strainer shall include a removable and washable stainless steel 20-mesh (800 micron) filter element. A water manifold with one input and a minimum of two output water connections shall be provided. The water input connection shall have a minimum diameter of 1".

D. The wash system shall be operated on an intermittent basis only. Wash systems which operate continuously will not be acceptable.

E. The solenoid valves shall be operated by the programmable logical controller. Individual manual operation of each solenoid shall also be possible from the control panel.

F. Solenoid valves shall be brass body, 2-way, and designed for 120 VAC operation with an explosion-proof rating. Solenoid valves shall be normally closed and rated for up to 100 psig.

2.8 GEAR MOTOR DRIVE

A. The screw shall be driven by a shaft mounted geared motor. The geared motor shall have a minimum service factor of 1.0 equivalent to an AGMA Class I rating.

B. The gear reducer shall be bolted to a machined flange welded to the upper end of the auger tube.

C. The gear reducer shall be driven by a minimum 1.0 hp to a maximum 2.0 hp, 1800 rpm, 480 volt, 3-phase, 60 Hertz, Class I, Division 1, continuous-duty motor with leads to a conduit box for outdoor operation.

2.9 BAGGER – REMOVED. Not required. Chute shall discharge into a dumpster.

2.10 ANCHORAGE AND FASTENERS

A. Equipment manufacturer shall determine sizes and furnish anchor bolts of sufficient size and strength to securely anchor each item of equipment. All non-embedded anchors shall be capsule or epoxy Type 316 stainless steel. Expansion type anchors are not acceptable. The CONTRACTOR shall set the bolts in accordance with manufacturer recommendations.

B. All equipment hardware and fasteners including nuts, bolts, and washers shall be Type 316 stainless steel.

2.11 OUTDOOR WEATHER PROTECTION

A. The screenings transport tube shall be furnished with heat tracing and thermal insulation which shall enclose the screenings transport tube, compaction and dewatering zone, and all spray wash piping. Exposed wash water solenoid valves and shall be heat traced and installed in a 304 stainless steel box attached to the screen by the manufacturer. All hoses on the screen shall also be heat taped and insulated by the manufacturer. All other exposed, exterior wash water supply piping coming to the screen shall be heat traced and insulated in the field by the contractor per Section 15190.

B. The outdoor weather protection system shall include self-regulating heat tracing, adjustable thermostat, insulation and a include a protective jacket. Heat tracing supplied by the manufacturer shall be powered from the manufacturer's control panel.

C. The heat tracing system shall be suitable for operation in a Class 1 Division 2 hazardous environment, at a minimum temperature of -13 deg F (-25 deg C), and shall be powered from the main control panel.

D. Where the wash water supply and electrical wiring conduit penetrate the stainless steel cover bulkhead adapters shall be provided.

E. All components requiring service or maintenance shall be easily accessible.

2.12 SPARE PARTS

A. As a minimum, the following Spare Parts shall be included and supplied together with the equipment:

1. 2 cleaning brushes.
2. 1 Solenoid valve rebuild kit.
3. Boxes of endless bags totaling at least 1400 ft.

2.13 INSTRUMENTATION AND CONTROLS

A. Manufacturer shall provide a local control panel and all instrumentation and controls necessary for the fully automatic operation of the screen.

B. The control system shall allow cleaning parameters of the screen to be changed via the local control panel display. Systems which do not offer this feature shall not be acceptable for this project.

C. Provide capability to operate screen on liquid level control signal, timed, or continuous basis. A preset high upstream liquid level (indicative of blinding of the screen) shall initiate operation of the screen drive, in connection with a timer. Screens which operate continuously or via timer only will not be acceptable.

D. Control panel shall be NEMA 4X 316 stainless steel suitable for outdoor installation on unistrut frame provided by Contractor. Panel shall include the following:

1. Front cover.
2. Full window.
3. Lockable door latch.
4. Door-interlocked and fused disconnect.
5. 600 VAC terminal block.
6. NEMA reversing motor starter and MCP type circuit breaker for screen motor.
7. Panel heater with thermostat.
8. Control power transformer with 120 VAC transient voltage surge compressor (TVSC) and fused primary and secondary.
9. Programmable logic controller (PLC), Allen Bradley Micrologix 1400.
10. Operator Interface (OIU), Allen Bradley PanelView C400.
11. Hand-Off-Auto selector switches for the following:

    a. Screen drive.
    b. Screen forward-off-reverse.
    c. Screenings washing system.
    d. Screen press zone flushing.
    e. Pilot lights for:

        i. Control power on (white).
        ii. Screen running (green).
        iii. Screen high level (amber).
        iv. Screen fault (red).

    f. E-stop push button (red).
    g. Screen reset push button (black).
    h. Door mounted elapsed time meters for the following:

        i. Screen drive.

    i. Digital inputs for the following:
        i. Upstream water level.
        ii. Downstream water level.
        iii. One spare input.

    j. Remote dry contact outputs for the following:

        i. Screen running.

ii. General alarm.
iii. One spare output.

k. Flashing alarm light and alarm horn with silencer-reset button.
l. Plastic Nameplates.

2.14 INSTRUMENTATION

A. Level sensor/transmitters and/or controllers: Manufacturer shall supply two ultrasonic level sensors to be located upstream and downstream of the screen, respectively. Provide stainless steel mounting hardware and expansion anchors. Any enclosures shall be rated NEMA 4X.

B. Safety Microswitch: A 120V safety switch shall be factory mounted to the compaction and discharge zone access door. The microswitch shall prevent the unit from operating while the door is open. The switch housing shall be rated NEMA 4X.

C. Thermostat: One (1) ambient temperature thermostat shall be provided to control power to the heat trace cable. The thermostat shall be 120 Volt, single phase, 60 Hz with a NEMA 4X housing. The temperature setpoint shall be selectable by an adjustable dial.

PART 3 EXECUTION

3.1 FIELD PREPARATION AND PAINTING

A. Contractor shall touch-up all shipping damage to the paint as soon as the equipment arrives on the job site.

B. Contractor shall supply paint for field touch-up and field painting.

C. Contractor shall finish paint electrical motors, speed reducers, and other self-contained or enclosed components with oil-resistance enamel.

D. Contractor shall coat all stainless steel bolts and nut threads with a non-seizing compound prior to final assembly.

3.2 INSTALLATION, START-UP AND OPERATOR TRAINING

A. Contractor shall verify all dimensions in the field to ensure compliance of equipment dimensions with the drawings. Contractor shall notify Engineer of any significant deviations.

B. Installation of the equipment shall be in strict accordance with the contract documents and the manufacturer's written instructions.

C. Manufacturer shall furnish the services of a factory-trained Service Representative for one (1) trip including two (2) eight-hour days on-site to inspect the installation, observe start up, and provide operator training.

1. Equipment shall not be energized, or "bumped" to check the electrical connection for motor rotation without the Service Representative present.

2. The Service Representative shall make all necessary adjustments and settings to the controls. In particular, Service Representative shall verify the level setpoints for the screen.

3. The Service Representative shall demonstrate proper operation of screen. The screen shall operate automatically based on the water level.

END OF SECTION

SECTION 11144

SLUDGE DEWATERING SCREW PRESS

PART 1 GENERAL

1.1 SCOPE:

A. Section Includes:

1. A complete sludge dewatering screw press for dewatering waste activated sludge (WAS).

2. Drive motors, gear reducers, support legs, anchor bolts, internal piping and wiring, controls, thin sludge feed pump, polymer feed system, and all other accessories and appurtenances required for a complete and properly operating system.

3. Manufacturer representation and assistance during installation, startup, and testing.

B. Contractor shall coordinate all details of the equipment with other related parts of the work. He shall verify that all structures, piping, wiring, and equipment components are compatible. Contractor shall furnish flocculation pipe as shown. Contractor shall complete all structural and other alterations required to accommodate equipment differing in dimensions or other characteristics from these specifications and drawings, at his own expense.

1.2 REFERENCES:

A. American Society for Testing and Materials (ASTM) Publications:

1. Section A322: Carbon and Alloy Steel Bar Specifications.

2. Section A507-10: Standard Specification for Drawing Alloy Steel, Sheet and Strip, Hot-Rolled and Cold Rolled.

B. Anti-Friction Bearing Manufacturers Association (AFBMA) Publications:

1. Standard 9-90 Load Ratings and Fatigue Life for Ball Bearings.
2. Standard 11-90 Load Ratings and Fatigue Life for Roller Bearings.

C. American Institute of Steel Construction (AISC) Publications.

D. American Welding Society (AWS) Publications.

E. American Structures Painting Council (ASPC) Publications.

1.3 SUBMITTALS:

The following information shall be submitted to the Engineer in accordance with Section 01300. Submittals shall include the following:

A. Product Data: Include the following:

1. Descriptive literature, brochures, catalogs, cut sheets, and other detailed descriptive material of the equipment.

2. Motor characteristics and performance information.

3. Gear reducer data including service factor, efficiency, torque rating, and materials.

4. Parts list including a list of recommended spare parts.

B. Shop Drawings: Include the following:

1. Manufacturer's installation drawings.
2. Wiring and schematic diagrams.

C. Operations and maintenance manual: See Section 01300.

D. Detailed installation instructions, with clear step-by-step points on the correct mechanical and electrical installation procedures.

E. Equipment weights and lifting points.

F. Recommendations for short and long term storage.

G. A copy of documents proving certification of the Manufacturer's Quality Management System according to ISO 9001.

H. Failure to include all drawings applicable to the equipment specified in this section will result in rejection of the entire submittal with no further review.

1.4 QUALITY ASSURANCE:

A. To ensure quality, conformance, and reliability with regard to the manufacturing and production of the machinery described in this section, the equipment manufacturer shall meet the requirements listed in this section.

B. Manufacturer shall have established an ISO 9001 certified quality management system.

C. All stainless steel components and structures shall be pickled and passivated by immersion, in which the assembly is submersed in a chemical bath to remove any residues that may be present on the material as a result of forming, manufacture, or handling. After removal from the chemical bath, the equipment shall be washed with a high-pressure wash of cold water to remove any remaining surface debris and promote the formation of an oxidized passive layer.

D. Screw Press shall be manufacturer's standard product and shall only be modified as necessary to comply with the drawings, specifications, and specified service conditions.

E. All welding shall be performed in accordance with American Welding Society (AWS) D1.1 Structural Welding Code, or equivalent.

F. All equipment shall be designed, fabricated, and assembled in accordance with recognized and acceptable engineering and shop practice. Individual parts shall be manufactured to standard sized and thicknesses so that repair parts can be installed in the field. Like parts of duplicate units shall be interchangeable. Equipment shall not have been in service prior to delivery, except as required by testing.

G. Each major component of equipment shall have the manufacturer's name, address and product identification on a nameplate securely affixed to the equipment.

1.5 DELIVERY, STORAGE, AND HANDLING OF EQUIPMENT:

A. Equipment shall be shipped and delivered fully assembled, except where partial disassembly is required in order to conform to transportation regulations or for the protection of components.

1.6 WARRANTY:

A. The manufacturer shall provide a warranty on equipment against manufacturer's defects for twelve (12) months, commencing on the date of Owner-accepted substantial completion of the project. If the equipment should fail during the warranty period due to a defective part, it shall be replaced and the unit restored at no cost to the owner, including both service and parts.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS:

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:

1. Q-Press 620.2 Screw Press from Huber Technology, Inc.
2. DSP Screw Press from BDP Industries, Inc.
3. ES-302 Volute Dewatering Press.
4. ESMIL Multi-Disc Screw Press MDQ.
5. Or Engineer-approved equivalent.

2.2 PERFORMANCE AND DESIGN REQUIREMENTS:

A. Number of screw presses: One (1).

B. Sludge to be dewatered shall be well-mixed and well blended having the following characteristics:

a. Sludge type: waste activated sludge (WAS) from sequencing batch reactor (SBR) process treating municipal sewage.

b. Solids concentration: Approximately 1%-1.5%.

c. Volatile solids ratio: Approximately 60%.

C. Design Capacity: Each screw press shall be capable of dewatering at least 35 gallons per minute (GPM) of the specified sludge (185 pounds dry solids per hour) to a minimum final solids content of 16%.

1. The solids capture rate shall be a minimum of 95%.

D. Location: Screw press and all appurtenances shall be suitable for installation outdoors under a roof canopy, as shown.

1. Ambient temperature range: 0°F to 110°F

E. Screw press shall be suitable for the available wash water supply:

1. Effluent water from SBR system and chlorine contact basins. (Effluent water system is by others.)

2. Available pressure: 70 psi.

3. Maximum usage: 55 gallons per minute; up to 500 gallons per day.

4. Connection: 1.5 inch female threaded connection. Contractor shall adapt the water supply to the connection provided on the screen.

5. Manufacturer shall supply a strainer of appropriate mesh size if required.

F. Power Supply: 480 V, 60 Hz, 3 phase.

G. All parts of the screw press shall be designed and appropriate for the service specified and for continuous operation.

H. The physical layout shown on the drawings is based on the Huber Q-PRESS Q620®. If equipment by another manufacturer is to be supplied, Contractor shall include in the bid all necessary modifications to the piping, electrical, structural, and mechanical layouts to accommodate the equipment proposed.

I. All parts shall be designed and manufactured to handle the forces that may be exerted on the screw press during fabrication, shipping, erection, and proper operation according to the O&M manual.

J. All components shall be so arranged that they can be serviced from the operating floor.

K. All components shall be balanced so that jamming at any point will not result in structural failure, but will cause the drive motor to stall. All components, including the gear reducer, shall be designed to withstand, without damage or permanent distortion, the full stalling torque of the drive motor.

2.3 MATERIALS:

A. Screw press shall be manufactured from AISI 304L stainless steel shapes (rods, angles, and channels), pipes, and sheets. In particular, wedge wire basket, screw, shaft, covers; support legs, fasteners and anchor bolts shall be made of this material.

B. Brushes for helical screw flights shall be of wear resistant plastic material. The brush is held in place by stainless steel clamps and bolts which can be easily removed.

C. Bearings shall be anti-friction, and without the need for grease lubrication.

2.4 SCREW PRESS DESIGN:

A. The screw press shall be installed inclined (at 10º - 12º). Dewatering of the sludge shall take place in a basket, which consists of three sections of wedge wire baskets. The first wedge section basket shall have a bar spacing of 0.01 in (0.25 mm) and the second wedge section basket 0.01 in (0.25 mm). The third basket section shall have openings of 0.006 in (0.1 mm). The overall basket length shall be 86 in (2,250mm). The basket diameter shall be a minimum of 17 in (440 mm).

B. The screw press shall be completely enclosed to prevent odor emission. The whole dewatering section and basket area shall be easily accessible through an inspection lid, which is mounted via two hinges on the side of the machine.

C. A screw shall be installed inside of the screen basket. The screw transports the sludge from the inlet to the discharge area at the end of the pressure zone. Its shaft diameter shall be conical towards the discharge section of the machine. The flights of the helical screw shall be provided with brushes to clean the wedge wire screen from the inside.

D. The screw shall be shafted and shall be made of stainless steel. A shaft-less screw is not acceptable. A bearing shall support the discharge end of the screw shaft. Wear strips are not acceptable.

E. A screw drive shall be provided at the sludge feed side of the press. The nominal motor power shall be the manufacturer's standard size for the model provided. The motor speed shall be controlled with a VFD. The drive unit shall be coupled to the screw shaft through a gearbox.

F. The cleaning of the wedge wire screen from the outside shall be performed with a spray bar washing system made of stainless steel piping and PVDF or stainless steel spray nozzles. The spray area shall run the entire length of the screen. One solenoid valve shall control the flow to the spray bar washing system. For stationary spray bar systems, when a cleaning cycle is initiated, the screw press motor reverses and rotates the basket, until it has completed a 360 degree rotation ensuring the entire surface area of the screen is cleaned.

G. A pneumatically actuated cone that serves for adjusting the pressure in the pressure zone shall be provided at the discharge end of the screening basket.

H. Sludge cake shall be automatically discharged through a rectangular sludge discharge opening. The discharge height shall be a minimum of 3 feet above floor level.

I. Manufacturer shall provide a discharge chute to direct the dewatered solids into the dumpster as shown. Slope of chute shall be at least 40° above horizontal so that solids exit chute by gravity.

J. Contractor shall provide a 6 inch diameter drain line for the filtrate and connect it to the bottom drain connection of the screw press, as shown. The drain line shall also be provided with a 1.5 in flush connection with manual ball valve.

2.5 INTERNAL PIPING:

A. Contractor shall provide connecting piping including the sludge feed pipe as shown including the flocculation pipe. The magnetic-inductive thin sludge flow meter, polymer-dosing ring, and polymer mixing valve shall be provided by the screw press manufacturer and installed by the Contractor.

2.6 DRIVE:

A. The screw press shall be driven by a shaft mounted gearbox and motor assembly. The gear reducer shall be bolted to a machined flange welded to the lower end of the press.

B. Motor shall be a 1,680 rpm, 3-phase, 60 Hertz, 460 volt. The motor power shall be 3 to 5 hp.

2.7 COMPRESSED AIR SYSTEM:

A. Screw press manufacturer shall provide a compressed air source as required to operate the pneumatic cylinder. The compressed air system shall include a compressor, receiver, and any required valves, air dryers, filters, and other appurtenances.

B. Compressor power supply: 120 V, 1 phase, 60 Hz.

C. Compressor power: 2.0 HP.

D. Pressure: 85 psi

E. Max Air Flow: 0.42 CFM

2.8 THIN SLUDGE FEED PUMP:

A. The screw press manufacturer shall supply a progressive cavity sludge feed pump.

B. Refer to Section 11350, “Progressive Cavity Pump,” for requirements.

2.9 POLYMER SYSTEM:

A. System shall be designed for the preparation, aging and dosing of up a polymer solution having an active polymer concentration between 0.05% and 0.25%.

B. The polymer station shall be self-contained with pumps, piping, fittings, and accessories, and shall be factory assembled and tested to eliminate field assembly work. The frame shall be 304 stainless steel and the piping shall be Sch. 80 PVC.

C. A polymer mixing chamber shall be provided. A high energy, multi-zoned, hydro-mechanical mixing device shall be provided. The mixing chamber shall have a translucent front cover.

D. The hydro-mechanical impeller shall be designed to produce variable intensity, back flow mixing action to optimize polymer performance without damaging polymer molecular structure.

E. The mixer motor shall be 0.5 hp, 1750rpm, 480 V, 60 Hz, wash down duty.

F. Materials: Impeller - PVC; body of mixing device – PVC; cover – clear lexan; fastener – 316 SS; seals – viton; pressure rating – 150 PSI.

G. The polymer system shall be suitable for the dilution water supply:

1. Effluent water from cloth filters. (Effluent water system is by others.)

2. Available pressure: 70 psi.

3. Maximum usage: 10 gallons per minute.

4. Connection: 1.5 inch female threaded connection. Contractor shall adapt the water supply to the connection provided on the screen.

5. Manufacturer shall supply a strainer of appropriate mesh size if required.

H. Provide accessories for the dilution water supply including a UL listed solenoid valve (rated IP65), and a flow meter with a rate adjusting valve, and low pressure alarm switch.

I. A neat polymer metering pump with hose connector shall be provided and connected through a barbed hose to the polymer mixing device. The neat polymer pump shall be a progressive cavity type pump suitable for a 120 VAC, 1 PH, 60 Hz power supply.

J. Control Panel: NEMA 4X FRP or Type 304 Stainless Steel enclosure, 120 VAC, 1 PH, 60 Hz power supply.

1. Operator interface – discrete selector switch (ON/OFF/REMOTE); mechanical mixer speed adjustment potentiometer; stroke length / stroke speed adjustment at metering pump.

2. Status / Alarm indicators: system running indication; LCD display of metering pump rate (on metering pump); low pressure switch alarm.

3. Inputs: remote start / stop (discrete dry contact); pacing signal from main control panel (4-20mA).

4. Outputs: system running (discrete dry contact); remote mode (discrete dry contact); low pressure alarm (discrete dry contact).

K. The pressure side of the polymer system shall be connected through a 2 in diameter PVC pipeline and a magnetic inductive flow meter to the polymer injection ring.

L. Polymer shall be added to the sludge at the injection ring. A mixing valve with adjustable weights shall be provided to ensure optimum mixing conditions and creating the right size and strength of floc. The retention time between the mixing valve and the screw press shall be a minimum of 30 seconds.

M. Accessories:

1. Drum Mixer: A bayonet mount drum mixer shall be supplied for mixing neat polymer drum contents. Mixer shall include a ½ hp, 1725 rpm TEFC motor with 28 inch long mixer shaft, (2) 4 inch long collapsible mixing blades, 8 foot power cord and on/off switch. Mounting plate shall include 2 inch bung mount and shall be constructed of mild steel with powder epoxy coating. Electrical requirements shall be 120 VAC/ 1 phase/ 60 Hz. Mixer shall be Neptune Model H-3.0 or Engineer-approved equivalent.

2. Drum pipe connection (drumstick) including fabricated piece to reach to near bottom of polymer drum and completely evacuate its contents. Material of construction shall be PVC. Drumstick shall be supplied with 2 inch NPT and ¾ inch NPT connections for connection to either drum port.

3. Polymer drum suction assembly: The assembly shall include quick disconnect cam-lock fittings, a full port ball valve, and 10 feet of braided PVC hose.

2.10 CONTROLS AND INSTRUMENTATION:

A. The screw press manufacturer shall provide a control system to coordinate operation of the screw press, feed pump, polymer feed system, air supply, and other accessories.

B. The Contractor shall provide wiring between all system components as required.

C. The dewatering system shall be fully automatic and shall include the following:

1. Main control panel for screw press.
2. Magnetic-inductive flow meter for thin sludge feed.
3. Automatic control for the pneumatic pressure cone.

D. A main control panel shall be provided in a NEMA 4X rated Type 304 stainless steel enclosure. The enclosure shall be suitable for mounting on a stainless steel unistrut frame provided by Contractor, shall have hinged covers which swing horizontally and shall be held closed with mechanical spring loaded fasteners, and shall include the following:

1. Main power disconnect switch (pad-lockable).

2. Control power transformer.

3. Surge arrester.

4. H-O-A control switches (screw drive including F/R selector switch, wash water solenoid valve).

5. Variable Frequency Controller (VFD) including over-current and over-heat protection for screw press main drive.

6. Programmable logic controller (PLC): Allen Bradley Compactlogix with on-board Ethernet.

7. Operator interface screen: Allen Bradley Panelview 600 with color touch screen and ethernet communication.

8. Running time meter for screw press.

9. Text messages displayed on touch screen:

   a. Over-current indications.
   b. Spray bar washing system on.

10. Operating and warning lights for the following:

    a. Power on.
    b. Dewatering system in operation.
    c. Malfunction indication.
    d. Reset button.

11. Laminated plastic nametags shall be provided for the name of the control panel and all disconnects, switches, lights, and meters.

12. Spare terminals (control- and power voltage) shall be provided to accommodate for future remote control operation and to interface with other equipment components such as the thin sludge pump.

2.11 SPARE PARTS

A. Provide spare parts recommended by manufacturer, including at a minimum:

1. One (1) set of brushes with mounting hardware (clips) - (brushes are wear parts).

2. One (1) bearing assembly for shaft.

3. One (1) solenoid valve 1-inch, 110V, Cl.1/ Div.2 for spray bar washing system.

4. Ten (10) nozzles for spray bar washing system.

B. Spare parts shall be packaged with labels indicating the contents of each package, and shall be delivered to Owner as directed.

PART 3 EXECUTION

3.1 INSTALLATION, START-UP AND OPERATOR TRAINING:

A. Contractor shall verify all dimensions in the field to ensure compliance of equipment dimensions with the drawings. Contractor shall notify engineer of significant deviations.

B. Installation of the equipment shall be in strict accordance with the contract documents and the manufacturer's instructions and shop drawings. Manufacturer shall supply anchor bolts for the equipment. Contractor shall install the anchor bolts in accordance with the manufacturer's recommendations.

C. After installation, touch-up paint shall be applied to all scratched, abraded and damaged shop painted surfaces. Coating type and color shall match shop painting. Contractor shall passivate all field welds.

D. Supplier shall furnish the services of a factory-trained service engineer for two (2) trips including a total of six (6) full workdays on-site to inspect the installation, observe start up, and provide operator training.

1. Equipment shall not be energized, or "bumped" to check the electrical connection for motor rotation without the service engineer present.

2. The service engineer shall make all necessary adjustments and settings to the controls.

3. Instruct plant personnel on the operation and maintenance of the equipment, including preventative maintenance, method of controlling equipment and troubleshooting.

END OF SECTION

SECTION 13442

PRIMARY ELEMENTS AND TRANSMITTERS

PART 1 GENERAL

1.1 SUMMARY:

A. Section Includes:

1. Flow components.
2. Pressure components.
3. Level components.
4. Analytical components.
5. Pipe, tubing and fittings.
6. Instrument valves.

1.2 QUALITY ASSURANCE:

A. Referenced Standards:

1. American Gas Association (AGA):

a. Gas Measurement Committee Report #3.

2. American Iron and Steel Institute (AISI).

3. American National Standards Institute (ANSI):

a. B16.5 – Pipe Flanges and Flanged Fittings.

b. B16.22 – Wrought Copper and Bronze Solder-Joint Pressure Fittings.

c. PTC 19.3 – Instruments and Apparatus, Part 3 Temperature Measurement.

d. MC96.1 – Temperature Measurement Thermocouples.

4. American Society of Mechanical Engineers (ASME):

a. B31.1 – Power Piping.

b. SEC II-A SA-182 – Standard Specification for Forged or Rolled Alloy Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature.

c. SEC II-A SA-479 – Standard Specification for Stainless and Heat-Resisting Steel Bars and Shapes for Use in Boilers and Other Pressure Vessels.

d. Fluid Meters – Sixth Edition.

5. American Society for Testing and Materials (ASTM):

   a. A106 – Standard Specification for Seamless Carbon Steel Pipe for High-Temperature Service.

   b. A126 – Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.

   c. A182 – Standard Specification for Forged or Rolled Alloy - Steel Pipe Flanges, Forged Fittings and Valves and Parts for High Temperature Service.

   d. A234 – Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures.

   e. A240 – Standard Specification for Heat-Resisting Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels.

   f. A269 – Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.

   g. A276 – Standard Specification for Stainless Steel Bars and Shapes.

   h. A479 – Standard Specification for Stainless Steel Bars and Shapes for use in Boilers and other Pressure Vessels.

   i. B16 – Standard Specification for Free-Cutting Brass Rod, Bar and Shapes for Use in Screw Machines.

   j. B32 – Standard Specification for Solder Metal.

   k. B68 – Standard Specification for Seamless Copper Tube, Bright Annealed.

   l. B75 – Standard Specification for Seamless Copper Tube.

   m. B88 – Standard Specification for Seamless Copper Water Tube.

   n. B124 – Standard Specification for Copper and Copper-Alloy Forging Rod, Bar, and Shapes.

   o. B283 – Standard Specification for Copper and Copper-Alloy Die Forgings (Hot-Pressed).

   p. B453 – Standard Specification for Copper-Zinc-Lead Alloy (Leaded-Brass) Rod.

   q. B61 – Standard Specification for Steam or Valve Bronze Castings.

6. National Electrical Manufacturers Association (NEMA):

a. ICS 6 – Enclosures for Industrial Controls and Systems.

1.3 SYSTEM DESCRIPTION:

A. The instruments specified in this Section are the primary element components for the control loops shown on the P&ID Drawings and specified in Section 13442. These instruments are integrated with other control system components specified under the 13440 specification series to produce the functional control defined in the Contract Documents.

1.4 SUBMITTALS:

A. Shop Drawings:

1. See Sections 01300 - Submittals and 13440 – Instrumentation Basic Requirements.

2. Submit list of all instruments to be provided identified by tag number, along with product data for each instrument.

B. Operation and Maintenance Manuals:

1. See Section 01300.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS:

A. Subject to compliance with the Contract Documents, the Manufacturers listed in the articles describing the elements are acceptable.

B. Submit requests for substitutions in accordance with Specification Section 01600 – Material and Equipment.

2.2 FLOW COMPONENTS:

A. Full Bore Magnetic Flow Meters:

1. Acceptable manufacturers, subject to compliance with Specifications:

a. Endress & Hauser Promag.
b. Siemens SITRANS.
c. Rosemount.
d. ABB.
e. Or Engineer pre-approved equal.

2. Design and fabrication: Mag meters shall:

a. Be suitable for drinking water process liquids and a Western Europe and America (WEA) language group.

b. Have a measured error less than 0.25% over an operable velocity range of 0.5 to 10 ft/s (or error of 0.005 ft/s at low end of velocity range).

c. Have a capability to handle fluid temperatures up to 170 ºF, process pressures up to 360 psi, and be compliant with AWWA Class D standards.

d. Be suitable for minimum liquid conductivity of 5 μS/cm.

e. Have 4-20 mA outputs, current inputs, and signals on alarm.

f. Retain the measuring system data in the event of a power supply failure.

g. Have switch points for low flow cutoff.

h. Have IP68 rated (i.e., NEMA 4X/6P) electronic protection. Flow meters shall be suitable for continuous immersion to avoid damage in case of sump pump failure. Provisions for immersion service shall include appropriate potting of electronics.

i. Have four line display with backlighting, and touch control.

j. Have lengths in accordance with ISO standards.

k. Have measuring tubes and electrodes of 304L or 316 stainless steel.

l. Have flanges and connections in accordance with ANSI B16.5, Material A105, Class 150.

m. For each mag meter, provide:

i. Device Drivers.
ii. Operating Instructions.
iii. Mounting Instructions.

3. The SSI shall confirm meter linings in writing with the meter manufacturer. Meters shall be equipped with NSF Standard 61 certified linings unless otherwise approved by the Engineer for applications such as drain service.

4. The SSI shall confirm meter sizes and capacities in writing with Engineer before ordering mag meters from the manufacturer.

5. The SSI shall use a compact version (i.e., transmitter and sensor form a mechanical unit), or a remote version (i.e., sensor is mounted separately from transmitter) as the individual application warrants. The SSI shall verify each application in writing with Engineer and manufacturer before purchase.

6. Transmitters shall be standard field housings, or stainless steel field housings (where applicable), or wall-mounted housing (where applicable). The SSI and the manufacturer shall determine the correct housing type, and verify such in writing with Engineer before purchase.

B. Ultrasonic Level Type Flow Meters:

1. See requirements for Ultrasonic Level Sensors and Transmitters below in this Specification Section.

2. Unit shall convert measurement of head on a weir to a flow rate based on weir discharge equations. Unit shall be configurable for a variety of weir types, including a rectangular weir of a user-defined width with end contractions.

C. Schedule of Flow Meters (FM, FE/FIT):

TAG	LOCATION	TYPE
FIT/FE 02.0002	Lift Station Discharge	Magnetic
FIT/FE 03.0001	SBR Effluent Line	Magnetic

2.3 PRESSURE COMPONENTS:

A. Pressure Gauge:

1. Acceptable manufacturers, subject to compliance with Specifications:

a. Ashcroft.
b. Ametek.
c. NoShok.
d. Endress & Hauser.
e. Winters.

2. Materials:

a. Bourdon tube, socket, connecting tube: 316-stainless steel.
b. Case: Phenolic.
c. Diaphragm seal housing: 316-stainless steel.
d. Pressure snubber:

i. Filter disc: 316-stainless steel.
ii. Housing: 316-stainless steel.

3. Accessories:

a. Provide diaphragm seals.

b. Provide valve at point of connection to equipment and at panel if panel mounted.

c. Utilize pressure snubbers with porous metal discs to provide pulsation dampening on gage applications as shown on schedule.

d. Provide 1/2 IN stainless steel antisiphon pigtail inlet connection for hot water and steam applications.

4. Design and fabrication:

a. All components suitable for service at:

i. 250°F.

ii. The maximum process temperature to which the gage is to be exposed.

b. Provide viewer protection from element rupture.

c. Calibrate gages at jobsite for pressure and temperature in accordance with manufacturer's instructions.

d. Unless otherwise required by codes, provide stem mounted or flush mounted, as required, with dial diameter as follows:

PIPE SIZE	DIAL SIZE	GAGE CONNECTION
1-1/2 IN or less	2-1/2 IN	1/4 IN
Larger than 1-1/2 IN	4-1/2 IN	1/2 IN

e. Equip with white faces, black numerals and black pointers.

f. Gage tapping position to be clear of equipment functions and movements, and protected from maintenance and operation of equipment. Gage to be readable from an accessible standing position.

g. Gage accuracy: 1 percent of full range.

h. Select gage range so that:

i. The normal operating value is in the middle third of the dial.

ii. Maximum operating pressure does not exceed 75 percent of the full scale range.

i. Provide pressure gages on discharge of each pump and blower and at locations indicated on Drawings or otherwise specified.

j. Provide compound type on pump suction gages which show at least 10 psi vacuum.

B. Pressure Transmitters:

1. Acceptable manufacturers, subject to compliance with Specifications:

a. Rosemount, Model 2088.

b. Foxboro, I/A series.
c. Honeywell 100e.
d. ABB.
e. Endress & Hauser.

2. Materials:

a. Isolating diaphragm: 316 stainless steel.
b. Process flanges and adapters: 316 stainless steel.
c. Housing: Aluminum.
d. Vent/drain valve: 316 stainless steel.
e. Fill fluid:

i. Utilize halocarbon fill for process applications involving strong oxidizing agents. Agents include but are not limited to: Cl2, KMNO4, FeCl, NaOH, and NaOCl.

ii. Utilize manufacturer's standard fill for other applications.

iii. Ensure fill is suitable for application temperatures.

3. Design and fabrication:

a. Smart transmitters utilizing microprocessor-based electronics.

b. Output: 4-20 mA DC proportional to pressure.

c. Nonvolatile EEPROM memory.

d. Power supply: 24 Vdc.

e. Adjustable zero and span.

f. Temperature limits: –20 to 180°F.

g. -4 to 175°F for LCD indicators.

h. Overpressure limits: Withstand 150 percent of stated maximum service pressure without damage.

i. Humidity limits: 0 to 100 percent relative humidity.

j. Damping: Adjustable between 0 and 32 seconds.

k. Inaccuracy (includes effects of linearity, repeatability and hysteresis): +0.10 percent of calibrated span for 15:1 rangeability.

l. Stability: +0.2 percent of upper range limit for 12 months.

m. Temperature effect:

i. Total effect including span and zero errors: +0.2 percent of upper range limit per 100°F for minimum 15:1 rangeability.

n. Minimum 1/2 IN pressure connection.

o. Equip with test jacks or accessible terminals for testing output.

p. Equip with isolation valve and test connections with isolation valves and/or plugs.

2.4 LEVEL ELEMENTS:

A. Ultrasonic Level Sensor and Transmitter:

1. Acceptable manufacturers, subject to compliance with Specifications:

a. Milltronics.
b. Endress and Hauser.
c. Rosemount.
d. ABB.

2. Materials:

a. Sensor wetted parts: PVC, polypropylene, KYNAR or PVDF.

3. Design and fabrication:

a. Sensor:

i. Emits ultrasonic sound.

ii. Detects return echo reflected from surface and converts it to electrical energy proportional to level.

iii. Temperature compensated.

iv. Operating temperature: -4 to 140°F.

v. Humidity: 95 percent non-condensing.

vi. Include any required controllers.

b. Transmitter:

i. Capable of producing output signal proportional to level of 4-20 mA DC into 500 ohm load.

ii. Power supply: 120 V AC (±10 percent), 60 HZ.

iii. Inaccuracy: 0.25 percent of range or 0.24 IN, whichever is greater.

iv. Resolution: 0.1 percent of span or 0.08 IN, whichever is greater.

c. Display:

i. Four-digit LED or LCD scalable to engineering units with selectable decimal point.

ii. Temperature: –5 to 122°F.

iii. Humidity: 95 percent noncondensing.

iv. Memory: EEPROM (non-volatile).

v. Keypad programmer.

B. Ultrasonic Sludge Blanket Level Sensor and Transmitter:

1. Acceptable manufacturers, subject to compliance with Specifications:

a. Rosemount/Mobrey MSL-600.
b. Entech EchoSmart.
c. ABB.
d. Endress & Hauser.
e. Engineer-approved equivalent.

2. Design and fabrication:

a. Sensor:

i. Emits ultrasonic sound.

ii. Detects return echo reflected from water/sludge interfaces and converts it to electrical energy proportional to sludge level.

iii. Temperature compensated.

iv. Operating temperature: –4 to 140°F.

v. Humidity: 95 percent non-condensing.

b. Transmitter:

i. Capable of producing output signal proportional to level of 4-20 mA DC into 500 ohm load.

ii. Power supply: 120 V AC (±10 percent), 60 HZ.

iii. Inaccuracy: 0.25 percent of range or 0.24 IN, whichever is greater.

iv. Resolution: 0.1 percent of span or 0.08 IN, whichever is greater.

c. Display:

i. Four-digit LED or LCD scalable to engineering units with selectable decimal point.

ii. Temperature: –5 to 122°F.

iii. Humidity: 95 percent noncondensing.

iv. Memory: EEPROM (non-volatile).

v. Keypad programmer.

C. NPT Pressure Type Level Sensor and Transmitter:

1. Acceptable manufacturers, subject to compliance with Specifications:

a. Foxboro IGP10 series.
b. Rosemount.
c. ABB.
d. Endress & Hauser.
e. Engineer-approved equivalent.

2. Transducers for Influent Wetwell level monitoring shall be a direct connected signal convertor capable of measuring pressure in a range of 1 to 30 psi and converting the liquid pressure into a 4-20 mA output scaled proportional to the liquid level.

3. Transducers shall be solid-state two-wire transmitter type with a 4-20mA output from a nominal 24VDC excitation powered from the PLC power supply. The transducers shall have a combined error (linearity and hysteresis) of ±0.20% full scale and be temperature compensated to ±2.5% per 100 °F. Zero and span adjustments shall be standardized so that transducers are interchangeable without recalibration. Measurement shall be unaffected over a temperature range of 32 to 120 °F. The units shall be capable of 1.5 times full scale over pressure without damage or change of calibration. Provide a liquid crystal display (LCD) with on-board pushbuttons for calibration and configuration. Transducers shall be provided with a 316L stainless steel process connection and sensor. The fill liquid shall be silicone.

4. Transducers shall be mounted at the sensing point and wired to the PLC. The transducers shall have ½" NPT process pressure connection in a NEMA 4X aluminum housing with epoxy finish. Transducers shall have a ½" conduit connection for cable entry.

D. Submersible Pressure Type Level Sensor and Transmitter:

1. Acceptable manufacturers, subject to compliance with Specifications:

a. Endress Hauser Waterpilot FMX21.
b. Rosemount.
c. NoShok.
d. Engineer-approved equivalent.

2. Design and fabrication:

a. Housing: stainless steel for potable water applications.
b. Accuracy: 0.2 percent of set span.
c. Temperature: 14 to 158°F.
d. Transmitter: Capable of producing 4-20 mA output signal proportional to level.

E. Schedule of Level Transmitters (LE/LIT):

TAG	LOCATION	Type
LIT/LE 02.0001	Influent Lift Station	Ultrasonic
LIT/LE 03.0002	SBR Basin 1	Ultrasonic
LIT/LE 03.0004	SBR Basin 1	Ultrasonic
LIT/LE 04.0001	CCB No. 1	Ultrasonic
LIT/LE 04.0002	CCB No. 2	Ultrasonic
LIT/LE 05.0001	Sludge Storage Basin	Ultrasonic
LIT/LE 06.0001	Hydropneumatic Tank	Ultrasonic

2.5 PIPE, TUBING, AND FITTINGS:

A. Acceptable Manufacturers, subject to compliance with Specifications:

1. Tube fittings:

a. Parker CPI.
b. Swagelok.

B. Submit requests for substitution in accordance with Specification Section 01600.

C. Instrument Tubing and Fittings:

1. Material:

2. Tubing: ASTM A269, Grade TP 316 stainless steel.

3. Straight fittings: 316 stainless steel per ASME SA-479 or ASTM A276.

4. Shaped bodies: ASME SA-182 F316 stainless steel.

5. Design and fabrication:

a. Tubing:

i. Seamless.
ii. Fully annealed.

iii. Maximum hardness: 80 Rb.
iv. Free from surface scratches and imperfections.
v. Diameter: 1/2 IN OD unless specified otherwise.
vi. Wall thickness:

- Meet requirements of paragraph 122.3 of ASME B31.1.
- Minimum 0.049 IN for 1/2 IN OD tubing.

b. Fittings:

i. Flareless.
ii. Compression type.

D. Instrument Piping:

1. For applications where the instrument is supported solely by the sensing line, (e.g. pressure gauge directly mounted to process line) utilize piping as specified below.

a. Diameter: 1/2 IN unless specified otherwise.
b. Schedule 80.
c. 316 stainless steel.

E. Pneumatic Signal Tubing:

1. Material:

a. Copper per ASTM B75.

2. Design and fabrication:

a. Soft annealed.
b. Free from surface scratches and imperfections.
c. Wall thickness:

i. 0.030 IN for 1/4 IN OD.
ii. 0.035 IN for 3/8 IN OD.

F. Pneumatic Tube Fittings:

1. Material:

a. Straight fittings: Brass per ASTM B16 and B453.

b. Shaped bodies: Brass per ASTM B124 Alloy 377 or ASTM B283.

2. Design and fabrication:

a. Flareless.
b. Compression type.

2.6 INSTRUMENT VALVES:

A. Process instrument multi-valve manifolds, isolation, vent and blow-down valves:

1. Acceptable manufacturers, subject to compliance with Specifications:

a. Whitey Co.

b. Anderson-Greenwood USA, Inc.

c. Submit requests for substitution in accordance with Specification Section 01600.

2. Materials:

a. Packing:

i. 450°F and above: Graphite.
ii. Below 450°F: Graphite or Teflon.

b. Body: 316 stainless steel per ASTM A479.
c. Stem: 316 stainless steel per ASTM A276.
d. Ball: 316 stainless steel per ASTM A276.
e. Support rings: 316 stainless steel per ASTM A276.
f. Seats:

i. Metal:

- 316 stainless steel per ASTM A276.

ii. Soft:

- Teflon, Delrin, or equivalent.
- Only utilized on applications where manufacturer's temperature and pressure ratings exceed process design conditions.

3. Design and fabrication:

a. Either of the following:

i. Ball valve with 1/4 turn activation.
ii. Free-swiveling ball stem.

b. Provide body wall thickness sufficient for process design conditions per ASME B31.1.

c. Temperature: Manufacturer's temperature rating for all components shall exceed process design conditions.

B. Isolation Valves in Copper Instrument Air Tubing:

1. Acceptable manufacturers, subject to compliance with Specifications:

a. Whitey Co or equal.

b. Submit requests for substitution in accordance with Specification Section 01600.

2. Materials:

a. Packing: Graphite or Teflon.
b. Body: Brass per ASTM B16.
c. Stem: 316 stainless steel per ASTM A276.
d. Ball: 316 stainless steel per ASTM A276.
e. Support rings: 316 stainless steel per ASTM A276.
f. Seats:

i. Metal:

- 316 stainless steel per ASTM A276.

ii. Soft:

- Teflon, Delrin, or equivalent.
- Only utilized on applications where manufacturer's temperature and pressure ratings exceed process design conditions.

3. Design and fabrication:

a. Ball valve with 1/4 turn activation.

b. Provide body wall thickness sufficient for process design conditions per ASME B31.1.

2.7 ACCESSORIES:

A. Furnish all mounting brackets, hardware and appurtenances required for mounting primary elements and transmitters.

1. Materials, unless otherwise specified, shall be as follows:

a. Bolts, nuts, washers, expansion anchors:

i. 316 stainless steel.

b. Mounting brackets:

i. Standard: 316 stainless steel.
ii. Highly corrosive areas: Aluminum.

c. Mounting plates, angles:

i. Standard: Carbon steel.
ii. Corrosive areas: 316 Stainless steel.

d. Instrument pipe stands:

i. Standard: Hot-dip galvanized 2 IN schedule 40, ASTM A106, Grade B carbon steel.

ii. Corrosive areas: 316 stainless steel.

B. Tubing Support Angles and Brackets

1. Any of the following materials are acceptable:

a. Aluminum support with dielectric material between support and tubing.

b. Type 316 stainless steel.

c. Fiberglass.

C. Tubing Tray or Channel: Aluminum

1. Provide dielectric material between tray or channel and tubing.

D. Provide handheld communicator compatible with all intelligent transmitters furnished. Hand held communicator shall provide capability to check calibration, change transmitter range, and provide diagnostics. If these features are provided with the intelligent transmitter, the hand held communicator is not required.

E. Cable lengths between sensors and transmitters shall be continuous (without splices) and as required to accommodate locations as shown on Drawings.

PART 3 EXECUTION

3.1 INSTALLATION:

A. Install products in accordance with manufacturer's instructions.

B. Install instrument mounting pipe stands level and plumb.

C. Instrument Valves:

1. Orient stems for proper operation.

2. Install arrays orderly and neat in appearance with true horizontal and vertical lines.

3. Provide a minimum of 2 IN clearance between valve handle turning radii where there are multiple valve handles appearing in a straight line.

4. Valves shall have bonnets and any soft seals removed during welding or soldering into the line. When cool, reassemble the valves.

5. Support each valve individually. The tubing system does not qualify as support for the valve.

D. Locate instrument piping and tubing so as to be free of vibration and interference with other piping, conduit, or equipment.

E. Keep foreign matter out of the system.

F. Remove all oil on piping and tubing with solvent before piping and tubing installation.

G. Plug all open ends and connections to keep out contaminants.

H. Tubing Installation:

1. General:

a. Install such that tube shows no sign of crumpling, bends of too short a radius, or flattening, etc.

b. Make tube runs straight and parallel or perpendicular to the floor, equipment and piping runs.

c. For liquid and steam applications, slope continuously from the process to the instrument with a minimum slope of 0.50 IN per foot.

d. For gas and air applications, slope continuously from the instrument to the process with a minimum slope of 0.50 IN per foot.

e. If the sensing line cannot be continuously sloped, install high point vents and low point drains.

f. Keep instrument tubing clean during all phases of work.

g. Blow out with clean, dry, oil-free air immediately before final assembly.

h. Cut by sawing only and debur.

2. Bending:

a. Make each bend with tube bender of the correct size for the tube.

b. Make all bends smooth and continuous.

c. Rebending is not permitted.

d. Make bends true to angle and radius.

e. Maintain a true circular cross section of tubing without buckling or undue stretch of tube wall.

f. Allowable tolerance for flattening out of tubing bends: Maximum of 8 percent of the OD for stainless steel tubing.

g. Minimum bending radius for stainless steel tubing:

TUBE OD INCHES	MINIMUM BENDING RADIUS, INCHES
1/4	9/16
3/8	15/16
1/2	1-1/2

h. Minimum bending radius for type L, hard (drawn) copper.

TUBE OD INCHES	MINIMUM BENDING
3/8	1-3/4
1/2	2-1/2

3. Tubing support:

a. Intermittently support by clamping to support angle.

b. Install supports to be self-draining, supported by hangers, or cantilevered from walls or structural beams.

c. Support at 5 FT-0 IN maximum spans for horizontal or vertical runs.

d. Use tubing trays in areas where spans between supports are greater than 5 FT and for all signal tubing support.

e. Support each tubing tray at 10 FT maximum spans.

f. Align tubing in orderly rows and retain in the tray by bolted clips. The use of spring or speed clips is not acceptable.

g. Maintain order of the tubing throughout the length of the tray.

h. Locate angle, channel and tray installation to protect tubing from spills and mechanical damage.

i. Locate support members to clear all piping, conduit, equipment, hatchways, monorails, and personnel access ways and allow access for equipment operation and maintenance.

j. Support trays to prevent torsion, sway or sag.

k. Permanently attach supports to building steel or other permanent structural members.

l. Arrange supports and trays so that they do not become a trough or trap.

4. Routing and orientation:

a. Route to maintain a minimum headroom clearance of 8 FT.

b. Locate and orient valves and specialties so that they are accessible for operation and maintenance from the operating floor. Do not route through or over equipment removal areas, below monorails or cranes nor above or below hatches.

5. Expansion and vibration provisions:

a. Provide horizontal expansion loops at the process connections.

b. Route tubing parallel to relative motion through sleeved supports that allow linear tube movement.

c. Cold springing of tubing to compensate for thermal expansion is prohibited.

d. Utilize flexible hoses to connect pneumatic tubing to air users which may move or vibrate.

I. Air Supply:

1. Connect all instruments requiring air to air supply piping and tubing. Provide connections as follows:

a. Terminate branch supply line not more than 36 IN from the device with a 1/2 IN isolation valve.

b. For remaining line, use 1/4 or 3/8 IN tubing of a length to allow for normal equipment movement and vibration.

c. Use flexible hoses to connect pneumatic tubing to air users which may experience significant movement or vibration.

d. Make branch connections to individual instruments from the top of the supply header.

e. Purge instrument air piping of extraneous material by blowing clean, dry, oil-free air through the system prior to final connection.

J. Threaded Connection Seals:

1. Use Tite-Seal or acceptable alternate.
2. Use of lead base pipe dope or Teflon tape is not acceptable.
3. Do not apply Tite-Seal to tubing threads of compression fittings.

K. Capillary Tubing:

1. Route capillary tubing in tubing tray.

2. Install capillary tubing with a 2 IN minimum bend radius which does not kink or pinch the capillaries.

3. Do not cut or disconnect at any point.

4. Coil excess capillary tubing and secure at the instrument.

L. Temperature Elements:

1. Assemble in the following sequence:

a. Remove temperature sensor sheaths and terminal blocks from the head and nipple assembly.

b. Connect nipple and head to thermowell installed in the pipe.

c. Insert sheath and terminal block until it seats in the thermowell.

d. Connect to the head.

M. Instrument Mounting:

1. Mount all instruments where they will be accessible from fixed ladders, platforms, or grade.

2. Mount all local indicating instruments with face forward toward the normal operating area, within reading distance, and in the line of sight.

3. Mount instruments level, plumb, and support rigidly.

4. Mount to provide:

a. Protection from heat, shock, and vibrations.

b. Accessibility for maintenance.

c. Freedom from interference with piping, conduit, and equipment.

3.2 TRAINING:

A. Provide on-site training in accordance with Section 01600.

END OF SECTION

SECTION 15101

GATE VALVES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Gate valves.

1.2 QUALITY ASSURANCE

A. Referenced Standards:

1. ASTM International (ASTM):

a. A126, Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.

2. American Water Works Association (AWWA):

a. C500, Standard for Metal-Seated Gate Valves for Water Supply Service.

b. C509, Standard for Resilient-Seated Gate Valves for Water Supply Service.

c. C515, Standards for Reduced-Wall, Resilient-Seated Gate Valves for Water Supply Systems.

d. C520, Standard for Knife Gate Valves.

e. C550, Standard for Protective Epoxy Interior Coatings for Valves and Hydrants.

3. Manufacturers Standardization Society of the Valve and Fitting Industry Inc. (MSS):

a. SP-70, Cast Iron Gave Valves, Flanged and Threaded Ends.
b. SP-80, Bronze Gate, Globe, Angle, and Check Valves.

1.3 DEFINITIONS:

A. OS&Y: Outside Screw and Yoke.

B. NRS: Non-rising Stem.

C. RS: Rising Stem.

1.4 SUBMITTALS

A. Shop Drawings:

1. See Division 01 for requirements for the mechanics and administration of the submittal process.

2. See Specification Section 15100 – *Valves Basic Requirements*.

B. Operation and Maintenance Manuals:

1. See Division 01 for requirements for:

a. The mechanics and administration of the submittal process.
b. The content of Operation and Maintenance Manuals.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the manufacturers listed in the applicable Articles below are acceptable.

B. Submit request for substitution in accordance with Division 01.

2.2 VALVES:

A. Resilient Wedge Gate Valves, 2 to 48 IN (Water, Wastewater Application):

1. Comply with AWWA C515.

2. Materials:

a. Stem and stem nut: Bronze.

i. Wetted bronze parts in low zinc bronze.

b. Body, gate: Ductile iron.

c. Resilient wedge: Fully encapsulated rubber wedge. Ethylene Propylene Diene Monomer (EPDM).

3. Design requirements:

a. Minimum 50 psig working pressure.
b. Buried: NRS, O-ring stem seal, 2 IN square operating nut.
c. Exposed: OS&Y, stuffing box stem seal, handwheel.
d. Counter clockwise open rotation.
e. Fusion bonded epoxy coating interior and exterior except stainless steel and bearing surfaces.

i. Comply with AWWA C550.

4. Acceptable manufacturers:

   a. Clow.
   b. Mueller.
   c. American Flow Control.
   d. M & H.
   e. J&S.
   f. Approved Engineering Equal.

B. Double Disc Gate Valves, 14 to 48 IN (Wastewater Application):

1. Comply with AWWA C500.

2. Materials:

   a. Seating surfaces, stem, stem nut: Bronze.
   b. Body, discs: Cast iron.

3. Design requirements:

   a. 150 psi working pressure.
   b. NRS O-ring stem seal.
   c. Provide gear actuator, 20 IN and larger valves.
   d. Provide roller tracks and scrapers for horizontal valves size 16 IN and larger.
   e. Provide bypass valve sized per AWWA C500.

4. Acceptable manufacturers:

   a. Clow.
   b. Mueller.
   c. American Flow Control.
   d. M & H.

C. Knife Gate Valves, 2 to 36 IN (Wastewater Sludge Application):

1. Comply with AWWA C520.

2. Materials:

   a. Body construction:

      i. 2 to 4 IN: Cast stainless steel.
      ii. 6 to 48 IN: Cast iron body with stainless steel lining.

   b. Wetted parts: Stainless steel Type 304.
   c. Packing: Flax, 150 Deg F max.
   d. Stem: Stainless steel, double pitch thread.
   e. Resilient seat material (2 to 36 IN): Butadiene.

3. Design requirements:

   a. Working pressure (WOG non-shock):

i. 2 to 24 IN: 150 psi.
ii. 30 to 36 IN: 125 psi.
iii. Actuator: Geared actuator for valves 20 IN and larger.

4. Acceptable manufacturers:

a. DeZurik, Series L.
b. Fabri-Valve.
c. Approved equal.

2.3 ACCESSORIES

A. Refer to Drawings and valve schedule for type of actuators.

1. Furnish actuator integral with valve.

B. Refer to Specification Section 15100 for actuator requirements.

2.4 FABRICATION

A. General:

1. Provide valves with clear waterways the full diameter of the valve.

PART 3 EXECUTION

3.1 INSTALLATION

A. See Specification Section 15100.

B. Where larger buried valves utilize smaller bypass valves, provide a second valve box installed over the bypass valve operating nut.

C. Do not install gate valves inverted or with the stems sloped more than 45 degrees from the upright unless the valve was ordered and manufactured specifically for this orientation.

END OF SECTION

SECTION 15103

BUTTERFLY VALVES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Butterfly valves.

1.2 QUALITY ASSURANCE

A. Referenced Standards:

1. American Society of Mechanical Engineers (ASME):

a. B16.5, Pipe Flanges and Flanged Fittings - NPS 1/2 through NPS 24.

2. ASTM International (ASTM):

a. A48, Standard Specification for Gray Iron Castings.

b. A126, Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.

c. A276, Standard Specification for Stainless Steel Bars and Shapes.

d. A395, Standard Specification for Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures.

e. A436, Standard Specification for Austenitic Gray Iron Castings.

f. A536, Standard Specification for Ductile Iron Castings.

g. B148, Standard Specification for Aluminum-Bronze Sand Castings.

3. American Water Works Association (AWWA):

a. C504, Standard for Rubber-Seated Butterfly Valves.

4. Manufacturers Standardization Society of the Valve and Fittings Industry Inc. (MSS):

a. SP-67, Butterfly Valves.

1.3 SUBMITTALS

A. Shop Drawings:

1. See Division 01 for requirements for the mechanics and administration of the submittal process.

2. See Specification Section 15100 – *Valves – Basic Requirements*.

3. For valves 8 IN and larger, furnish "Affidavit of Compliance" with Owner in accordance with AWWA C504.

B. Operation and Maintenance Manuals:

1. See Division 01 for requirements for:

a. The mechanics and administration of the submittal process.
b. The content of Operation and Maintenance Manuals.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:

1. DeZurik.
2. Clow.
3. Mueller.
4. Pratt.
5. Crispin Valves.
6. Val Matic.
7. GA.
8. J&S.
9. Engineer approved equal.

B. Submit request for substitution in accordance with Division 01.

2.2 BUTTERFLY VALVES (AWWA C504)

A. Comply with AWWA C504.

B. Materials:

1. Valve bodies:

a. ASTM A126, Class B or ASTM A536 Grade 65-45-12 ductile iron.

b. Wafer valves may be constructed of ASTM A48, Class 40 cast iron.

2. Valve shafts:

   a. Stainless steel, 18-8, Type 316.

3. Valve discs:

   a. Potable and nonpotable water:

      i. ASTM A48, Class 40 cast iron.
      ii. ASTM A536, Grade 65-45-12 ductile iron.
      iii. ASTM A436, Type 1 alloy cast iron.
      iv. Bronze in accordance with AWWA C504.

   b. Wastewater and similar applications:

      i. ASTM A536, Grade 65-45-12 ductile iron.
      ii. ASTM A436, Type 1 alloy cast iron.
      iii. Bronze in accordance with AWWA C504.

   c. Air and similar applications: ASTM A48, Class 40 cast iron.

4. Valve seats:

   a. Potable and nonpotable water below 150 Deg F:

      i. Natural rubber.

   b. Potable and nonpotable water and wastewater and air below 180 Deg F:

      i. Buna-N.

   c. Heating water and air 180 to 250 Deg F.

      i. EPDM.

5. Mating surfaces:

   a. Valves less than 30 IN: ASTM A276, 18-8, stainless steel.
   b. Valves 30 IN and larger: ASTM A276, 18-8, stainless steel.

C. Design Requirements:

1. Seat type:

   a. Resilient.
   b. Comply with AWWA C504.

2. Exposed and submerged valves 3 through 20 IN.

   a. Body type: Wafer or short body flange (laying length may vary from AWWA C504).

b. Equip wafer type with fully tapped anchor lugs drilled per ASME B16.5, Class 150.

3. Exposed and submerged valves 24 IN and larger:

a. Body type: Short body flange.
b. Working pressure: Rated for 150 psi (Class 150B per AWWA C504).

4. Direct buried valves:

a. All valves: Working pressure rated for 150 psi (Class 150B per AWWA C504).

2.3 BUTTERFLY VALVES (MSS SP-67)

A. Comply with MSS SP-67.

B. Materials:

1. Valve bodies:

a. Wafer body: Cast iron ASTM A126, Class B.
b. Lug body: Ductile iron, ASTM A395.

2. Valve shaft or stem:

a. Stainless steel, ASTM A276, Type 316.

3. Valve disc:

a. Ductile iron, ASTM A395, nickel plated.

4. Valve seat:

a. Water and air below 180 Deg F:

i. Buna-N.

b. Water and air 180 to 250 Deg F:

i. EPDM.

c. Valve seat shall be a full body seat isolating stem and body from flow.

C. Design Requirements:

1. Exposed and submerged valves 3 IN through 20 IN.

a. Body type: Wafer.
b. Working pressure: Rated for 150 psi.

c. Equip with fully tapped anchor lugs drilled per ASME B16.5, Class 150.

2. Exposed and submerged valves 24 IN and larger:

a. Body type: Short body flange.
b. Working pressure: Rated for 150 psi.

2.4 ACCESSORIES

A. Refer to Drawings and/or valve schedule for type of actuators.

1. Furnish actuator integral with valve.

B. Refer to Section 15100 for actuator requirements.

PART 3 EXECUTION

3.1 INSTALLATION

A. See Section 15100.

END OF SECTION

SECTION 15104

BALL VALVES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Ball valves.

1.2 QUALITY ASSURANCE

A. Referenced Standards:

1. ASTM International (ASTM):

a. A48, Standard Specification for Gray Iron Castings.

b. A126, Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.

c. D1784, Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds.

2. American Water Works Association (AWWA):

a. C507, Standard for Ball Valves, 6 IN through 48 IN.

3. Manufacturers Standardization Society of the Valve and Fittings Industry Inc. (MSS):

a. SP-72, Ball Valves with Flanged or Butt-Welding Ends for General Service.

b. SP-110, Ball Valves; Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.

1.3 DEFINITIONS

A. PVDF: Polyvinylidene fluoride.

1.4 SUBMITTALS

A. Shop Drawings:

1. See Division 01 for requirements for the mechanics and administration of the submittal process.

2. See Specification Section 15100 – *Valves – Basic Requirements*.

3. Test results for AWWA valves.

B. Operation and Maintenance Manuals:

1. See Division 01 for requirements for:

a. The mechanics and administration of the submittal process.
b. The content of Operation and Maintenance Manuals.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the manufacturers listed in the applicable Articles below are acceptable.

B. Submit request for substitution in accordance with Division 01.

2.2 METALLIC BALL VALVES 1/4 TO 3 IN DIA

A. Acceptable Manufacturers:

1. Apollo.
2. Jamesbury.
3. Watts.
4. Stockham.
5. Nibco.
6. Val Matic.
7. J&S.
8. Engineering Approved Equal.

B. Materials:

1. Body: Stainless Steel.
2. Stem, stem gland nut: Stainless Steel.
3. Ball: Brass, chrome plated.
4. Seats, stuffing box ring, and thrust washer: Reinforced Teflon.
5. Handle: Vinyl coated or zinc- or cadmium-plated steel.

C. Design Requirements:

1. Rated for 400 psi and 250 Deg F, WOG for threaded end applications and 285 psi WOG and 150 psi saturated steam service for flanged end applications.

2. Handles showing direction of opening.

3. Stuffing boxes capable of being repacked under pressure and adjustable for wear.

4. Stem with reinforced Teflon stuffing box ring and blowout-proof design.

5. Renewable reinforced Teflon seats.

6. Ball design which does not allow media contact with stem.

7. Balancing stop for all applications.

8. Bodies with mounting pad for applications requiring actuators.

2.3 PLASTIC BALL VALVES: 1/2 IN TO 4 IN DIA

A. Acceptable Manufacturers:

1. Chemtrol.
2. Spears.
3. ASAHI/America.

B. Materials:

1. Body, stem, ball, handle, end connectors:

a. PVC ASTM D1784-12454B
b. CPVC ASTM D1784-23477-B

2. Ball Seat: Teflon.
3. O-rings:

a. General: Viton or PTFE encapsulated fluorocarbon.
b. NaOH or LAS Service: EPDM.

C. Design Requirements:

1. Rated at 150 psi at 75 Deg F.
2. Double or "true union" design.
3. Blocks both directions, upstream and downstream.
4. Union nut capable of compensating for seat wear.
5. Body with mounting pad for actuators where required.
6. Capable of being disconnected at downstream end under full line pressure.

2.4 AWWA C507 BALL VALVES: 6 IN TO 48 IN DIA {PRATT (P), WILLAMETTE (W)}

A. Comply with AWWA C507.

B. Acceptable Manufacturers:

1. Willamette.
2. Pratt.

C. Materials:

1. Body:

a. Cast iron ASTM A126, Class B (P).

b. Cast iron ASTM A48, Class 35 (W).

2. Ball:

a. Cast iron ASTM A48, Class 40 (P).
b. Cast iron ASTM A48, Class 35 (W).

3. Shaft:

a. Stainless steel 18-8 Type 304 (P)
b. Forged steel, chrome plated at seal tensile yield 82,000 psi (W).

4. Bearings, sleeve type, non-metallic:

a. Teflon lined (P).
b. Sleeve type (W).

5. Ball seat: Stainless steel Type 304 (P and W).

6. Body seat:

a. Buna-N (P).
b. Monel (W).

D. Design Requirements:

1. Design pressure: 150 psi.
2. Flanges: Class 125.
3. Ball shall provide one (1) direction seal or closure.
4. Provide pipe tap for body drain and air vent and legs or base for support.
5. Ball and body seats: Field adjustable and replaceable.

2.5 ACCESSORIES

A. Refer to Drawings and valve schedule for type of actuators.

1. Furnish actuator integral with valve.

B. Refer to Section 15100 for actuator requirements.

2.6 SOURCE QUALITY CONTROL

A. Shop test AWWA C507 ball valves in accordance with AWWA C507.

B. Furnish record of test.

PART 3 EXECUTION

3.1 INSTALLATION

A. See Section 15100.

3.2 FIELD QUALITY CONTROL

A. For AWWA C507 ball valves, and in accordance with Division 01 employ and pay for services of equipment manufacturer's field service representative(s) to:

1. Inspect equipment covered by these Specifications.

2. Supervise adjustments and installation checks.

3. Provide test equipment, tools, and instruments necessary to accomplish equipment testing.

4. Conduct startup of equipment and perform operational checks.

5. Provide Owner with a written statement that manufacturer's equipment has been installed properly, has been started up, and is ready for operation by Owner's personnel.

END OF SECTION

SECTION 15106

CHECK VALVES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Check valves.

1.2 QUALITY ASSURANCE

A. Referenced Standards:

1. American Water Works Association (AWWA):

a. C508, Standard for Swing-Check Valves for Waterworks Service, 2 IN through 24 IN NPS.

2. Manufacturers Standardization Society of the Valve and Fittings Industry Inc. (MSS):

a. SP-71, Cast Iron Swing Check Valves, Flanged and Threaded Ends.
b. SP-80, Bronze Gate, Globe, Angle and Check Valves.

1.3 DEFINITIONS

A. PVDF: Polyvinylidene fluoride.

1.4 SUBMITTALS

A. Shop Drawings:

1. See Division 01 for requirements for the mechanics and administration of the submittal process.
2. See Specification Section 15100 – *Valves Basic Requirements.*

B. Operation and Maintenance Manuals:

1. See Division 01 for requirements for:

a. The mechanics and administration of the submittal process.
b. The content of Operation and Maintenance Manuals.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, manufacturers listed under the valve with types are acceptable.

B. Submit request for substitution in accordance with Division 01.

2.2 CHECK VALVES: 2.5 IN AND SMALLER

A. Class 125 Swing Check Valves:

1. Comply with MSS SP-80.

2. Acceptable manufacturers:

a. Nibco T413-Y.
b. Stockham B-319Y.

3. Materials:

a. Body, bonnet, disc: Cast Iron.

4. Design requirements:

a. 125 psi steam to 406 DegF, 200 psi WOG.
b. Horizontal swing, renewable disc.

2.3 SWING CHECK VALVES: 3 IN TO 30 IN

A. Swing Check Valves:

1. Comply with AWWA C508.

2. Acceptable manufacturers:

a. Clow.
b. American Darling.
c. Golden Anderson.
d. Val Matic.
e. J&S.
f. Engineer approved equal.

3. Materials:

a. Body and cover: Cast iron.
b. Seat ring, hinge: Cast Iron.
c. Disc:

i. 3 to 30 IN: Cast iron with rubber face.

d. Hinge shaft: Stainless steel.
e. Bearings, connecting hardware: Stainless Steel.

4. Design requirements:

a. 175 psi working pressure (3 to 12 IN).
b. 150 psi working pressure (14 to 30 IN).
c. Furnish with outside weight and lever or lever and spring.

PART 3 EXECUTION

3.1 INSTALLATION

A. See Specification Section 15100.

B. Install in accordance with manufacturer's instructions.

END OF SECTION

SECTION 15115

WATER CONTROL GATES

PART 1 GENERAL

1.1 SUMMARY:

A. Section Includes:

1. Slide gates and frames, fabricated stainless steel.

B. Referenced Standards:

1. American Water Works Association (AWWA):

a. C542, Electric Motor Actuators for Valves and Slide Gates.
b. C561, Fabricated Stainless-Steel Slide Gates.

2. National Electrical Manufacturers Association (NEMA):

a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).

1.2 SUBMITTALS:

A. Submit under provisions of Specification Section 01300 - *Submittals*.

B. The following submittals are required, at a minimum:

1. Shop Drawings:

a. Submit product technical data including:

i. Acknowledgment that products submitted meet the requirements of standards referenced.

2. Operation and Maintenance Manuals:

C. Include any other information necessary for the ENGINEER to determine compliance with the specifications.

D. All deviations from Contract Documents shall be clearly identified and approved in writing by the ENGINEER.

E. Partial or incomplete submittals will not be reviewed by ENGINEER.

1.3 WARRANTY:

A. The manufacturer shall provide a warranty on equipment against manufacturer's defects for twenty-four (24) months, commencing on the date of Owner-accepted substantial completion of the project. If the equipment should fail during the warranty period due to a defective part, it shall be

replaced and the unit restored at no cost to the owner, including both service and parts.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS:

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:

1. Fontaine / Rodney Hunt.
2. Fontaine-Aquanox.
3. Hydro Gate.
4. Waterman Industries.
5. Whipps.
6. GA Industries.
7. Golden Harvest
8. Engineer-approved equal.

2.2 SLIDE GATES:

A. Gates shall comply with the requirements of AWWA C561.

B. Gates shall be as specified and have the characteristics and dimensions shown on the Drawings.

C. Leakage shall not exceed 0.05 gpm/ft of wetted seal perimeter in seating head and unseating head conditions.

D. Gate shall utilize self-adjusting seats.

E. Structural components of the frame and slide shall be fabricated from stainless steel having a minimum thickness of 1/4-inch and have adequate strength to prevent distortion during normal handling, during installation and while in service.

F. All welds shall be accomplished by welders with AWS certification.

G. Finish:

1. Mill finish on stainless steel.

2. Welds to be cleaned to remove weld burn and scale.

3. Stainless steel components shall be pickled and passivated by immersion after fabrication.

H. Gates, including lift, shall be designed with a minimum factor of safety of five.

I. Materials:

1. Frame, yoke, stem, stem guides, slide, stem extension, and lift pedestal: Stainless Steel ASTM A276, Type 316.

2. Seals: Neoprene or ultra high molecular weight polyethylene (UHMWPE).

3. Anchor bolts, assembly bolts, and nuts: Stainless Steel ASTM A276, Type 316.

2.3 GATE OPERATORS AND LIFTS:

A. All gates shall have actuators (lifts) in accordance with the Schedule below.

B. Provide lifts in accordance with AWWA C561, C542, or as modified in this Specification Section.

C. All gates shall have rising stem.

D. Provide all lifts with clear butyrate plastic stem cover with Mylar open-close indicator.

E. Manual Operators:

1. Centerline of crank or handwheel approximately 36 IN above operating floor, unless otherwise shown.

2. Maximum effort of 40 LBS on crank or handwheel shall operate gate after unseating gate from wedges bored upon seating head specified.

F. Electric Operators:

1. Electric motor-operated lift mechanism including electric motor, reduction gearing, stem nut, pedestal, torque and limit switches, enclosure strip heaters, reversing magnetic starter, pushbutton control, indicator lights, shop wiring, gear case, and handwheel for operation in case of power failure.

2. Unit to be complete in a NEMA 4X enclosure requiring only the field connection of 3 PH, 460 V electric power.

3. Gate operation speed: 12 IN per minute.

2.4 MOUNTING HARDWARE:

A. Manufacturer shall supply all required mounting hardware including brackets, stem guides, anchor bolts, etc.

PART 3 EXECUTION

3.1 INSTALLATION:

A. See Specification Sections 11005 – *Equipment Basic Requirements*.

B. Schedule:

WATER CONTROL GATE SCHEDULE									
Tag. No.	Type	Location	Function	Operating Size (WxH)	Channel Depth	Seating Head (ft)[1]	Unseating Head (ft)[1]	Lift Type	Closure
SG-02.0002 SG-02.0004	Up Op Slide Gate	Screen Channel	Isolation of screens for maintenance	16″ x 36″	4′-0″	0.6	0.6	Manual	Conv
SG-02.0001 SG-02.0003	Up Op Slide Gate	Screen Channel	Bypass of Coarse Screens	16″ x 36″	4′-0″	0.6	0.6	Manual	Conv
SG-03.0001 SG-03.0002	Up Op Slide Gate	SBR Inlet Channel	Isolation of each SBR Train	30″ x 42″	9′-8″	2.1	2.1	Manual	Conv

Abbreviations:

Conv	Conventional Upon-Channel Embedded Frame
Elec	Electric Operator
FB	Flush Bottom Closure
Up Op	Upward Opening

Notes:

1. Design values. Manufacturer to advise on maximum value for each gate.

END OF SECTION

SECTION 16100

SEWAGE LIFT STATION CONTROL PANEL
(Primary and Backup Level Control System)

PART 1 GENERAL

1.1 SECTION INCLUDES:

A. Furnish and install a new pump control panel (PCP) with all necessary installation accessories and appurtenances, training and start-up to control a complete and functional three pump sewage lift station as specified.

B. The PCP shall be designed to control three submersible pumps.

C. The system shall be provided with a primary level control system and a backup level control system. In the event the primary level control system fails, the PCP shall automatically switch to the backup level control system and alarm to SCADA.

D. Related Sections:

1. Division 1.
2. Division 16.

1.2 SUBMITTALS:

A. Submit under provisions of Section 01300 - *Submittals*.

B. Product Data:

1. PCP equipment and material, including a bill of material and manufacturer's data on each item.
2. Electrical wiring diagram of the control panel.
3. Panel layout.
4. Electrical schematics.
5. Ultrasonic level control systems.

1.3 OPERATIONS & MAINTENANCE MANUAL:

A. Manufacturer shall provide copies of installation, operation and maintenance procedures to Owner in accordance with general requirements of Division 1. Operation and maintenance (O&M) manuals shall be provided complete, including technical data sheets, wiring diagrams, guide to trouble shooting, and information for ordering replacement parts.

B. Wiring diagrams shall have their terminals identified to facilitate installation, operation, and maintenance and shall indicate internal wiring for each item of equipment and the interconnections between the items of equipment.

C. Each component shall be provided with the manufacturer's information for that component.

D. Provide O&M manual in three ring binder with name of project, contractor, and manufacture's name on the outside of the binder. Binders shall be no more than three inches thick. Provide additional binders if required.

E. Provide the name and contact information of the contactor and manufactures representative in the first section of the O&M manual.

F. Submit operation and maintenance data based on factory and field-testing, operation, and maintenance of the specified products.

1.4 SERVICE NETWORK:

Manufacture of PCP shall have an authorized service center located within 100 miles of the installation. Sales representatives or distributors do not qualify as a service center unless a service technician has been to the manufacturer's school and has been certified.

1.5 WARRANTY:

A. Warranty shall be manufactures standard warranty that shall cover 12 months from date of startup but limited to 18 months from date of shipment.

B. The VFD shall be provided with an additional 5 year warranty to provide a total of a six year warranty on the VFD. This warranty includes coverage for momentary line or load anomalies such as lightning strikes. This includes the cost for travel for one visit to the customer site for repair or replacement of the VFD. The extended warranty shall cover momentary line anomalies including lightning.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURES:

A. Global Pump Solutions

B. Pump Solutions

C. Engineer / Owner Approved Equal

2.2 PUMP CONTROL PANEL:

A. SCOPE:

1. A control system shall be provided containing all of the mechanical and electrical equipment necessary to provide for the operation of the submersible pumps as specified herein, depicted on the drawings, or required for the proper operation of the system.

2. The system shall provide all of the required components including to but not limited to main disconnect, surge protection, phase monitor, fuses/blocks, Variable Speed Drives, high speed drive fuse protection, backup alternator, door devices, and configurable controller with level signal devices.

B. ENCLOSURE:

1. The control panel enclosure shall be NEMA 4X 316 stainless steel. The door shall open a minimum of 180 degrees with a door holder. The enclosure door shall use a 3 Point latch system. A padlock hasp shall be provided.

2. The enclosure shall contain a pour in place two part urethane gasket. Adhesive strip gaskets will not be allowed.

3. A back plate shall be manufactured from 12 gauge sheet steel and shall be finished with a primer coat and two (2) coats of baked on white enamel. All hardware shall be mounted using machine thread screws. Sheet metal or self-tapping screws shall not be acceptable. All installed devices shall be permanently identified with engraved legends.

4. The enclosure shall be equipped with the following minimum equipment/capability:

    a. Main circuit breaker.
    b. VFD for each pump provided.
    c. Separate control and alarm circuit fuses.
    d. Terminal Blocks.
    e. Isolated terminal for neutral wire & grounding.
    f. Individual pump circuit breakers.
    g. Control power circuit breaker.
    h. Lightning arrester.
    i. Phase monitor.
    j. Digital elapsed time meters.
    k. Ammeter for each pump (available on VFD keypad mounted on the deadfront)
    l. H-O-A switch for each pump.
    m. Schematic diagram in box cover.
    n. Red light and audible horn alarms.
    o. Spare fuse and bulb for each size and type.
    p. UL508-approved panel design.
    q. Allen Bradley PLC
    r. Ethernet switch
    s. Air conditioner

5. VFD Keypads shall be remote mounted on the dead front enclosure.

6. Phoenix Contact 12 DC 72 Watt Power Supply with built in UPS to maintain 8 Amp-hr gel cell battery.

7. Condensate heater. Provide 200 Watt 120 VAC condensate heater that is protected by the required sized miniature circuit breaker.

8. Provide one GFCI receptacle that is for use only to power programming devices.

C. POWER DISTRIBUTION:

1. The panel power distribution shall include all necessary components and be wired with stranded copper conductors rated at 90 degrees C. Conductor terminations shall be as recommended by the device manufacturer.

2. The panel shall be provided with a main breaker. Power supply to the panel will be 480 volts, 3-phase.

3. The power system shall contain incoming power terminals, main circuit breaker, and motor circuit breakers control circuit breaker. All circuit breakers shall be heavy duty thermal magnetic or motor circuit protector. Each breaker shall be sized to adequately meet the operating conditions of the load and have a minimum interrupting capacity of 42,000 amps at 480 volts. Breakers shall be indicating type, providing "on/off/tripped" positions on the handle. They shall be quick-make quick-break on manual and automatic operation and have inverse time characteristics. Breakers shall be designed so that tripping of one pole automatically trips all poles.

4. Each VFD shall be provided with a line side circuit breaker rated for 25 kA short circuit current rating and sized for motor load. Each VFD shall contain high speed fuses to provide type 1 protection for the VFD. VFD shall be protected by high speed J type fuses such as the Bussman JKS.

5. A lightning transit protector shall be provided. The device shall be a solid state device with a response time of less than 5 nanoseconds with a withstanding surge capacity of 6500 amperes. Units shall be instant recovery, long life and have no holdover currents.

6. The following shall be supplied as standard equipment:

   a. Phase/voltage monitor with two (2) sets of double pole double throw contacts. Unit shall be provided with adjustable trip delays.

   b. LED type Pump Run/Failure pilot lights.

   c. Elapsed Time meters for each pump.

D. PUMP PROTECTIVE DEVICES:

1. Each pump shall be protected by a solid state relay to monitor motor winding temperature and seal leakage.

   a. Seal Fail and High Pump Temp Monitor Relay shall be provided per pump. CA462 model is for submersible pumps equipped with leakage or temperature sensors. Unit shall be mounted on exterior of dead front and provided status indicators for power and alarm conditions. Unit shall provide for auto or manual reset. Individual NO/NC contacts per alarm.

2. Include phase-loss, unbalance (voltage & current), reversal and over/under-voltage protection assembly with adjustable nominal voltage setting for each phase motor. This device shall drop-out pumps if all phases drop below 90% or if one phase drops below 80-83% nominal voltage. This device shall have a nominal ½ second dropout delay and adjustable automatic restoration time delay of up to five minutes.

3. Do not lockout out the pump for events that are not directly associated with the pump, such as under voltage, or phase loss, but only prevent the motors from operating under these conditions. Lockout the motors for events that are directly related to the motor.

4. Motor Current Sensing: available on VFD keypad mounted on the deadfront.

E. VARIABLE FREQUENCY DRIVES:

1. Provide a variable frequency drive (VFD) for each pump. Furnish the VFD complete as specified herein for the motor horsepower provided. VFD's shall be user-selectable for either constant or variable torque loads.

2. The VFD shall be a 18 pulse or Active Front End (AFE) design or Passive Harmonic Filter with 6-Pulse Variable Frequency Drive. The VFD shall be of a PWM output design utilizing current IGBT inverter technology and voltage vector control of the output PWM waveform and shall output a waveform that closely approximates a sine wave.

3. The manufacturer of the VFD shall demonstrate a continuous period of manufacturing and development of VFD's for a minimum of 40 years. VFD's that are brand-labeled are not acceptable. The VFD shall produce an output waveform capable of handling maximum motor cable distances of up to 1,000 ft. (unshielded) without tripping or de-rating.

4. VFD shall automatically boost power factor at lower speeds. In variable torque applications, the VFD shall provide a CT-start feature and be able to provide full torque at any speed up to the base speed of the motor. In either CT or VT mode, the VFD shall be able to provide its full rated output current continuously and 110% of rated current for 60 seconds.

5. Switching of the input power to the VFD shall be possible without interlocks or damage to the VFD at a minimum interval of 2 minutes. Switching of power on the output side between the VFD and the motor shall be possible with no limitation or damage to the VFD and shall require no additional interlocks.

6. The VFD shall include an integral RFI filter conforming to the A2 standard as a minimum. VFD shall provide full galvanic isolation with suitable potential separation from the power sources (control, signal, and power circuitry within the drive) to ensure compliance with PELV

requirements and to protect PLC's and other connected equipment from power surges and spikes. All inputs and outputs shall be optically isolated. Isolation boards between the VFD and external control devices shall not be required.

7. The VFD shall provide internal DC link reactors to minimize power line harmonics and to provide near unity power factor. DC Link reactor shall be installed so that power fluctuations to the DC Capacitors shall be reduced to increase Capacitor life. VFD's without a DC link reactor shall provide a 5% impedance line side reactor and provide spare capacitors.

8. VFD shall have input surge protection utilizing MOV's, spark gaps, and Zener diodes to withstand surges of 2.3 times line voltage for 1.5 msec. Printed Circuit boards shall be conformal coated to reduce the corrosion effect from environmental gases and other conditions. The conformal coating must meet IEC 61721-3-3, Class 3C2. VFD shall include circuitry to detect phase imbalance and phase loss on the input side of the VFD.

9. VFD shall include current sensors to monitor all three-output phases to detect and report phase loss or unbalance or other power issues to the motor. The VFD shall identify which of the output phases is low or lost.

10. VFD shall provide an alphanumeric backlit display keypad (LCP) which may be remotely mounted using a standard 9-pin cable. VFD may be operated with keypad disconnected or removed entirely. The remote mount must meet N4X rating. Keypad may be disconnected during normal operation without the need to stop the motor or disconnect power to the VFD.

11. All VFD's shall be of the same series, and shall utilize a common control card and LCP (keypad/display unit) throughout the rating range. The control cards and keypads shall be interchangeable through the entire range of drives used on the project.

12. A battery back-up shall be provided to maintain internal clock operation during power interruptions. Battery life shall be no less than 10 years of normal operation.

13. The VFD shall have an adjustable output switching frequency.

14. Four complete programming parameter setups shall be provided, which can be locally selected through the keypad or remotely selected via digital input(s), allowing the VFD to be programmed for up to four alternate control scenarios without requiring parameter changes.

15. In each programming set up, independent acceleration and deceleration ramps shall be provided. Acceleration and deceleration time shall be adjustable over the range from 0 to 3,600 seconds to base speed.

16. The VFD shall have four programmable "Bypass frequencies" with adjustable bandwidths to prevent the driven equipment from running at a mechanically resonant frequency. The feature shall offer a Semi-Automatic program to simplify the set-up.

17. In each programming setup, independent current limit settings, programmable between 50% and 110% of the drives output current rating, shall be provided.

18. The VFD shall include a "loss of follower" function to detect the loss of process feedback or reference signals with a live-zero value and a user-selectable choice of responses (go to set speed, min speed, max speed, stop, stop, and trip).

19. An initial ramp function shall be available to provide a user-selectable ramp, up to 60 seconds, for applications requiring a faster or slower ramp than the normal ramp.

20. A Dual Ramp feature shall include a Check Valve Ramp and a final Ramp feature. The Check Valve Ramp shall be programmable to gently seat a check valve and reduce the potential of damage from excess pressure while shutting-down the system. Both time and end speed shall be programmable. On the Final Ramp, the VFD shall be programmable to quickly stop the motor after seating of a check valve or for a more rapid stopping than the normal ramp down setting.

21. The ambient operating temperature of the VFD shall be -10ºC to 50ºC (14 to 122°F), with a 24-hour average not to exceed 45ºC. Elevation to 3,300 feet (1000 meters) without de-rating. VFD shall provide full torque to the motor, given input voltage fluctuations of up to +10% to -15% of the rated input voltage (525 to 690VAC, 380 to 480VAC, or 200 to 240VAC). Line frequency variation of ± 2% shall be acceptable.

22. The VFD shall be equipped with a standard RS-485 serial communications port and front-of-drive accessible USB port. ModBus RTU communications shall be integrally mounted.

F. SENTRY PUMP CONTROLLER:

1. System Operation:

a. The control panel shall function as a triplex system. Operation of the pumps will be staged in a lead, lag, and standby sequence.

i. Control panel shall ensure no more than 2 pumps are operating at a time.

b. The primary control will consist of a "SENTRY" programmable controller, operator interface & ultrasonic level transducer as specified here after. The pump controller shall consist of all the components, hardware and software to provide a trouble-free

pumping station.

2. SENTRY Pump Controller:

   a. The control system shall utilize standard "off the shelf" equipment. Job specific, "one-of-a-kind" customized software and hardware components will not be accepted. A standard system is defined, as one, which has published literature, is available at time of bid, with fully tested hardware and software, such that no development must be done beyond system configuration.

   b. The equipment shall be protected from transient voltages and surges induced into the signal lines. The contractor shall provide a permanent earth ground connection to the panel ground lug in order to insure proper operation of transient protectors.

   c. A microprocessor-based automatic pump and alarm control system shall be provided for each pumping station incorporating an industrial-grade, 16-bit CMOS microcomputer and associated elements suitable for achieving performance as hereinafter described. The controller will incorporate the following:

      i. Internal diagnostics.
      ii. Real time clock calendar.
      iii. Floating-point math.
      iv. Battery back up.
      v. Non-proprietary RTU communication.
      vi. (4) PID loops.

   d. The system shall incorporate UL 508 Industrial Control Panel approved elements as required of all components of these project panels and be furnished with all necessary hardware and software to accomplish level-responsive pump and alarm operation with software specifically suited to this project.

   e. All of the discrete I/O circuitry of the computer-based system shall be built to the IEEE 472 (1974) Surge Withstand Capability Standards. The automatic pump and alarm control system computer shall be the standard product of the control system manufacturer and specifically suited for this type of industrial control panel service. All job connections shall be a UL recognized clamp type barriered screw terminals accepting up to two AWG 14 conductors per terminal.

   f. The variable speed drive equipment shall be programmed to respond to variations in the wetwell in a manner wherein the hydraulic requirement will be accommodated in the pumping program using simple menu-related operator interface routines.

g. Upon power-up, the Controller shall go through a timing routing, which allows the analog signal and display to stabilize before any control, or alarm outputs are enabled. After the stabilization period, the control circuits of the Controller shall be sequentially enabled on a time-step arrangement.

h. In addition to the time delay upon power-up, the differential-level control circuits shall each be forced to an off condition upon power up so that a level excursion will need to go past their turn-on elevation for them to operate.

i. An alternator shall operate the pumps in a First-on/First-off (FOFO) sequence and can be configured to sequence the pumps every start, every 24 hours, on the lowest run time or manually.

j. The alternator shall be capable of accepting pump failure and/or advance inputs and shall automatically transfer to the next pump sequence when failure condition input is sensed.

k. The alternator shall provide automatic transposing of the operating sequence of the control relays for the pumps on successive starts. The FOFO alternator sequencing shall operate such that the next load turned on is always the one that has had the longest opportunity to rest since its last operation.

l. It is the specific intention of this functional requirement that a standard programmable logic controller will be employed with features as herein described and be a fully integrated assembly. That is, the furnishing of similar functions using a proprietary controller with custom software, a multiplicity of setpoints, modules or extensive relay-timer logic to accomplish control sequences, etc., is specifically precluded by this specification and will not be acceptable.

m. Microprocessor based, programmable controller and operator interface shall provide all of the above controls and operations. A redundant back up float system shall be incorporated into the controller along with programmable automatic operation.

n. The automatic pump and alarm control shall employ a backlit LCD operator interface having a 10" 800 x 480 pixel 65k color display with touch screen. The operator interface shall be IEC standard IP65F rated. The display also must support bar graphs or analog meters for wetwell levels, VFD #1, #2, #3 speed indication.

o. A Configuration and Operations Manual will be included for the pump controller. The Manual shall include the following information as a minimum:

i. How to view and change between the various displays.
ii. How to configure the controller.
iii. How to display alarms.
iv. How to display statuses.
v. Analog control set point adjustment.
vi. Analog alarm set point adjustment.
vii. How to view and reset pump run times.
viii. How to view and reset pump start counters.
ix. Security Password usage.
x. An example of programming values.
xi. Adjustment of the real-time calendar/clock.
xii. A listing of values programmed at the factory.
xiii. A worksheet for entering the values programmed in the field.

p. The intent of the specification is that a standard controller be provided, with standard documentation. A custom written Description of Operation is not acceptable.

3. Controller Configuration

a. The pump controller operates on a 4-20mA input via a ultrasonic level transducer and shall be capable of being configured at the factory or jobsite to perform operating functions as described below. All configurations are password protected and shall be provided as a minimum as follows:

i. Simplex/Duplex/Triplex Pump operation.
ii. Clock hours (0-23) and minutes (0-59).
iii. Calendar day of week (0-6 for Monday - Sunday).
iv. Wetwell ultrasonic transducer rating.
v. Wetwell ultrasonic transducer offset.
vi. Lag pump(s) disable for non-additive systems.
vii. Pump Alternation method.
viii. Minimum 1 Pump Speed.
ix. Minimum 2 Pump Speed.
x. Minimum 3 Pump Speed.
xi. Maximum 1 Pump Speed.
xii. Maximum 2 Pump Speed.
xiii. Maximum 3 Pump Speed.
xiv. Set Flush Cycle time of day.
xv. Shut down, Alarm only or Standby pump designation upon Seal fail.
xvi. On board or Redundant float back up with weekly test feature.
xvii. Selectable pump fault for Low oil, Bearing overtemp or Check valve limit switch.

b. The pump controller will include the field adjustable delay timers. All timer settings are password protected and shall be provided as follows:

i. Pump 1 start fail delay (0-99 seconds).
ii. Pump 2 start fail delay (0-99 seconds).
iii. Pump 3 start fail delay (0-99 seconds).
iv. Lead pump start delay (0-99 seconds).
v. Lag pump start delay (0-99 seconds).
vi. Lag 2 pump start delay (0-99 seconds).
vii. High Level alarm delay (0-99 seconds).
viii. Low Level alarm delay (0-99 seconds).
ix. Delay between calls (0.1-9.9 minutes).
x. Back up float pump down timer (1-5 minutes)
xi. Back up float lag call timers (0-99 seconds)

c. The pump controller will include the field adjustable set points. Set points are password protected and provided as follows:

i. Lead pump start.
ii. Lead pump stop.
iii. Lag pump start.
iv. Lag pump stop.
v. Lag 2 pump start.
vi. Lag 2 pump stop.
vii. High Level Alarm.
viii. Low Level Alarm.
ix. Back up high float.
x. Flush Cycle on/off.

d. Provide menu driven screen displays for the following:

i. Wetwell Level.
ii. Pump Run time values scaled to hours and tenths.
iii. Pump Start counters.
iv. Alarm Messages.

4. FLUSH CYCLE

a. The controller includes a flush cycle that will run the variable speed pumps at 100% in order to help clear any obstructions that may have developed by the pumps operating at lower velocities.

b. The flush cycle can be operated automatically daily or weekly or manually on demand as follows:

i. AUTO: Flush Cycle automatically controlled by using the preset set points.

- Configure screen: Flush DAY (M-SU or Daily).
- Configure screen: Flush HOUR (0-23, or Disable).
- Modify Set points screen: Flush Cycle. ON and OFF setpoint/level.

ii. MANUAL: On demand

- Start Flush Cycle button: Stops any running pump(s) to allow the w/w to fill to preset start level. Start all pumps and ramp speed to 100%. Pump will be stopped and flush cycle ended when the stop flush set point is reached.

- Cancel Flush Cycle button: Aborts the Flush cycle immediately.

    - Indicators:
    - Event screen (Time & Date stamp)

        > FLUSH START – Message appears when the Auto or Manual feature activates the flush cycle.

        > FLUSH CANCEL – Message appears when the Manual/Cancel Flush Cycle is activated.

        > FLUSH PUMP DOWN – Pump(s) are being called to run during the flush cycle.

        > FLUSH CYCLE DONE – Message appears when a running pump is stopped at the end of a flush cycle or when a flush cycle is cancelled.

c. Operation:

i. At the start of any flush cycle, the first action is to stop any pump that may be running. The wet well will be allowed to fill to the Flush ON set point (note: the transducer Hi & Low Level alarms are disabled during a flush cycle). When the wet well level reaches the Flush ON setpoint, the Lead pump and lag pump will be started and speed ramped up to meet the flow 2 setting as specified in Section 11220 – *Submersible Wastewater Pumps*. The lead and lag pumps will operate at this setting until the Flush OFF set point is reached. All pumps will be stopped. The flush cycle is now complete. Note, if the flush OFF set point is set below the transducer Low Level alarm level, a Low Level alarm condition will now occur and will clear as the wet well level rise above the Low Level alarm set point.

5. ALARM MESSAGES

   a. In the event of an alarm condition the operator interface will display an alarm message. Press the 'Alarm Ack' button to acknowledge the alarm and 'Alarm Reset' button to clear the alarm. The following list of alarms shall be provided:

      i. Low Level.
      ii. High Level.
      iii. Pump 1 Fail.
      iv. Pump 2 Fail.
      v. Pump 3 Fail.
      vi. Ultrasonic Level Transducer Fail.
      vii. Seal 1 Fail.
      viii. Seal 2 Fail.
      ix. Seal 3 Fail.
      x. Motor 1 Overtemp.
      xi. Motor 2 Overtemp.
      xii. Motor 3 Overtemp.
      xiii. Pump 1 Fail (Configurable from external device).
      xiv. Pump 2 Fail (Configurable from external device).
      xv. Pump 3 Fail (Configurable from external device).
      xvi. Backup Float Test Fail.Hardware.

6. The pump controller shall be programmed via built-in operator interface. The interface shall consist of pushbuttons in combination with a 2-line LCD backlit display in English. The front panel shall also include LED indicators for controller operation, communication status, alarm status, pump operation status, and individual critical alarms.

   a. The front panel operator interface shall be rated IP65 (applicable to NEMA 4 standard).

   b. The pump controller shall include 3 communications ports. One port shall be RS-232 and dedicated to service functions (local programming of controller with laptop).

   c. The other two ports shall be RS-232/485 capable, and available for use as communication interface to dialup modem, leased line modem, GSM modem, or radio.

7. Functions:

   a. The pump controller shall operate the pumps in accordance with operator programmed set points. The controller shall also be capable of remote start-stop functions via network. The following information shall be observed on the front panel display:

      i. Start-stop pump levels.
      ii. Alarm levels for low, high and overflow.
      iii. Pumped volume for two days.
      iv. Number of starts for each pump.

v. Run time for each pump.

b. The pump controller shall provide for local display, acknowledgement and remote notification of alarm conditions. The controller shall log up to 1000 alarm events. Alarm capabilities shall include the following. In addition to alarms available through the ModBus, provide normally open, dry contacts for each of the following.

i. Wet Well High Level.
ii. Wet Well Low Level. (This alarm shall not be activated during the sump cleaning function.)
iii. Pump Over-current (each pump.)
iv. Pump Under-current (each pump.)
v. Pump Fail to Start (each pump.)
vi. Pump Over-temperature (each pump.)
vii. Pump Seal Fail (each pump.)
viii. Pump Service Alarm (when pump run time exceeds preset service interval.)
ix. Intrusion Alarm.
x. Personnel Alarm (adjustable time-delay alarm if not acknowledged by on-site personnel.)
xi. Power Failure.
xii. Communications Failure.

c. The pump controller shall be capable of alternating which individual pump responds to the "Lead Pump Call" and subsequent "Lag Pump Call" signal to control the total pump run time on each of the pumps.

d. The level control system shall have operator selectable level control points. At a minimum, provide the following points:

i. Low level alarm.
ii. Pump shutoff. At this level, all pumps will be off, unless the sump cleaning function is being implemented.
iii. Lead pump on.
iv. Lag pump off.
v. All pumps on.
vi. Wetwell High Level.

e. The pump controller shall include an automatic override to start the lag pump if the lead pump fails for any reason, or is turned off.

f. The pump controller shall contain a real-time clock and shall time and date stamp all logged data. The controller shall store logged data for a period of up to 30 days.

8. Communications:

   The pump controller shall be capable of communicating via ModBus protocol.

G. CONTROL STRATEGY:

1. The sewage pumps shall be controlled by the PCP. Each pump shall also be connected to a VFD. An Ultrasonic level transducer (ULT) shall provide primary level control with a float switch system providing a redundant, secondary level control.

2. Refer to Section 11220 – *Submersible Wastewater Pumps*.

H. AUXILIARY DEVICES:

1. All devices shall be mounted on the front of the enclosure. No devices shall be mounted on the sides of the enclosure. Devices mounted on the enclosure shall have the same NEMA rating as the enclosure.

2. Pushbuttons shall be of the heavy-duty oiltight type, mounted on the front of the starter enclosure.

3. Selector switches shall be of heavy duty, oiltight type, mounted on the starter cover.

4. The operator button shall be molded Bakelite and solid in color throughout the material. Painted buttons are not acceptable. A suitable and clearly legible nameplate shall be provided for each button to designate its function.

5. All contact blocks shall be made of molded, high arc resistant material and shall have a minimum of one normally open, and one normally closed contact, with a continuous current rating of 10 amperes, 600 volts. All terminals shall be readily accessible, contact blocks shall be easily changed, or be arranged for the addition of contacts.

6. Pilot lights shall be an integral part of control station when indicated. Indicating lights shall be LED type, push to test, rated for the enclosure. Contractor shall install pushbuttons and selector switches not factory mounted.

7. Provide adjustable 1-60 second “on” time delay relay for each motor to stop the motor on loss of power. Set the first motor relay at 30 seconds and stagger each motor 30 seconds.

I. LOCAL ALARM:

A flashing red alarm light shall be provided. The alarm light shall be weatherproof and shatterproof with a minimum 4 inch diameter and an LED lamp. The alarm light shall be located on the panel. The alarm light shall be activated under the following conditions:

1. Wetwell High Level.
2. Any pump lockout condition.

J. CONTROL POWER:

1. Provide a control power transformer to step-down power from 480 volts to 120 volts and/or 24 volts. The control power transformers shall be sized to provide all control power requirements for the control panel.

2. Control power transformer shall be minimum 1.0 kVA with primary and secondary fuses.

3. Control power for the alarm system shall be provided with a battery backup that provides backup power for a minimum of 24 hours.

K. PRIMARY LEVEL CONTROL SYSTEM:

The Contractor shall furnish the following, and calibrate the instruments to the specific sewage lift station equipment:

1. Ultrasonic level transducer (ULT) per Instrument specification 13440. Unit shall have a range suitable for the wetwell depth. The level system shall provide a 4-20 mA signal back to the PCP based on level in the wetwell.

2. The ULT shall be mounted using a stainless steel support in a location that provides proper control of the pumps.

3. The transducer assembly shall be installed at a location at the wetwell which exhibits minimum turbulence (i.e. away from wetwell inlets and pumps) and that is in accordance with the manufacturer's recommendations. Connect the transducer with other system elements and place in successful operation. It shall be provided with input power and output signal transient protection, associated control elements as specified herein and in accordance with the Manufacturer's instructions.

4. All accessories, clamps, cable, pipe, couplings, bolts, screws and miscellaneous hardware shall be Type 316 stainless steel unless otherwise specified.

L. BACK-UP LEVEL CONTROL SYSTEM:

1. The Contractor shall furnish the following for each PCP required, and calibrate the instruments to the specific sewage lift station equipment.

2. The liquid level of the sewage lift stations shall be sensed by a level detecting device that shall consist of float switches with a mercury switch inside and flexibly supported by a PVC jacketed, heavy-duty cable system.

a. The number of floats and the mounting regime shall be as directed by the Engineer. Each system shall be installed in accordance with the Manufacturer's instructions.

b. Each float switch shall have a 20 A rating at 115 VAC and 10 A at 230 VAC. The float shall be type SO with three # 14 AWG fine-stranded copper conductors. The float shall be mounted using Type 316 stainless steel hardware.

c. The float switch system shall be furnished in quantities and with such accessories as are required by the Engineer to perform the specified control and alarm functions of these applications.

3. Each float switch system shall contain a SPST-NO/NC switch that makes or breaks circuit as the sensed liquid level rises or falls past the float mounting elevation. The ON/OFF level differential is less than 1-inch so the float essentially senses a single level.

4. Since the float switch system is a back-up to the ULT, it shall use three (3) independent floats. Backup float operation shall be as indicated in Section 11220 – *Submersible Wastewater Pumps*.

5. Basic float switch system equipment features shall be as follows:

a. Floats: Type 316 SS, 5½-inch diameter, # 20 gauge, permanently assembled to switch and cable.

b. Cable: Type SO, 5/8-inch O.D., Nitrile PVC jacket, 3- #14 AWG fine-stranded conductors for heavy flexing, underwater service. Switches shall be colored black and white.

c. Switch:Tilt type, NO or NC. Low tilt angle shall give less than 1-inch level differential. AC resistive rating 20 amps at 115, 10 amps at 230. AC lamp load 1000 watts. Encapsulated permanent. NO floats are orange. NC floats are red.

d. Mounting: Clamp tube, bracket and U-bolts are 316 SS.

6. The float switch system shall conform to the following:

a. Provide wetwell high level alarm signal to station SCADA. Such service shall be capable of operating the alarm light, and alarm annunciating station, bells, horns, etc.

b. When installing the float switch system, the green conductor of the three-wire cable is to be connected to the float body and shall be run to an electrical ground.

c. The float switch system shall be guaranteed against defects in materials and workmanship for three (3) years from date of shipment from the factory. Defective floats shall be replaced FOB factory in exchange for the defective floats shipped

prepaid to the factory.

d. The float switch system shall be connected to the pump and alarm controller specified above.

M. CABLE HOLDERS:

1. Cable holders shall be constructed of 316 stainless steel.

2. Install, on opposite sides of the wet well hatch opening, separate cable holders (Kellums grips) to support pump power cables (one for each pump in the lift station), float switches. Ensure cables are routed such that any individual pump can be raised from the wet well without interference with adjacent pump/float cables.

PART 3 EXECUTION

3.1 INSTALLATION:

A. The pump control panel shall be installed as indicated on the plans.

3.2 FIELD TESTING, TRAINING AND STARTUP:

A. Provide the services of a factory-trained and fully-qualified representative for one day to inspect the completed installation, make all adjustment necessary to place the system in trouble-free operation.

B. Provide one day of training for the Owner's operating personnel in the proper operation, care and maintenance of the equipment. Visit to be after water is available and pumps can be operated for extended periods.

C. Test and demonstrate proper operation of system.

D. Set pump control to occur at the various wet well levels indicated on the Plans and demonstrate pump operation at each level.

E. Fill basin and allow pump to cycle several times. Then shut off pump and allow basin to fill to trip the high water alarm. Demonstrate that all normal operations and alarm functions of the installed station work as designed and intended.

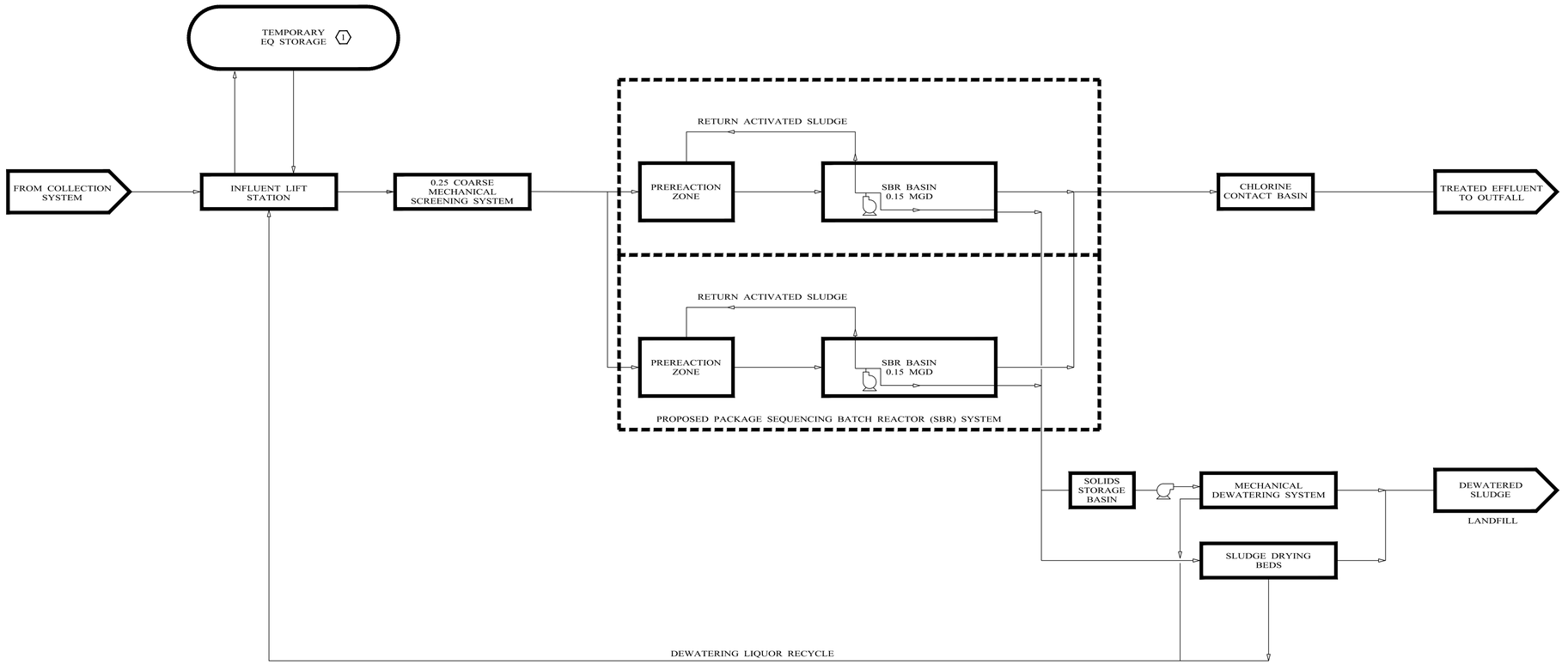
F. Measure motor current and voltage during testing and submit readings in accordance with section 01300 - *Submittals*.

3.3 SCHEMATIC:

A schematic diagram of wire coloring shall be permanently fastened to the inside of the enclosure. Schematic shall be specific to the control panel and shall reflect as-built conditions. An installation and service manual shall also be included with control panel.

END OF SECTION

DRAWINGS



INFLUENT LIFT STATION:

3 SUBMERSIBLE PUMPS (2 DUTY, 1 SPARE)
CAPACITY: 417 GPM (0.6 MGD) EACH
TDH: 46 FT
FIRM CAPACITY: 833 GPM (1.2 MGD)

MECHANICAL SCREENING SYSTEM:

1 SCREEN - 1/4-INCH
DESIGN CAPACITY: 0.3 MGD
PEAK CAPACITY: 1.2 MGD

MANUAL BAR SCREENING SYSTEM:

1 SCREEN - 1" BAR SPACING
DESIGN CAPACITY: 0.3 MGD
PEAK CAPACITY: 1.2 MGD

PREREACTION ZONE:

No. BASINS: 2
LENGTH: 6 FT
WIDTH: 15 FT EACH
SWD: 17.9 FT
VOLUME: 1612 FT^3 (12,057 GALLONS) EACH
TOTAL VOLUME: 3,224 FT^3 (24,114 GALLONS)

SBR BASIN:

No. BASINS: 2
LENGTH: 48 FT
WIDTH: 20 FT EACH
SWD: 17.9 FT
VOLUME: 17,184 FT^3 (128,536 GALLONS) EACH
TOTAL VOLUME: 34,368 FT^3 (257,072 GALLONS)

PROCESS AIR BLOWERS (SBR BASIN):

3 BLOWERS (2 DUTY, 1 SPARE)
DESIGN BLOWER FLOWRATE (EACH): 648 SCFM
MAXIMUM DESIGN DISCHARGE PRESSURE: 6.7 PSIG
MOTOR: 7.5 HP

SBR RAS/WAS PUMPS:

2 SUBMERSIBLE PUMPS
FLOWRATE: 108 GPM EACH
TDH: 25 FT
MOTOR: 2-3 HP

CHLORINE CONTACT BASIN:

No. BASIN: 2
PEAK CAPACITY: 2.40 MGD
CONTACT TIME AT PEAK FLOW: 20 MINUTES MINIMUM
LENGTH: 27 FT
WIDTH: 9 FT EACH
SWD: 8.99 FT
VOLUME: 2,185 FT^3 (16,341 GALLONS) EACH
TOTAL VOLUME: 4,369 FT^3 (32,681 GALLONS) 2

SOLIDS STORAGE BASIN:

No. BASINS: 1
LENGTH: 29 FT
WIDTH: 29 FT
SWD: 10 FT
VOLUME: 8,410 FT^3 (62,907 GALLONS)

SOLIDS TRANSFER PUMPS:

1 SLUDGE PUMPS
DESIGN CAPACITY: 37 GPM
TDH: 25 FT
HORSEPOWER: 0.5 HP

SLUDGE DEWATERING SYSTEM:

1 MECHANICAL DEWATERING SCREW PRESS
FLOW RATE: 26 GPM
DEWATERING CAKE CONCENTRATION: 12-20%

PLANT WATER PUMP STATION:

2 SELF-PRIMING PUMPS (1 DUTY, 1 SPARE)
PUMP CAPACITY (EACH): 105 GPM
TDH: 150 FT
HORSEPOWER: 15 HP
HYDROPNEUMATIC TANK VOLUME: 1,500 GALLONS

NOTES INDICATED ON DRAWING BY ⟨#⟩:

1. TEMPORARY EQ STORAGE IS LESS THAN 48 HOURS.

NO.	REVISION	DATE
0	ISSUED FOR ADVERTISEMENT	08/27/2024
1	ADDENDUM No. 2	09/24/2024
2	ADDENDUM No. 3	10/04/2024

10/04/2024

Brittany D. White

STATE OF TEXAS — BRITTANY D. WHITE — 128714 — LICENSED PROFESSIONAL ENGINEER

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DRAWN BY J.CASSIDY
CHECKED BY C.RICH
SCALE NO SCALE
DATE 10/04/2024

CITY OF TOLAR
WASTEWATER TREATMENT PLANT IMPROVEMENTS

PROPOSED PROCESS FLOW DIAGRAM

PROJECT NO.: 8434
SEQUENCE No. 8 OF 123
SHEET No. 00D-02

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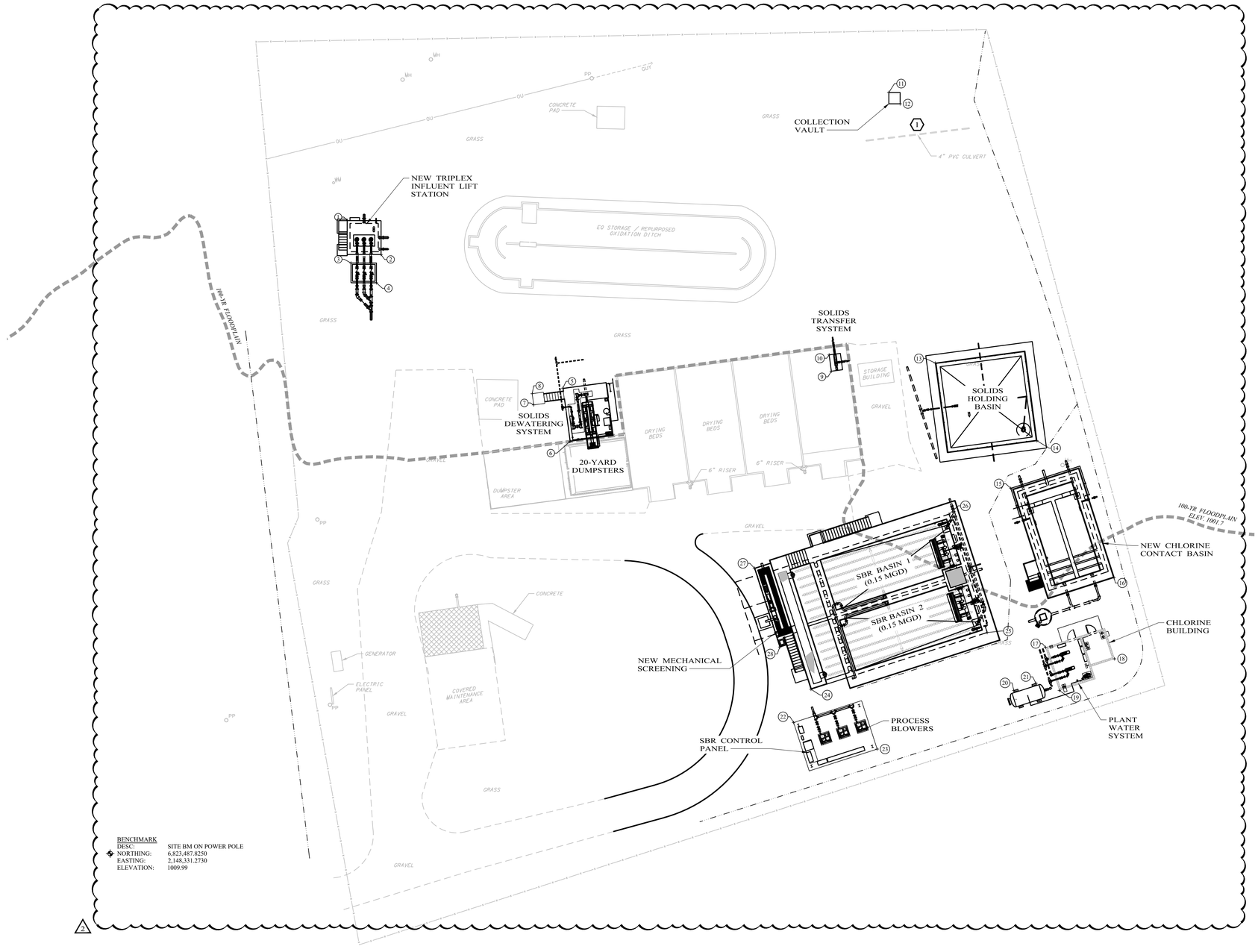

LEGEND

- MH — MANHOLE - SANITARY SEWER
- WM — WATER METER
- EM — ELECTRIC METER
- PP — POWER POLE
- GUY — GUY ANCHOR
- CHAINLINK FENCE
- OU — OVERHEAD UTILITY LINE
- FLOOD ZONE

SCALE IN FEET
10 0 20

Point Table		
Point #	Northing	Easting
1	6823711.7689	2148415.1143
2	6823699.7689	2148427.1143
3	6823696.7689	2148416.4705
4	6823689.7689	2148425.4705
5	6823652.4718	2148491.4127
6	6823633.6335	2148493.9390
7	6823646.5684	2148481.1087
8	6823650.5329	2148480.5771
9	6823658.4814	2148586.4067
10	6823664.2632	2148585.6336
11	6823757.0799	2148606.7481
12	6823753.0799	2148610.7481
13	6823661.3702	2148623.1899
14	6823633.8936	2148659.1487
15	6823617.0578	2148649.8892
16	6823585.4735	2148686.3956
17	6823560.7840	2148662.1820
18	6823556.7359	2148686.5962
19	6823545.5534	2148667.0839
20	6823545.5107	2148650.9449
21	6823548.0384	2148658.7985
22	6823534.2019	2148573.0620
23	6823524.8034	2148602.6125
24	6823545.9751	2148579.2006
25	6823566.0419	2148641.5493
26	6823607.9249	2148628.0693
27	6823588.7827	2148559.2075
28	6823560.8963	2148568.1827

BENCHMARK
DESC: SITE BM ON POWER POLE
NORTHING: 6,823,487.8250
EASTING: 2,148,331.2730
ELEVATION: 1009.99

UTILITY WARNING

THE UNDERGROUND UTILITIES SHOWN HAVE BEEN LOCATED FROM FIELD SURVEY INFORMATION AND EXISTING DRAWINGS. THE SURVEYOR MAKES NO GUARANTEE THAT THE UNDERGROUND UTILITIES SHOWN COMPRISE ALL SUCH UTILITIES IN THE AREA, EITHER IN SERVICE OR ABANDONED. THE SURVEYOR FURTHER DOES NOT WARRANT THAT THE UNDERGROUND UTILITIES SHOWN ARE IN THE EXACT LOCATION INDICATED ALTHOUGH HE DOES CERTIFY THAT THEY ARE LOCATED AS ACCURATELY AS POSSIBLE FROM INFORMATION AVAILABLE. THE SURVEYOR HAS NOT PHYSICALLY LOCATED THE UNDERGROUND UTILITIES.

NOTES INDICATED ON DRAWING BY (#):

1. REFER TO SITE GRADING PLANS FOR CONTINUATION.

GENERAL NOTE:

1. 100-YEAR FLOOD ELEVATION PER FEDERAL EMERGENCY MANAGEMENT AGENCY (FEMA) FLOOD RISK INFORMATION REPORT THROUGH THE ESTIMATED BASE FLOOD ELEVATION VIEW ON 01/06/2023.

NO.	REVISION	DATE
0	ISSUED FOR ADVERTISEMENT	08/27/2024
1	ADDENDUM No. 2	09/24/2024
2	ADDENDUM No. 3	10/04/2024

10/04/2024

Brittany D. White

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CHECKED BY C.RICH
SCALE 1" = 20'-0"
DATE 10/04/2024

CITY OF TOLAR
WASTEWATER TREATMENT PLANT IMPROVEMENTS

MODIFIED SITE PLAN

PROJECT NO.: 8434
SEQUENCE No. 17 OF 123
SHEET No. 01C-04

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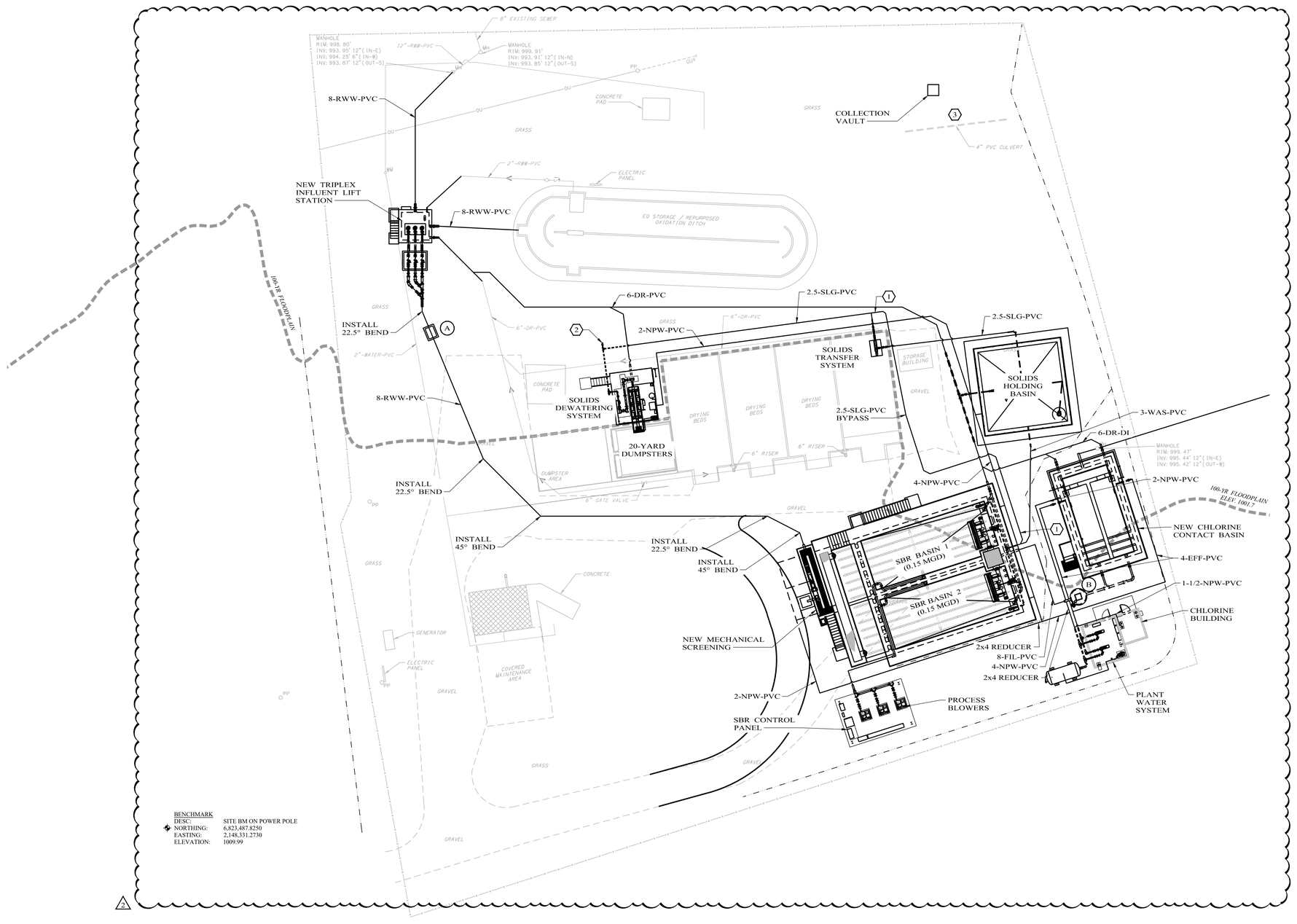

LEGEND

- MANHOLE - SANITARY SEWER
- WATER METER
- ELECTRIC METER
- POWER POLE
- GUY ANCHOR
- CHAINLINK FENCE
- OVERHEAD UTILITY LINE
- EXISTING SITE PIPING
- PROPOSED SITE PIPING
- FLOOD ZONE

10 0 20
SCALE IN FEET

VAULT SCHEDULE

POINT (#)	DESCRIPTION
A	MECHANICAL COARSE SCREEN METER VAULT
B	CHLORINE SOLUTION INJECTION AND CHLORINE CONTACT BASIN METER VAULT

UTILITY WARNING

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GENERAL NOTE:

1. 100-YEAR FLOOD ELEVATION PER FEDERAL EMERGENCY MANAGEMENT AGENCY (FEMA) FLOOD RISK INFORMATION REPORT THROUGH THE ESTIMATED BASE FLOOD ELEVATION VIEW ON 01/06/2025.
2. YARD PIPING SHALL BE PVC. THE TRANSITION FROM DI PIPING ENTERING AND EXITING THE STRUCTURE SHALL OCCUR A MINIMUM OF 2 FT FROM EACH STRUCTURE.

NOTES INDICATED ON DRAWING BY (#):

1. CONTRACTOR TO INSTALL PLUG VALVE FOR BYPASS LINE.
2. CONTRACTOR TO INSTALL CLEAN OUT FOR PRESSURIZED LINE.
3. REFER TO SITE GRADING PLANS FOR CONTINUATION.

NO.	REVISION	DATE
0	ISSUED FOR ADVERTISEMENT	08/27/2024
1	ADDENDUM No. 2	09/24/2024
2	ADDENDUM No. 3	10/04/2024

10/04/2024

Brittany D. White

BRITTANY D. WHITE 128714 LICENSED PROFESSIONAL ENGINEER

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DESIGNED BY	SCALE
B.WHITE	1" = 20'-0"
DRAWN BY	
J.CASSIDY	DATE
CHECKED BY	10/04/2024
C.RICH	

CITY OF TOLAR
WASTEWATER TREATMENT PLANT IMPROVEMENTS

MODIFIED SITE PIPING PLAN

PROJECT NO.: 8434
SEQUENCE No. 18 OF 123
SHEET No. 01C-05

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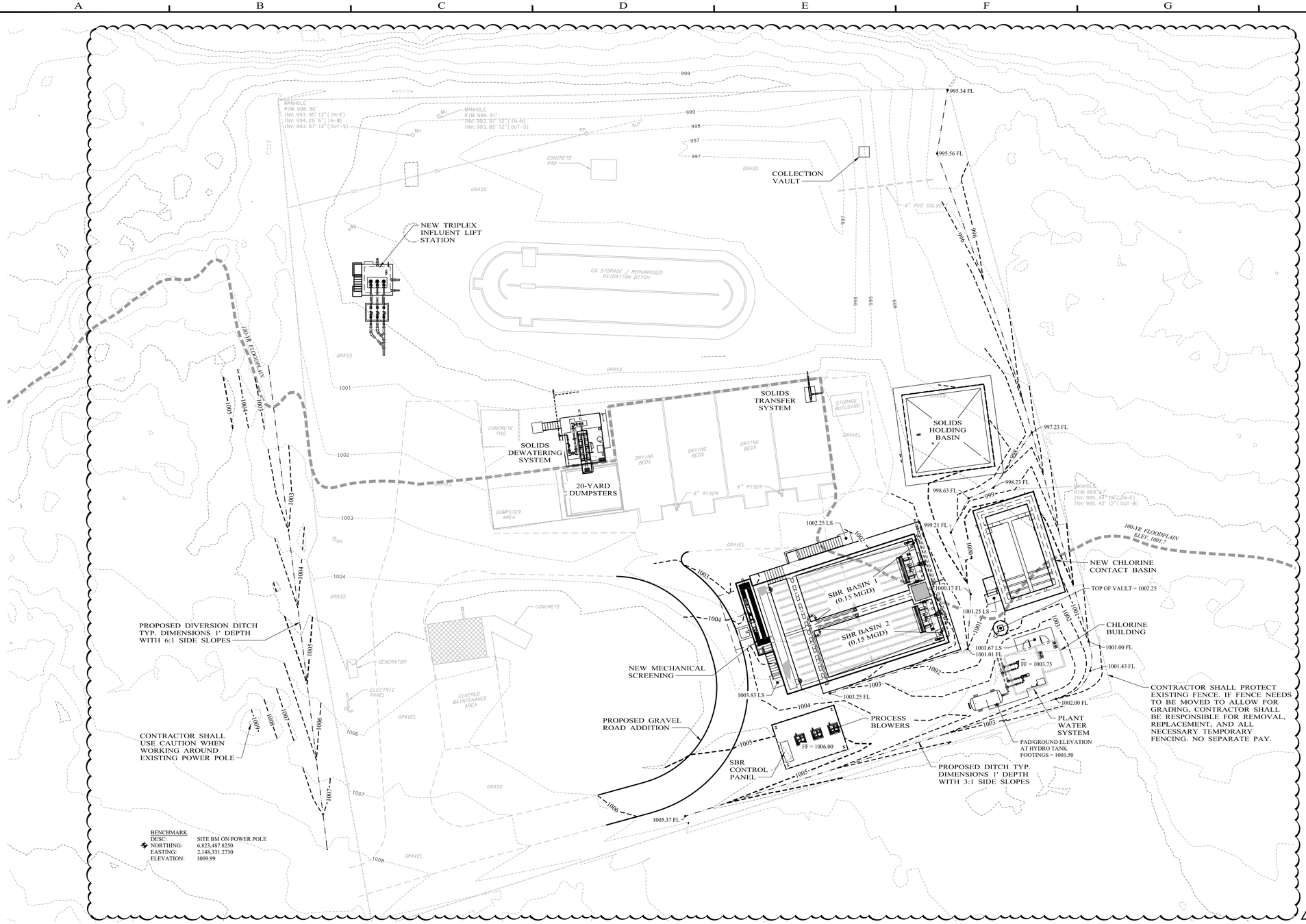

LEGEND

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- PP — POWER POLE
- GUY — GUY ANCHOR
- CHAINLINK FENCE
- OU — OVERHEAD UTILITY LINE
- FLOOD ZONE
- FL — FLOW LINE
- LS — LANDING SPOT
- FF — FINISHED FLOOR
- CONTOUR MINOR
- CONTOUR MAJOR
- DITCH LINE

SCALE IN FEET: 10 0 20

UTILITY WARNING

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GENERAL NOTE:

1. 100-YEAR FLOOD ELEVATION PER FEDERAL EMERGENCY MANAGEMENT AGENCY (FEMA) FLOOD RISK INFORMATION REPORT THROUGH THE ESTIMATED BASE FLOOD ELEVATION VIEW ON 01/06/2023.

NO.	REVISION	DATE
0	ISSUED FOR ADVERTISEMENT	08/27/2024
1	ADDENDUM No. 2	09/24/2024
2	ADDENDUM No. 3	10/04/2024

10/04/2024

JONATHAN AARON BAUM 100982 LICENSED PROFESSIONAL ENGINEER

Celebrating 35 years

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CHECKED BY C.RICH
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DATE 10/04/2024

CITY OF TOLAR
WASTEWATER TREATMENT PLANT IMPROVEMENTS

MODIFIED SITE GRADING PLAN

PROJECT NO.: 8434
SEQUENCE No. 21 OF 123
SHEET No. 01C-06

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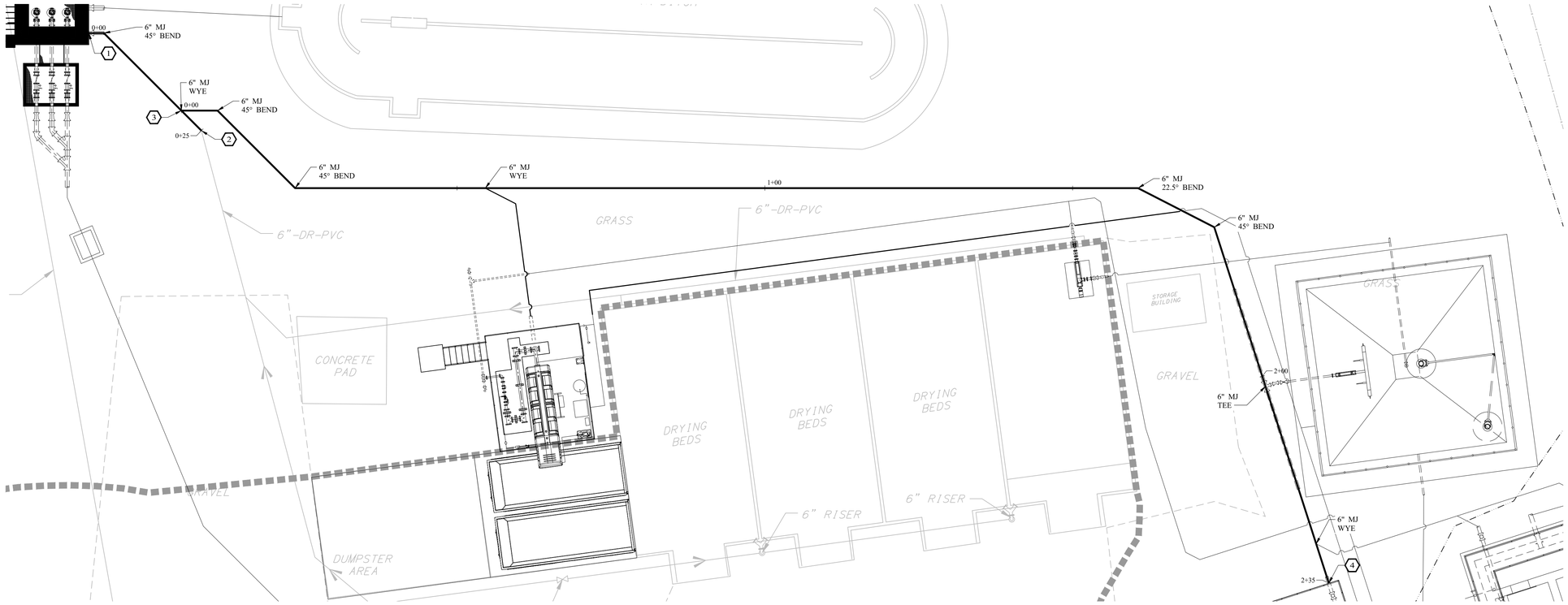

SCALE IN FEET

NOTES INDICATED ON DRAWING BY (#):

1. CONTRACTOR TO INSTALL INTO NEW LIFT STATION. REFER TO SHEETS 02D-01 AND 02D-02 FOR CONTINUATION.
2. CONTRACTOR TO TIE INTO EXISTING 6" DRAIN LINE AT THIS POINT. CONTRACTOR TO VERIFY LOCATION AND DEPTH OF EXISTING LINE PRIOR TO CONSTRUCTION.
3. CONTRACTOR TO TIE INTO PROPOSED 6-DR-DI LINE WITH A WYE AT THIS POINT.
4. CONTRACTOR TO TIE INTO SBR BASIN. REFER TO SHEETS 03D-01 AND 03D-02 FOR CONTINUATION.

LEGEND:

- EXISTING GRADE
- PROPOSED GRADE
- PROPOSED PIPING

UTILITY WARNING

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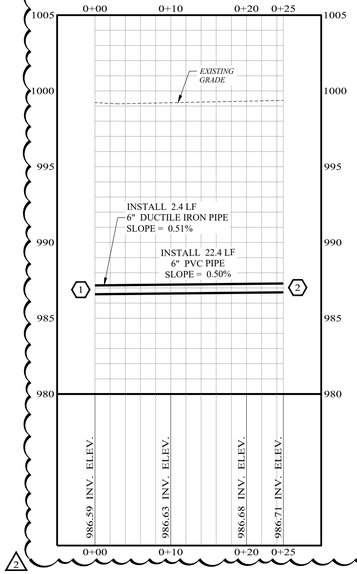
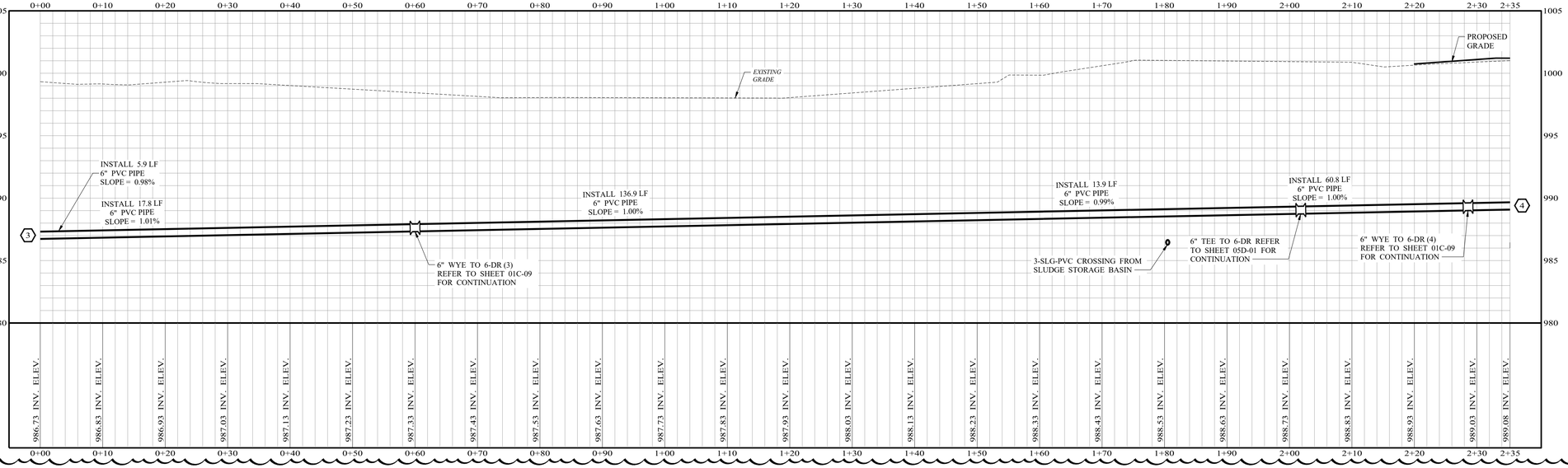
6-DR (1) PROFILE



6-DR (2) PROFILE



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0	ISSUED FOR ADVERTISEMENT	08/27/2024
1	ADDENDUM No. 2	09/24/2024
2	ADDENDUM No. 3	10/04/2024

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Brittany D. White

STATE OF TEXAS
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128714
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PROFESSIONAL
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SCALE HORZ. 1" = 10'-0" VERT. 1" = 5'-0"
DATE 10/04/2024

CITY OF TOLAR
WASTEWATER TREATMENT PLANT IMPROVEMENTS

6-DR (1) & (2) PLAN AND PROFILES

PROJECT NO.: 8434
SEQUENCE No. 23 OF 123
SHEET No. 01C-08

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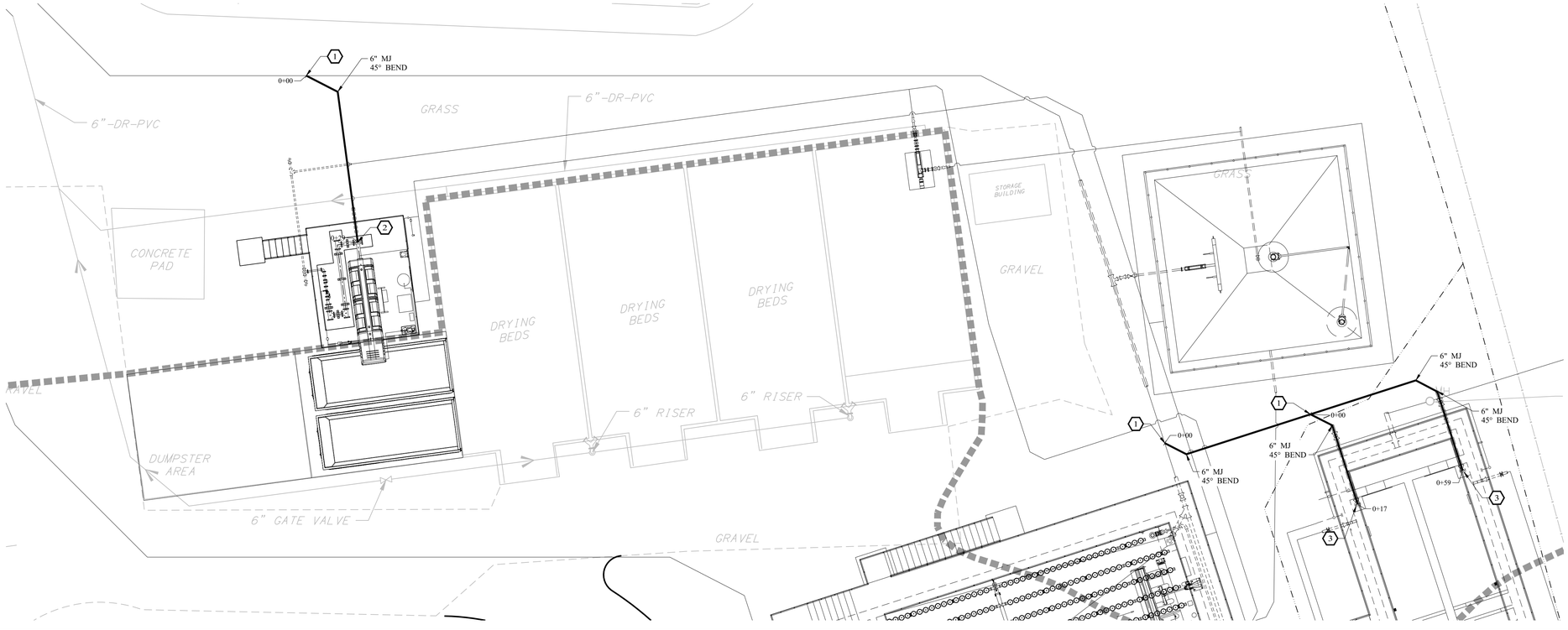

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5 0 10

SCALE IN FEET

NOTES INDICATED ON DRAWING BY (#):

1. CONTRACTOR TO TIE INTO PROPOSED 6-DR-DI LINE WITH A WYE AT THIS POINT.
2. CONTRACTOR TO TIE INTO SOLIDS DEWATERING SYSTEM. REFER TO SHEETS 05D-04 AND 05D-05 FOR CONTINUATION.
3. CONTRACTOR TO TIE INTO CHLORINE CONTACT BASIN. REFER TO SHEETS 04D-01 AND 04D-02 FOR CONTINUATION.

LEGEND:

- EXISTING GRADE
- PROPOSED GRADE
- PROPOSED PIPING

UTILITY WARNING

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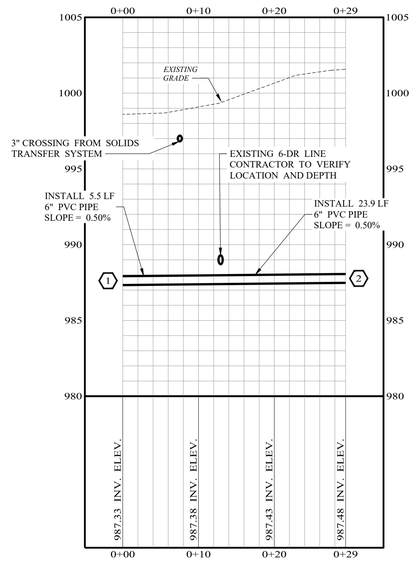
6-DR (3) PROFILE



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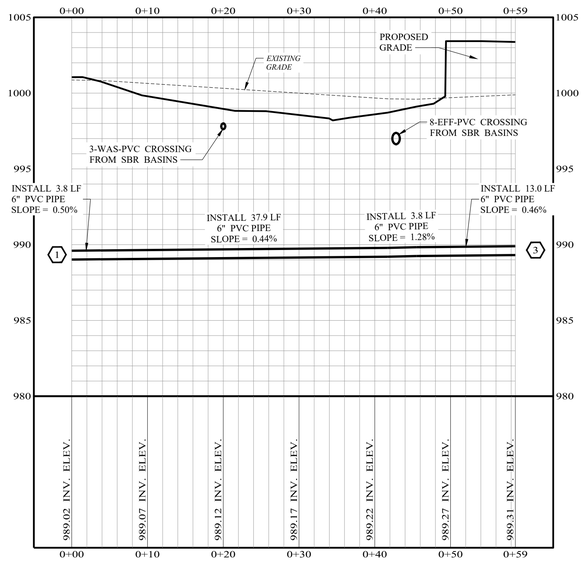
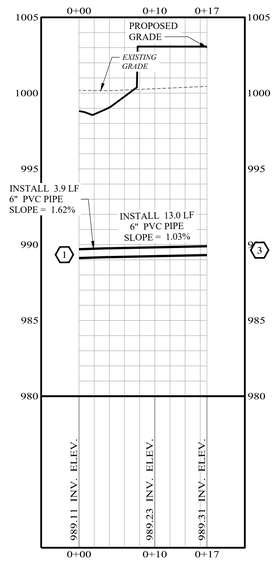


6-DR (5) PROFILE



NO.	REVISION	DATE
0	ISSUED FOR ADVERTISEMENT	08/27/2024
1	ADDENDUM No. 2	09/24/2024
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Brittany D. White

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DRAWN BY	J.CASSIDY
CHECKED BY	C.RICH
SCALE	HORZ. 1" = 10'-0" VERT. 1" = 5'-0"
DATE	10/04/2024

CITY OF TOLAR
WASTEWATER TREATMENT PLANT IMPROVEMENTS

6-DR (3), (4), & (5) PLAN AND PROFILES

PROJECT NO.:	8434
SEQUENCE No.	24 OF 123
SHEET No.	01C-09

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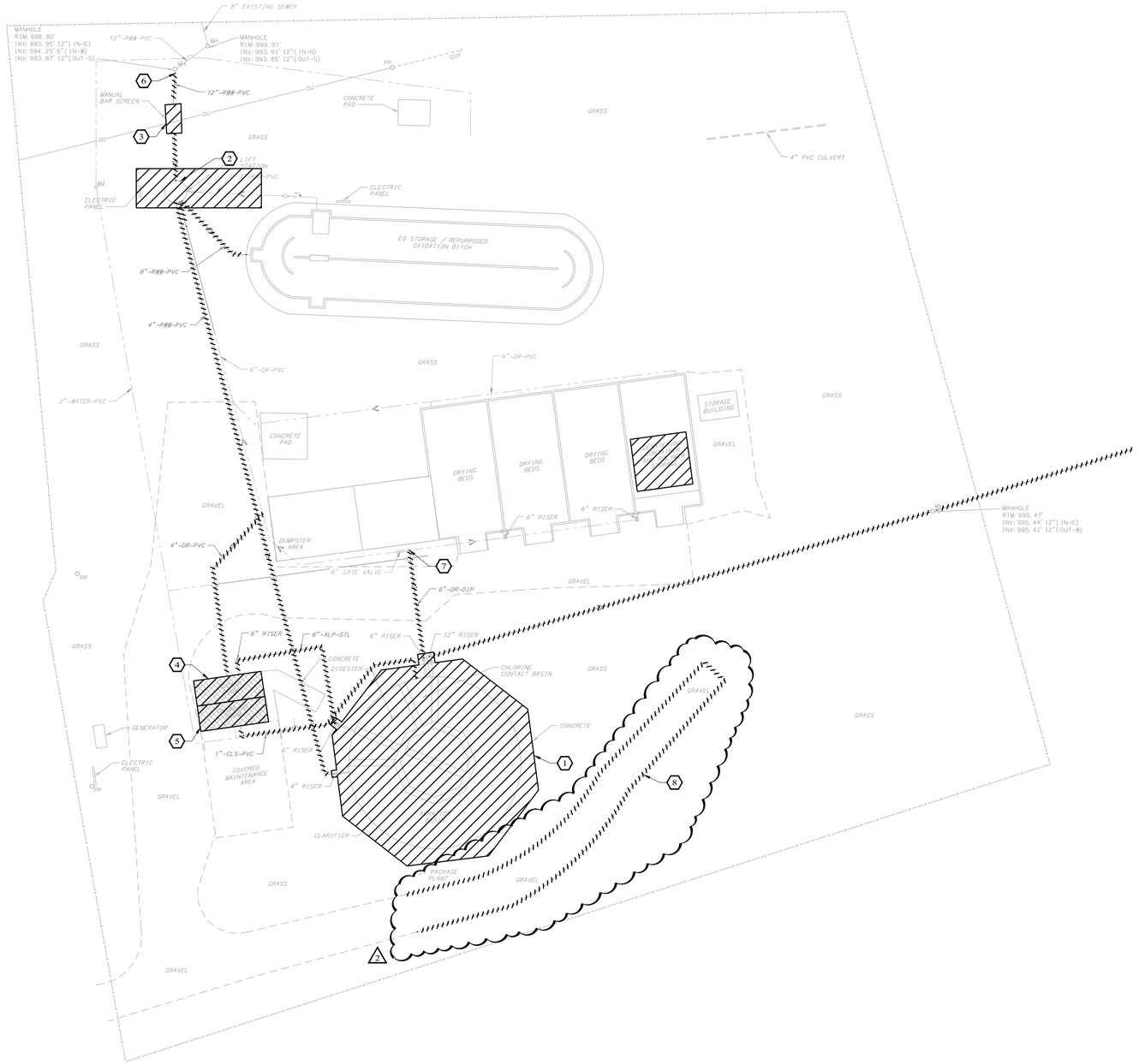

LEGEND

- MH — MANHOLE - SANITARY SEWER
- WM — WATER METER
- EM — ELECTRIC METER
- PP — POWER POLE
- GUY — GUY ANCHOR
- CHAINLINK FENCE
- OU — OVERHEAD UTILITY LINE
- EXISTING SITE PIPING
- STRUCTURE / PIPING TO BE DEMOLISHED, ABANDONED IN PLACE, SALVAGED, AND / OR LEGALLY DISPOSED OF.

N

10 0 20

SCALE IN FEET

DEMOLITION NOTES:

1. ALL ITEMS SHOWN CROSS HATCHED ARE TO BE DEMOLISHED AND REMOVED. CONTRACTOR TO LEGALLY DISPOSE OF ALL DEMOLISHED MATERIAL NOT SALVAGED BY THE OWNER.
2. CONTRACTOR TO COORDINATE WITH THE OWNER ON WHAT EQUIPMENT / VALVES ARE TO BE SALVAGED PRIOR TO DEMOLITION. CONTRACTOR TO MOVE AND STORE EQUIPMENT TO DESIGNED AREA WITHIN THE PLANT SITE SELECTED BY THE OWNER.
3. COORDINATE DEMOLITION WITH THE OWNER AND ENGINEER TO ALLOW UNINTERRUPTED TREATMENT AT THE FACILITY.
4. CONTRACTOR TO FIELD VERIFY EXISTING UTILITIES AND LINES.

GENERAL NOTES:

1. THE INFORMATION PROVIDED ON THIS SHEET IS INTENDED AS A DEMOLITION CONSTRUCTION SEQUENCING AID FOR CONTRACTOR. CONTRACTOR IS RESPONSIBLE FOR FIELD-VERIFYING ALL YARD PIPING AND INFORMATION ASSOCIATED WITH THE DEMOLITION.

NOTES INDICATED ON DRAWING BY (W):

1. EXISTING EA PACKAGE PLANT SHALL BE DEMOLISHED AFTER INSTALLATION AND START UP HAVE BEEN COMPLETED ON THE NEW WASTEWATER TREATMENT SYSTEM.
2. EXISTING DUPLEX LIFT STATION SHALL BE DEMOLISHED AFTER INSTALLATION AND START UP HAVE BEEN COMPLETED ON THE NEW WASTEWATER TREATMENT SYSTEM.
3. EXISTING MANUAL BAR SCREEN AND STRUCTURE SHALL BE DEMOLISHED AFTER INSTALLATION AND START UP HAVE BEEN COMPLETED ON THE NEW WASTEWATER TREATMENT SYSTEM.
4. EXISTING BLOWER EQUIPMENT WITHIN EXISTING BUILDING SHALL BE DEMOLISHED AFTER INSTALLATION AND START UP HAVE BEEN COMPLETED ON THE NEW WASTEWATER TREATMENT SYSTEM. BUILDING TO REMAIN.
5. EXISTING CHLORINE EQUIPMENT WITHIN EXISTING BUILDING SHALL BE DEMOLISHED AFTER INSTALLATION AND START UP HAVE BEEN COMPLETED ON THE NEW WASTEWATER TREATMENT SYSTEM. BUILDING TO REMAIN.
6. CONTRACTOR SHALL CAP AND PLUG EXISTING 12-INCH RAW WASTEWATER LINE FROM THE EXISTING MANHOLE.
7. CONTRACTOR SHALL CAP AND PLUG EXISTING 6-INCH DRAIN LINE FROM THE EXISTING EA PACKAGE PLANT.
8. EXISTING GRAVEL ROAD TO BE REMOVED.

NO.	REVISION	DATE
0	ISSUED FOR ADVERTISEMENT	08/27/2024
1	ADDENDUM No. 2	09/24/2024
2	ADDENDUM No. 3	10/04/2024

10/04/2024

Brittany D. White

BRITTANY D. WHITE 128714 LICENSED PROFESSIONAL ENGINEER

Celebrating 35 years

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0 1
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DESIGNED BY	B.WHITE
DRAWN BY	J.CASSIDY
CHECKED BY	C.RICH
SCALE	1" = 20'-0"
DATE	10/04/2024

CITY OF TOLAR
WASTEWATER TREATMENT PLANT IMPROVEMENTS

DEMOLITION SITE & PIPING PLAN

PROJECT NO.: 8434
SEQUENCE No. 25 OF 123
SHEET No. 01X-01

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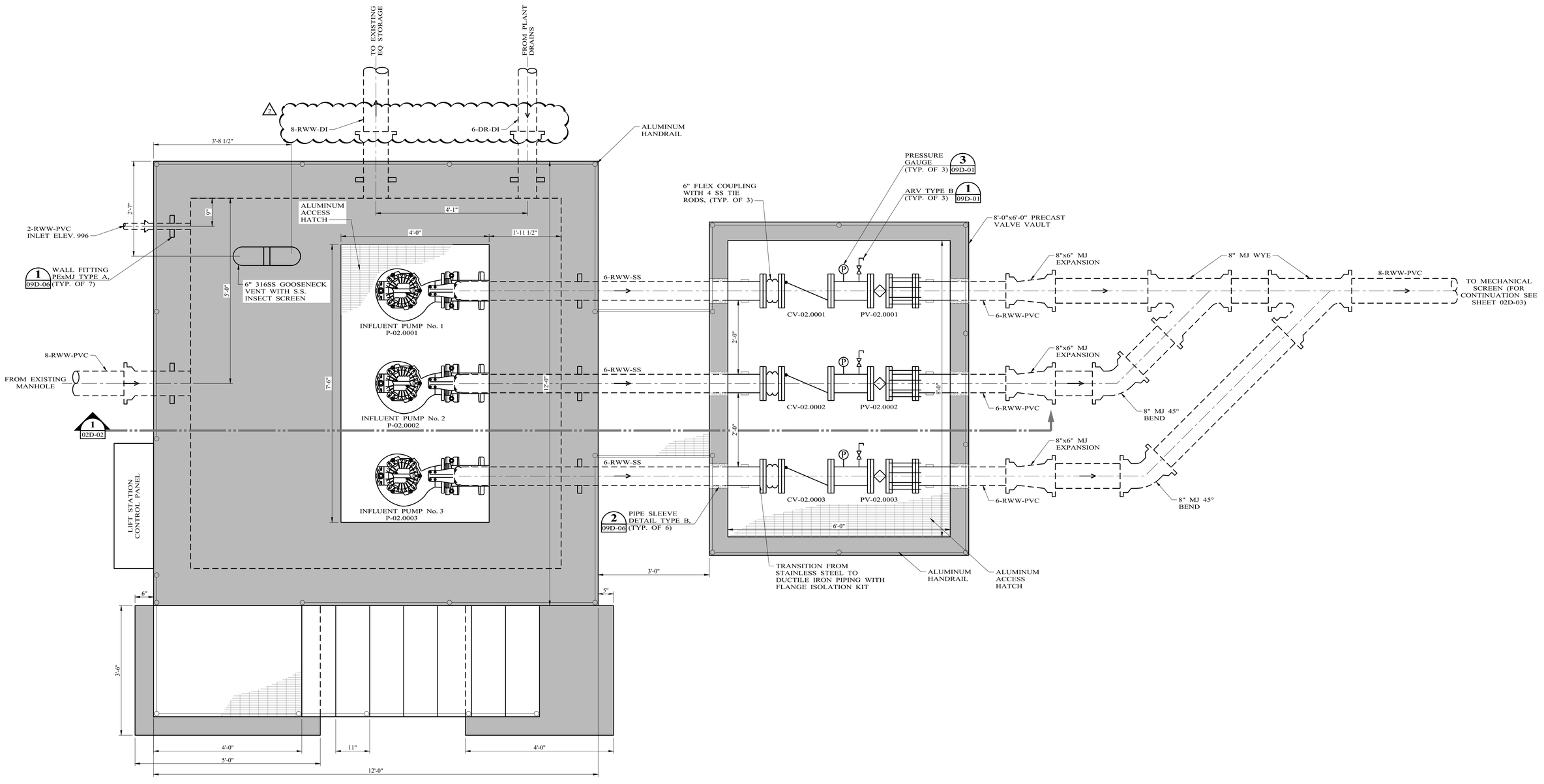

PLAN VIEW

GENERAL NOTES:

1. REFER TO SPECIFICATION 11220 FOR ADDITIONAL DETAIL ON THE SUBMERSIBLE PUMP EQUIPMENT REQUIREMENTS.

NO.	REVISION	DATE
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2	ADDENDUM No. 3	10/04/2024

10/04/2024

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CHECKED BY	C.RICH
SCALE	3/4" = 1'-0"
DATE	10/04/2024

CITY OF TOLAR
WASTEWATER TREATMENT PLANT IMPROVEMENTS

INFLUENT LIFT STATION PLAN

PROJECT NO.: 8434
SEQUENCE No. 26 OF 123
SHEET No. 02D-01

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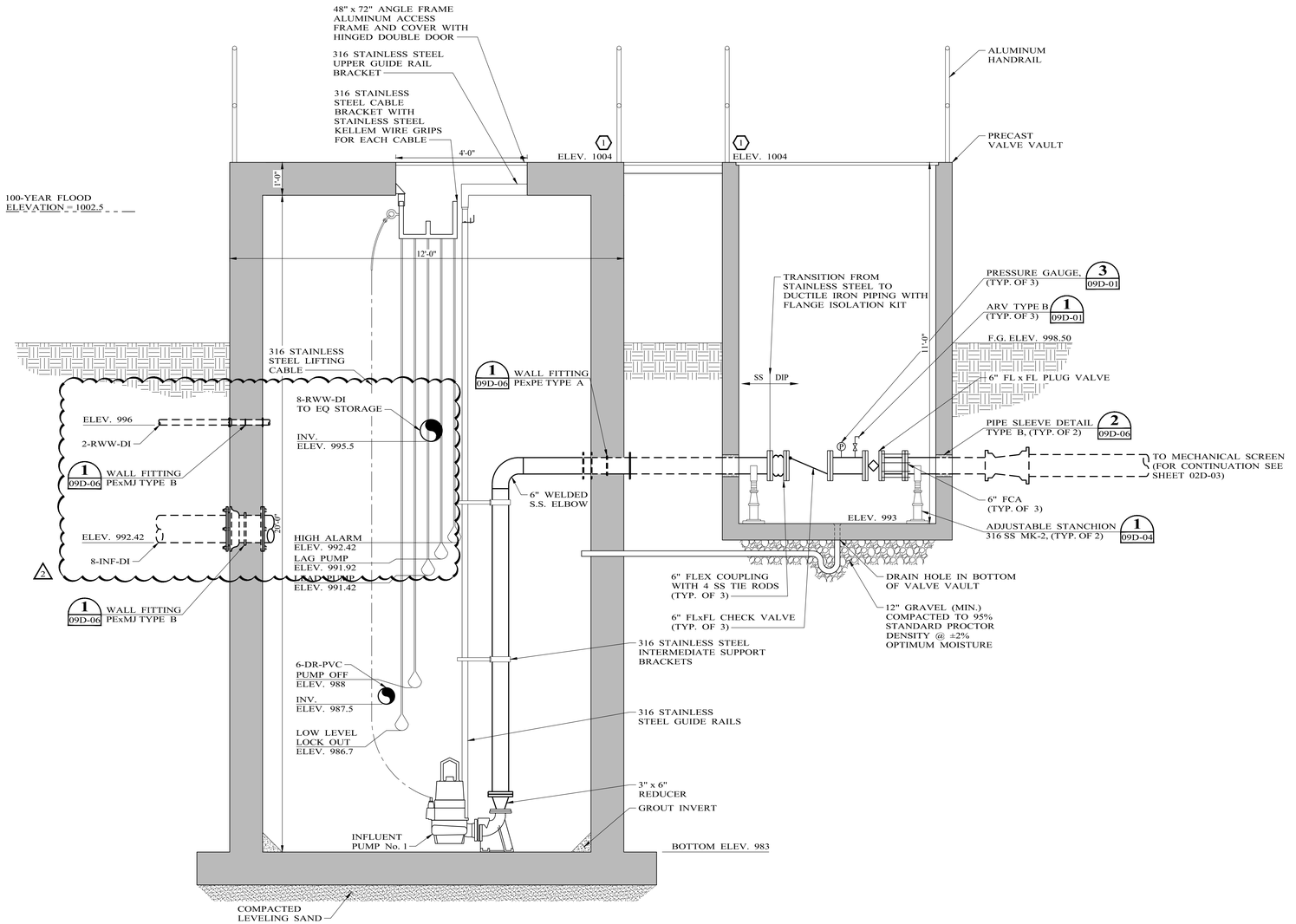

1 02D-01 SECTION

NOTES INDICATED ON DRAWING BY 1:

1. TOP OF STRUCTURE NEEDS TO BE A MINIMUM OF 1 FOOT ABOVE THE 100 YEAR FLOOD ELEVATION.

GENERAL NOTES:

1. WETWELL INLET AND DISCHARGE PIPING SHOWN IN SECTION FOR CLARITY. ACTUAL ORIENTATION AND PLACEMENT AS PER SITE PLAN. REFER TO PLAN VIEW FOR LOCATION. COORDINATE LOCATION WITH ON-SITE REPRESENTATIVES.
2. LIFT STATION MANUFACTURER TO CALCULATE THE REQUIRED WETWELL FOUNDATION DESIGN TO OVERCOME THE BUOYANCY FORCE.

NO.	REVISION	DATE
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10/04/2024

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CHECKED BY	C.RICH
SCALE	1/2" = 1'-0"
DATE	10/04/2024

CITY OF TOLAR
WASTEWATER TREATMENT PLANT IMPROVEMENTS

INFLUENT LIFT STATION SECTION

PROJECT NO.: 8434
SEQUENCE No. 27 OF 123
SHEET No. 02D-02

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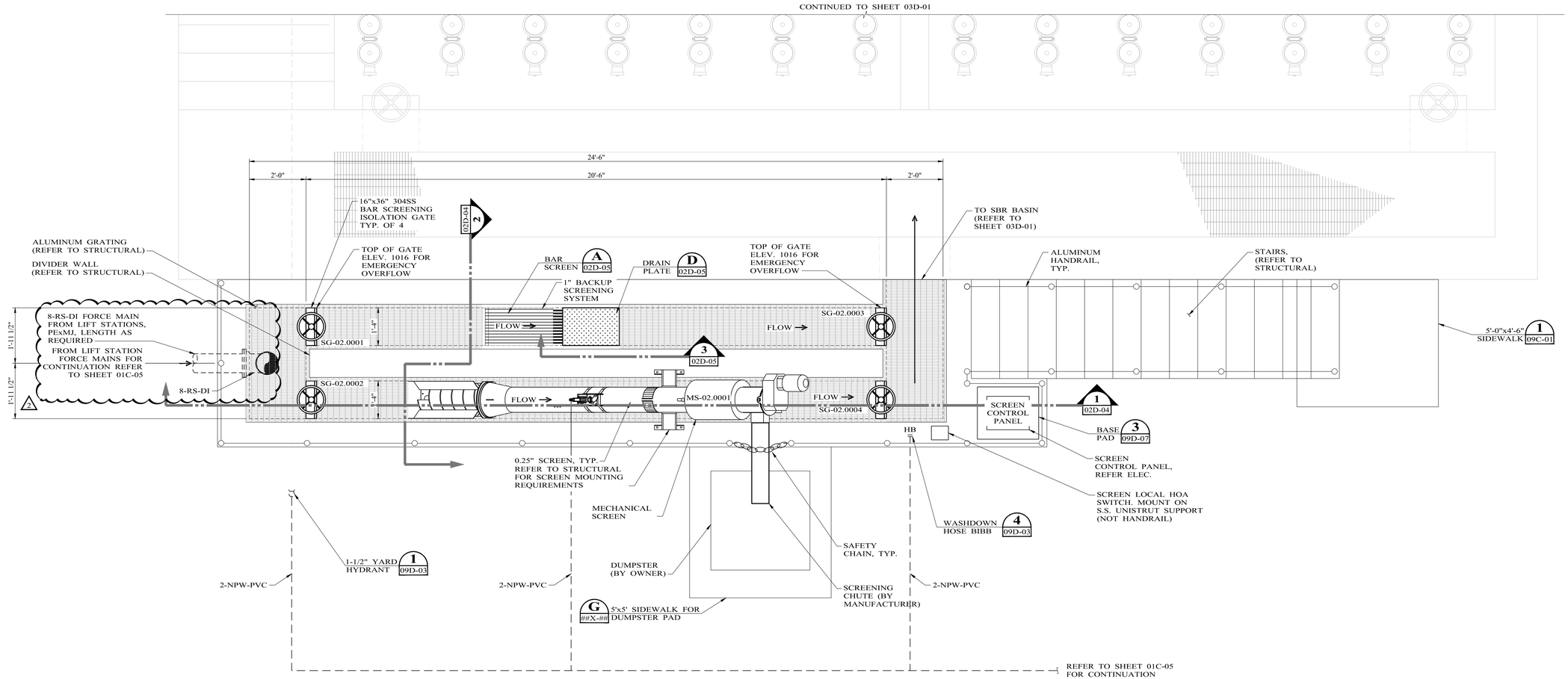

PLAN

NOTES:

1. FIELD VERIFY ALL EXISTING PIPING AND STRUCTURES PRIOR TO CONSTRUCTION.
2. HANDRAIL SHALL BE TOP MOUNTED AND PROVIDED AS SHOWN ON THIS SHEET. PROVIDE REMOVABLE SNAP CHAINS AS SHOWN. SEE STRUCTURAL. HANDRAIL LAYOUT AND FABRICATION SHALL BE BASED ON FIELD DIMENSIONS FOLLOWING INSTALLATION OF ALL EQUIPMENT.
3. NOT ALL PIPE SUPPORTS ARE SHOWN. PROVIDE PIPE SUPPORTS AT MAXIMUM SPACING LISTED IN SECTION 15090.
4. CONTRACTOR SHALL TRANSITION FROM DUCTILE IRON TO PVC AT A MINIMUM OF 5 FT FROM STRUCTURE.
5. PIPE RESTRAINT JOINTS SHALL BE EBAA IRON MEGALUG SERIES OR ENGINEER APPROVED EQUIVALENT.
6. FOR ADDITIONAL NOTES SEE SHEET 00G-04.

NO.	REVISION	DATE
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10/04/2024

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CHECKED BY C.RICH
SCALE 1/2" = 1'-0"
DATE 10/04/2024

CITY OF TOLAR
WASTEWATER TREATMENT PLANT IMPROVEMENTS

COARSE SCREENING SYSTEM PLAN

PROJECT NO.: 8434
SEQUENCE No. 28 OF 123
SHEET No. 02D-03

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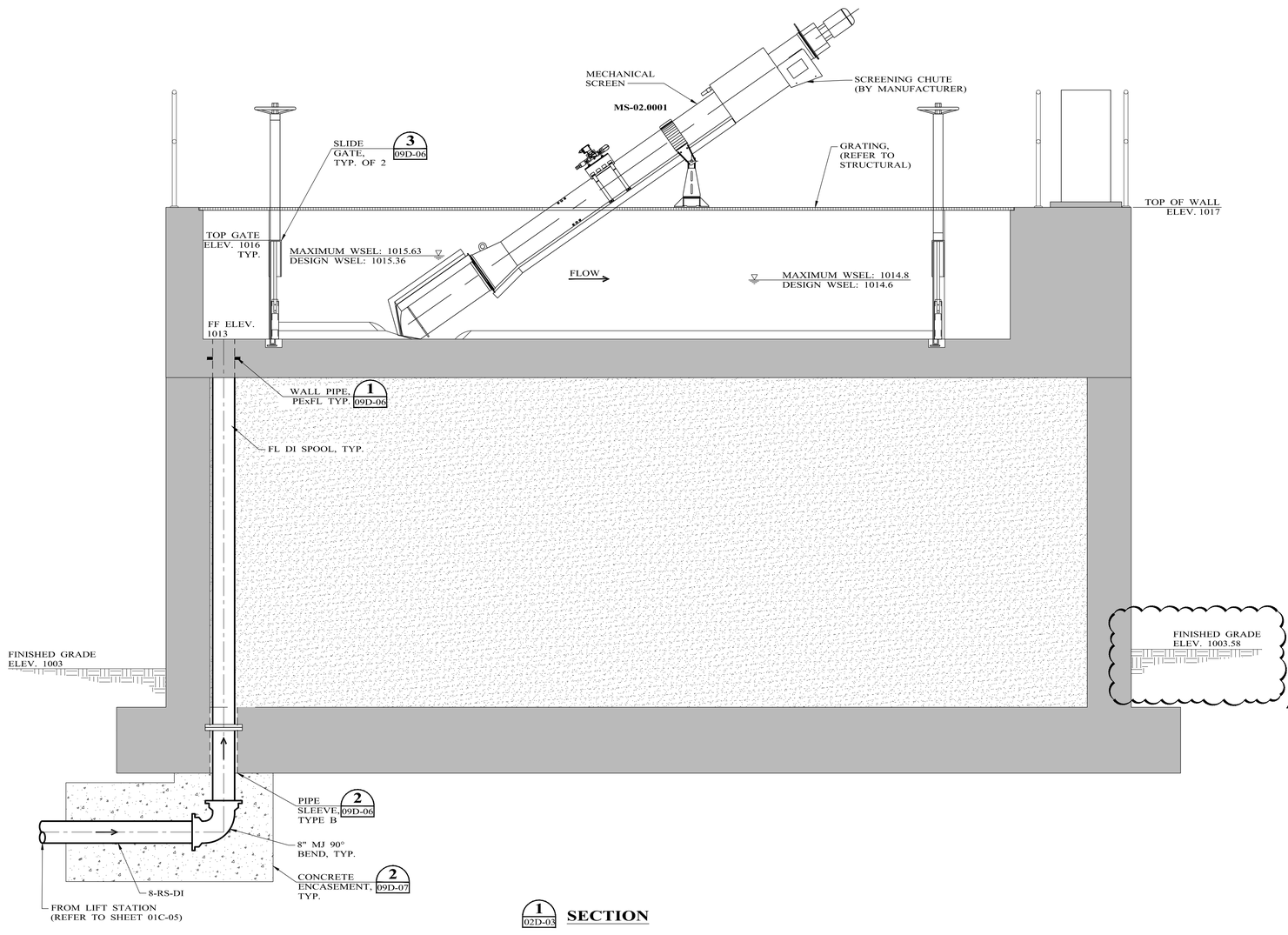
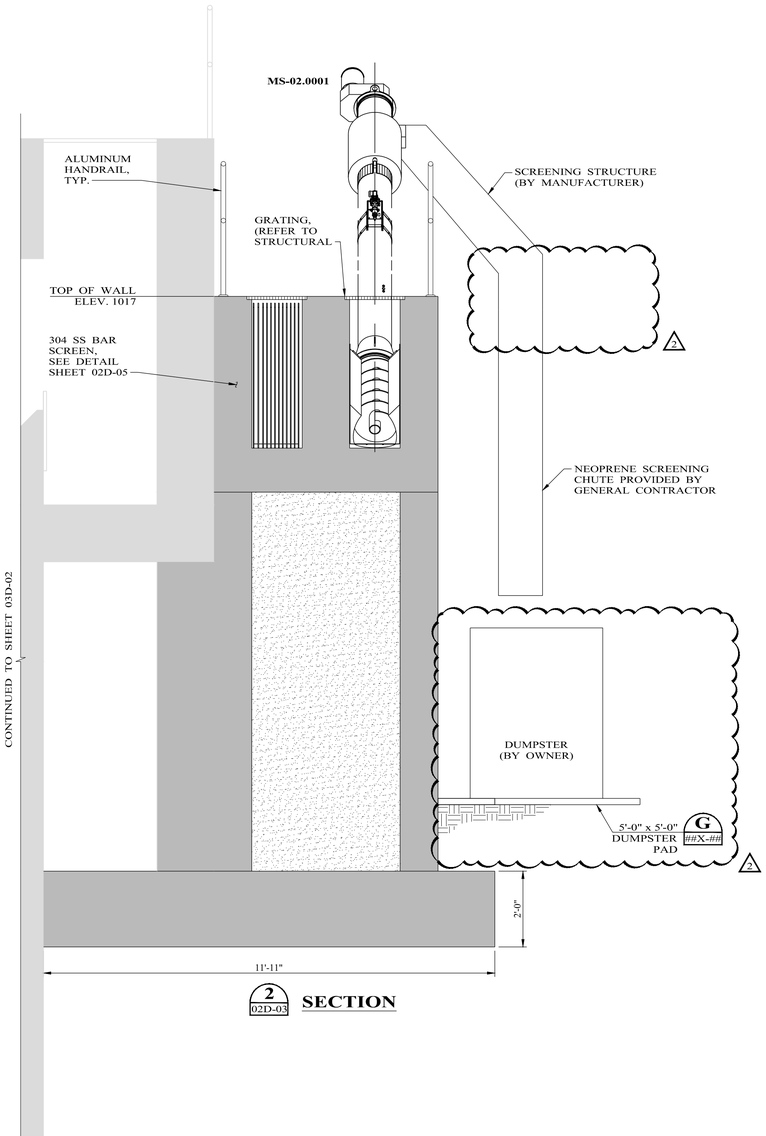


1 02D-03 SECTION



2 02D-03 SECTION

NO.	REVISION	DATE
0	ISSUED FOR ADVERTISEMENT	08/27/2024
1	ADDENDUM No. 2	09/24/2024
2	ADDENDUM No. 3	10/04/2024

10/04/2024

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CHECKED BY C.RICH
SCALE 1/2"=1'-0"
DATE 10/04/2024

CITY OF TOLAR
WASTEWATER TREATMENT PLANT IMPROVEMENTS

COARSE SCREENING SYSTEM SECTIONS

PROJECT NO.: 8434
SEQUENCE No. 29 OF 123
SHEET No. 02D-04

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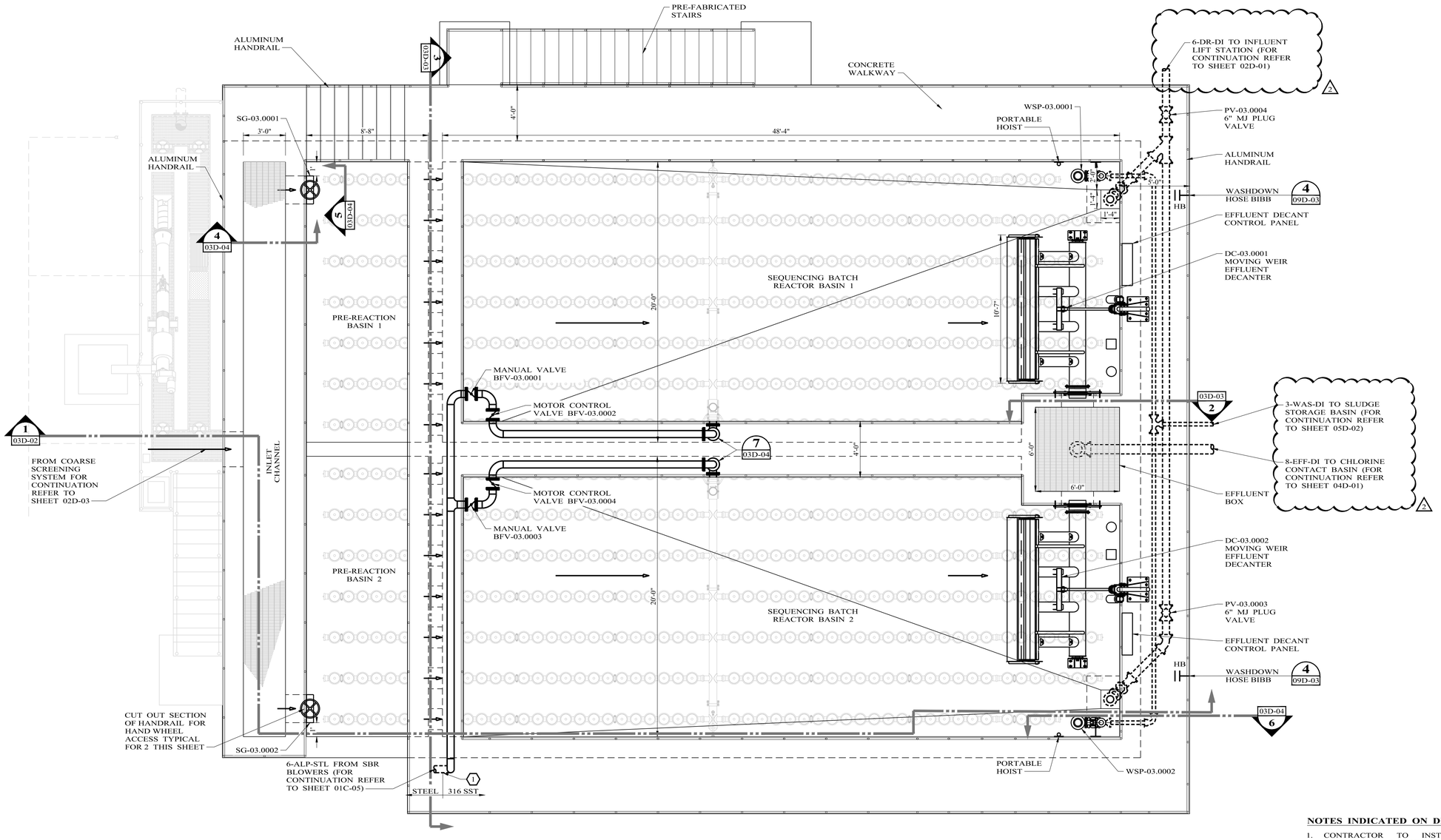

NTS **PLAN**

NOTES INDICATED ON DRAWING BY (#):

1. CONTRACTOR TO INSTALL DIELECTRIC FLANGE KIT AS SPECIFIED.

GENERAL NOTES:

1. CONTRACTOR TO FIELD VERIFY ALL EXISTING PIPING, STRUCTURES, AND UTILITIES PRIOR TO CONSTRUCTION. CONTRACTOR TO NOTIFY ENGINEER IMMEDIATELY OF ANY DEVIATIONS.
2. INSTALL SURFACE MIXER PER MANUFACTURER'S WRITTEN INSTRUCTIONS.
3. HANDRAILS SHALL BE TOP MOUNTED AND INSTALLED AS PER LAYOUT SHOWN ON THIS SHEET.

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CHECKED BY	C.RICH
SCALE	1/4" = 1'-0"
DATE	10/04/2024

CITY OF TOLAR
WASTEWATER TREATMENT PLANT IMPROVEMENTS

SBR BASIN - OVERALL PLAN

PROJECT NO.: 8434
SEQUENCE No. 37 OF 123
SHEET No. 03D-01

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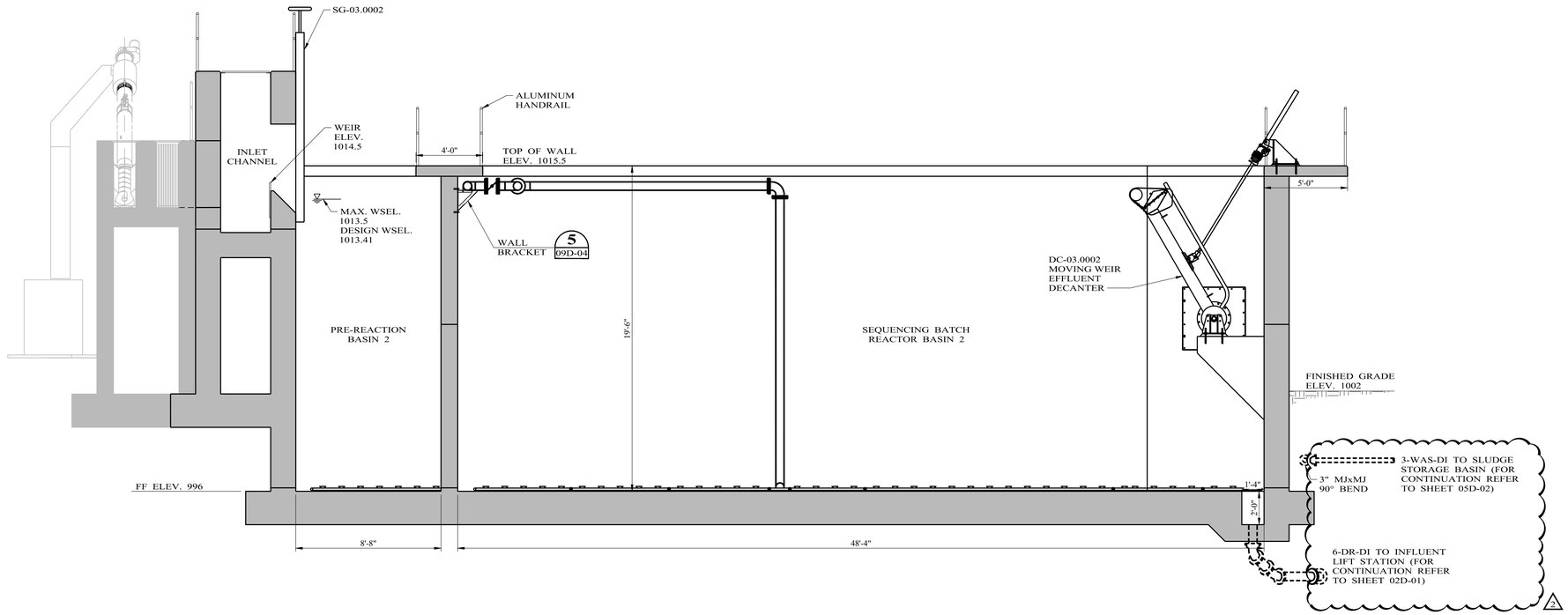

1 03D-01 **SECTION**

NO.	REVISION	DATE
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1	ADDENDUM No. 2	09/24/2024
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DATE 10/04/2024

CITY OF TOLAR
WASTEWATER TREATMENT PLANT IMPROVEMENTS

SBR BASIN - SECTION

PROJECT NO.: 8434
SEQUENCE No. 38 OF 123
SHEET No. 03D-02

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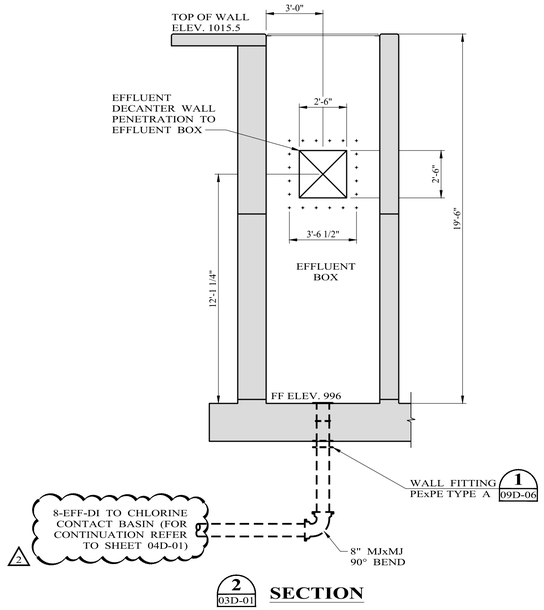
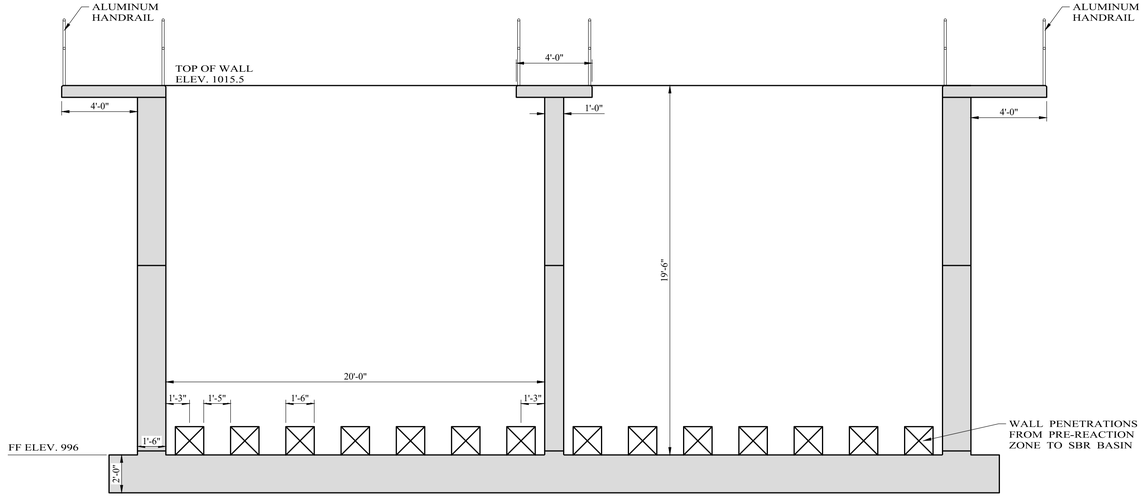


2 03D-01 **SECTION**



3 03D-01 **SECTION**

NO.	REVISION	DATE
0	ISSUED FOR ADVERTISEMENT	08/27/2024
1	ADDENDUM No. 2	09/24/2024
2	ADDENDUM No. 3	10/04/2024

10/04/2024

Brittany D. White

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DATE 10/04/2024

CITY OF TOLAR
WASTEWATER TREATMENT PLANT IMPROVEMENTS

SBR BASIN - SECTIONS

PROJECT NO.: 8434
SEQUENCE No. 39 OF 123
SHEET No. 03D-03

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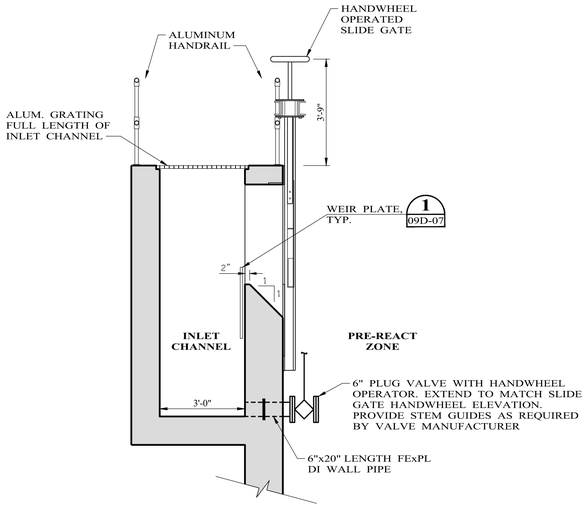
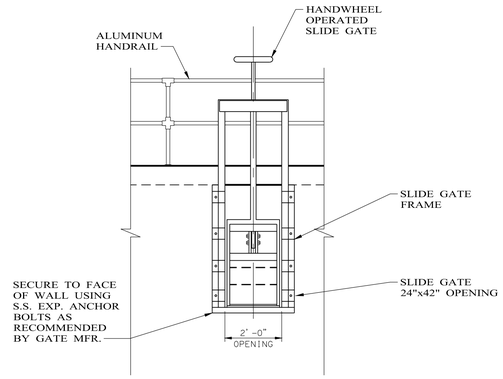


NOTES:

1. WEIRS TYP. OF 2 BASINS.
2. DRAIN TYPICAL OF 2 BASINS. SEE SHEET M-7. (DRAIN PLUG VALVES NOT SCHEDULED)

4 03D-01 **SECTION**
SCALE: 3/8" = 1'-0"



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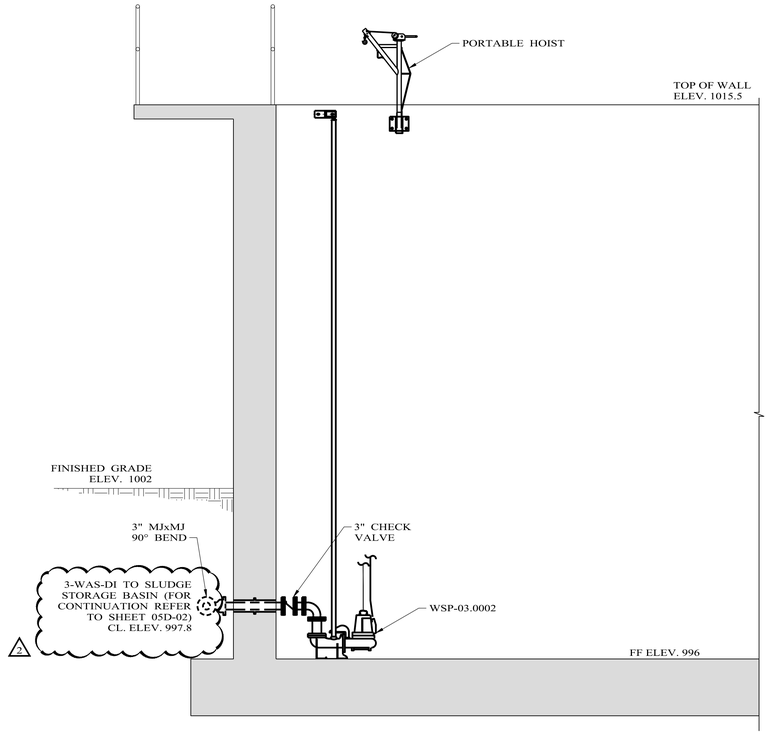

6 03D-01 **SECTION**
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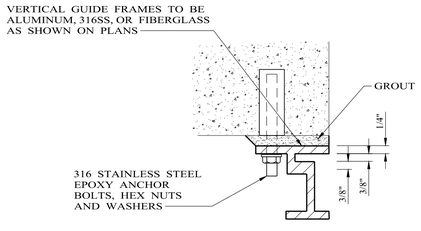
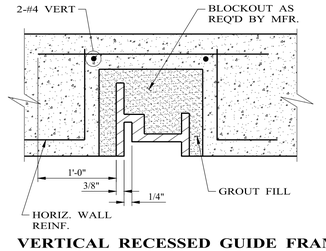
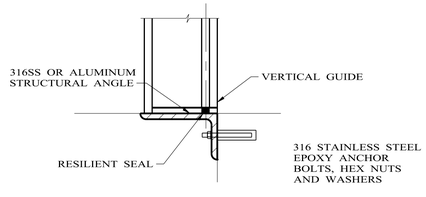


VERTICAL FACE MOUNTED GUIDE FRAME

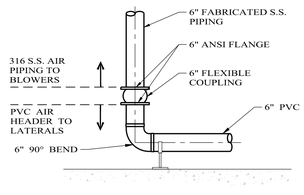


VERTICAL RECESSED GUIDE FRAME



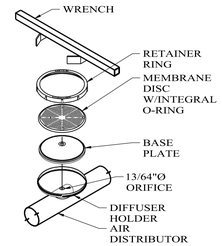
BOTTOM SEAT

SLIDE GATE GUIDE FRAME
SCALE: NO SCALE



NOTE
SECURE PVC HEADER TO BASIN FLOOR S.S. SUPPORTS BY MANUFACTURER.

AIR HEADER CONNCTION DETAIL
TYPICAL (4)
NO SCALE



EPDM DIFFUSER ASSEMBLY
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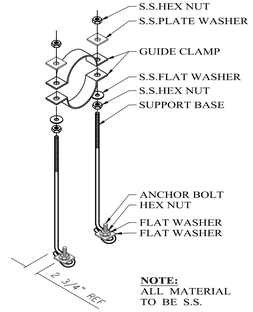

NOTE:
ALL MATERIAL TO BE S.S.

AIR DISTRIBUTION SUPPORT
NO SCALE

NO.	REVISION	DATE
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CHECKED BY C.RICH
SCALE AS NOTED
DATE 10/04/2024

CITY OF TOLAR
WASTEWATER TREATMENT PLANT IMPROVEMENTS

SBR BASIN - SECTIONS AND DETAILS

PROJECT NO.: 8434
SEQUENCE No. 40 OF 123
SHEET No. 03D-04

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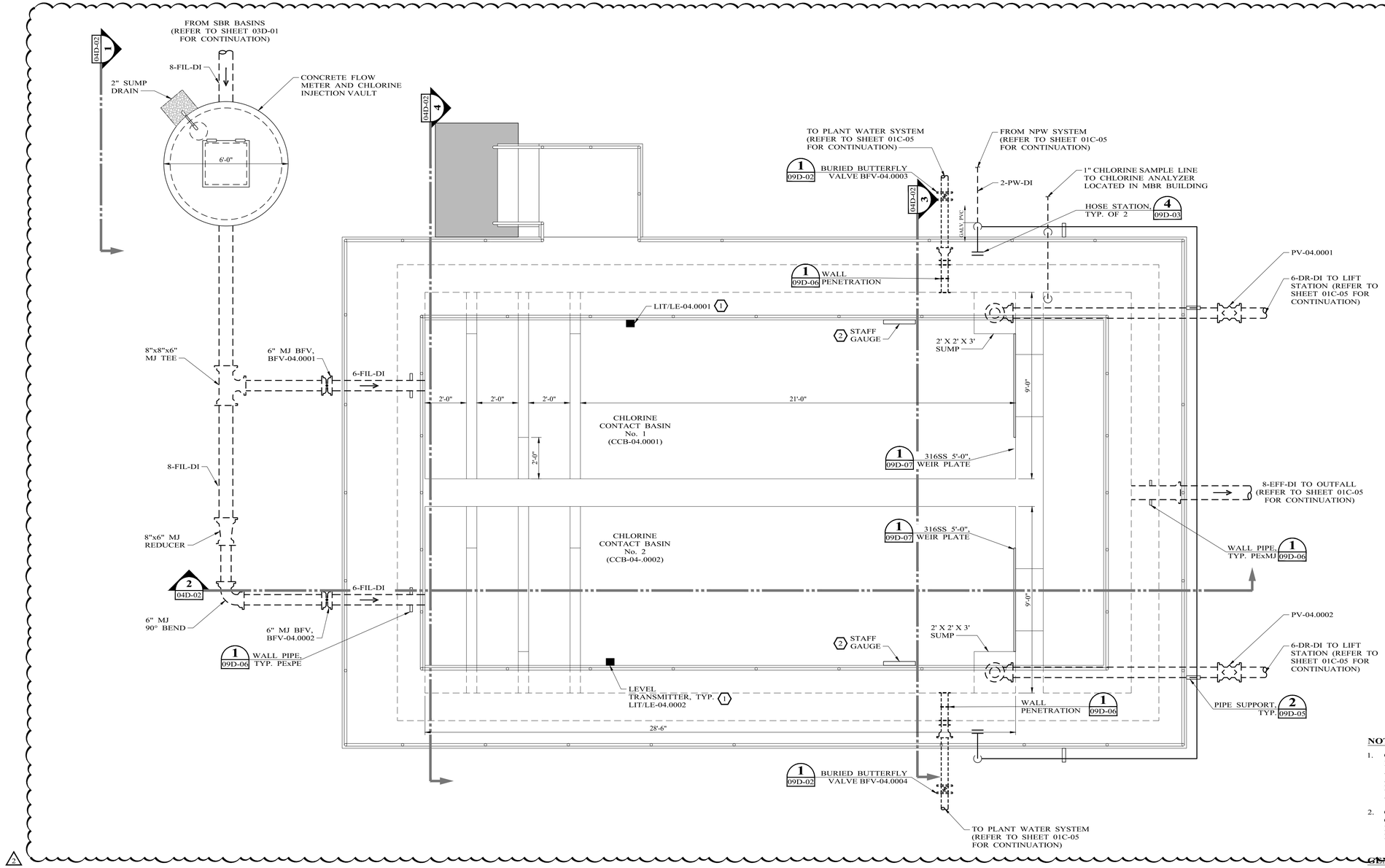

NOTES INDICATED ON DRAWING BY (#):

1. CONTRACTOR AND SCADA SYSTEMS INTEGRATOR TO INSTALL LEVEL SENSOR ABOVE WATER SURFACE ELEVATION IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS TO PROVIDE RELIABLE / ACCURATE LEVEL MEASUREMENT.
2. CONTRACTOR SHALL INSTALL CORROSION-RESISTANT STAFF GAUGE AT READILY VISIBLE LOCATION AT LEAST 3FT FROM WEIR CREST.

GENERAL NOTES:

1. CONTRACTOR TO FIELD VERIFY ALL EXISTING PIPING, STRUCTURES, AND UTILITIES PRIOR TO CONSTRUCTION. CONTRACTOR TO NOTIFY ENGINEER IMMEDIATELY OF ANY DEVIATIONS.
2. HANDRAILS SHALL BE TOP MOUNTED AND INSTALLED AS PER LAYOUT SHOWN ON THIS SHEET.
3. BASINS ARE SIZED FOR A PEAK CAPACITY OF 1.8 MGD FOR FUTURE PLANT FLOWS.

NO.	REVISION	DATE
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SCALE 3/8" = 1'-0"
DATE 10/04/2024

CITY OF TOLAR
WASTEWATER TREATMENT PLANT IMPROVEMENTS

CHLORINE CONTACT BASIN PLAN

PROJECT NO.: 8434
SEQUENCE No. 49 OF 123
SHEET No. 04D-01

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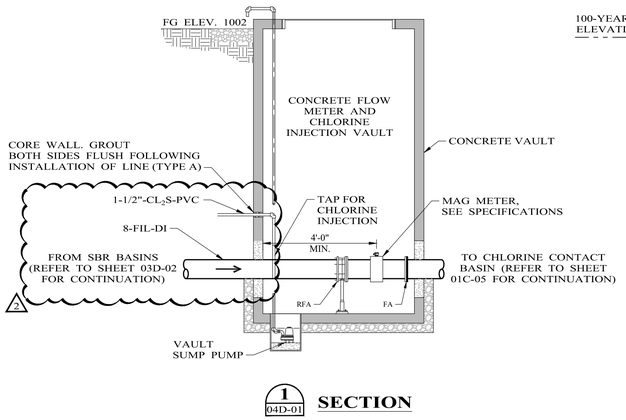
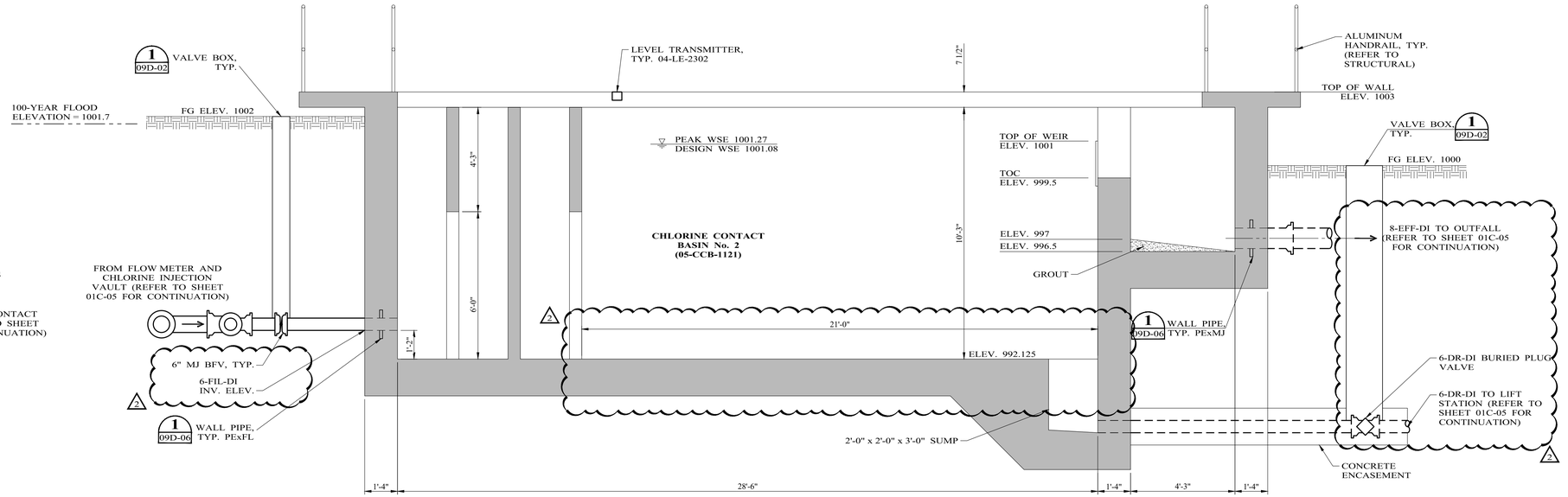


1 04D-01 **SECTION**



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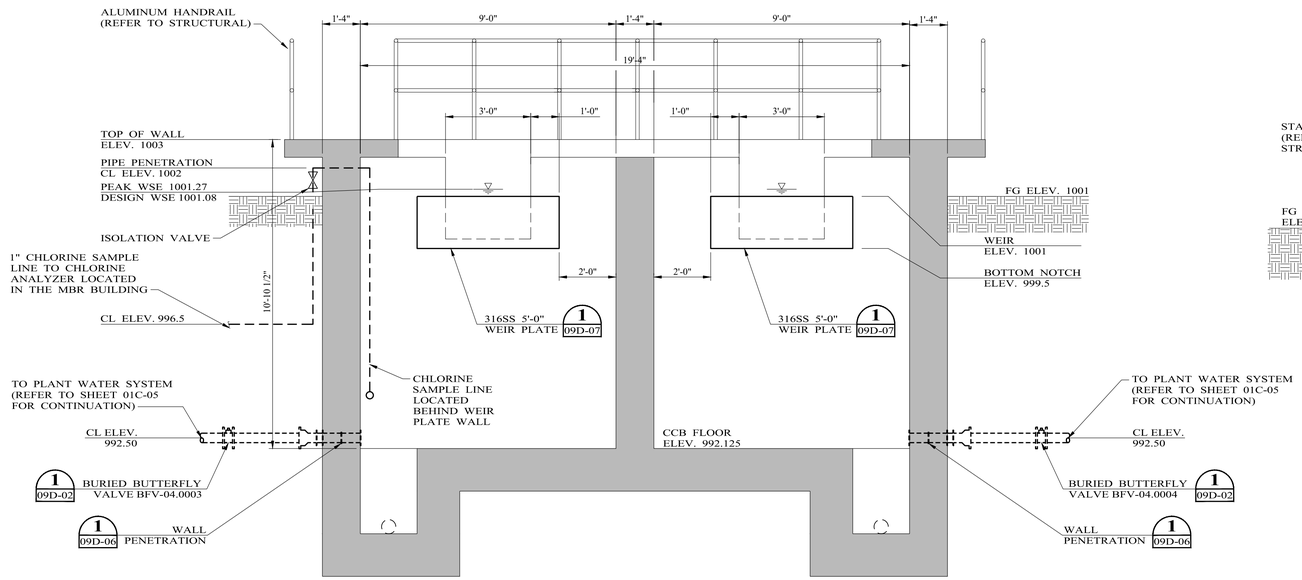

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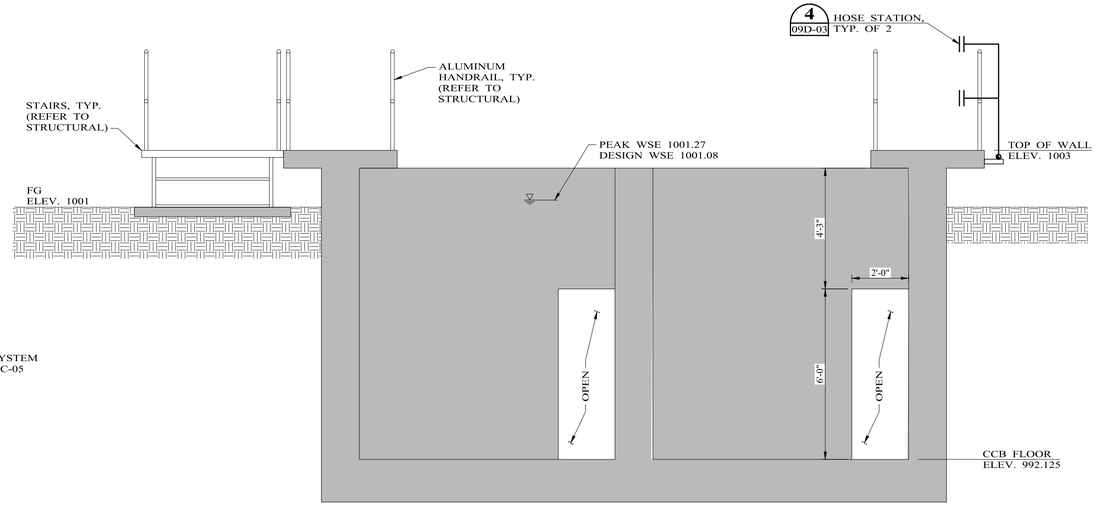

4 04D-01 **SECTION**

NO.	REVISION	DATE
0	ISSUED FOR ADVERTISEMENT	08/27/2024
1	ADDENDUM No. 2	09/24/2024
2	ADDENDUM No. 3	10/04/2024

10/04/2024

Brittany D. White

BRITTANY D. WHITE 128714 LICENSED PROFESSIONAL ENGINEER

Celebrating 35 years

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PE Firm Registration No. 1151 • PG Firm Registration No. 50103 • RPLS Firm Registration No. 10011900

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DESIGNED BY	B.WHITE
DRAWN BY	J.CASSIDY
CHECKED BY	C.RICH
SCALE	3/8" = 1'-0"
DATE	10/04/2024

CITY OF TOLAR
WASTEWATER TREATMENT PLANT IMPROVEMENTS

CHLORINE CONTACT BASIN SECTIONS

PROJECT NO.: 8434
SEQUENCE No. 50 OF 123
SHEET No. 04D-02

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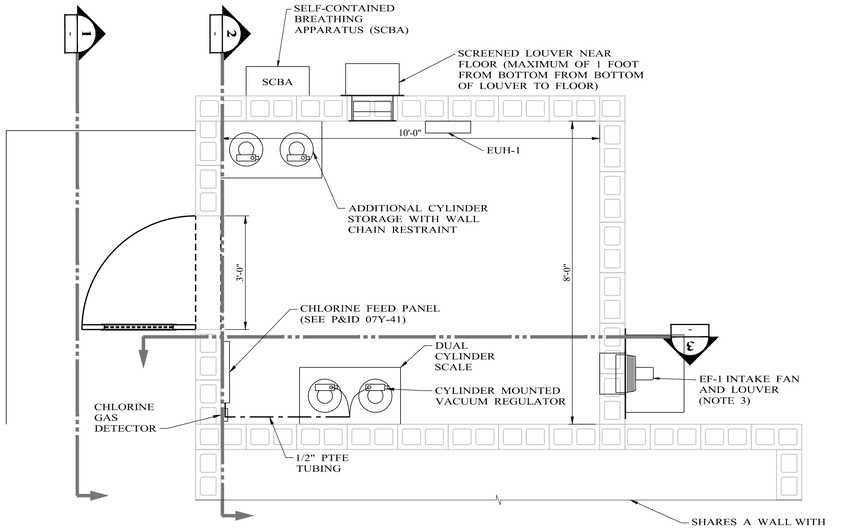

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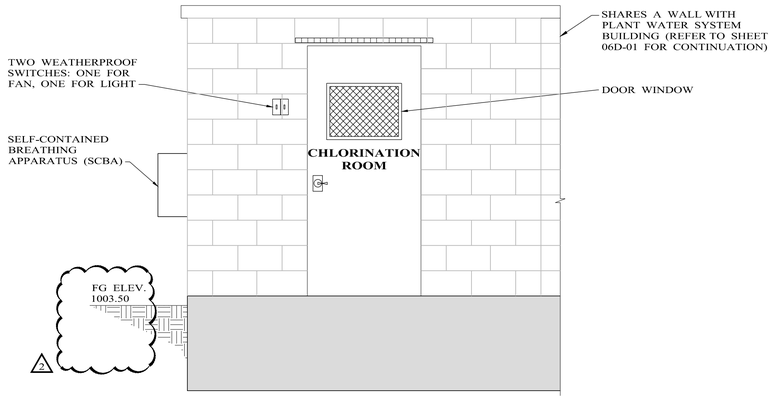
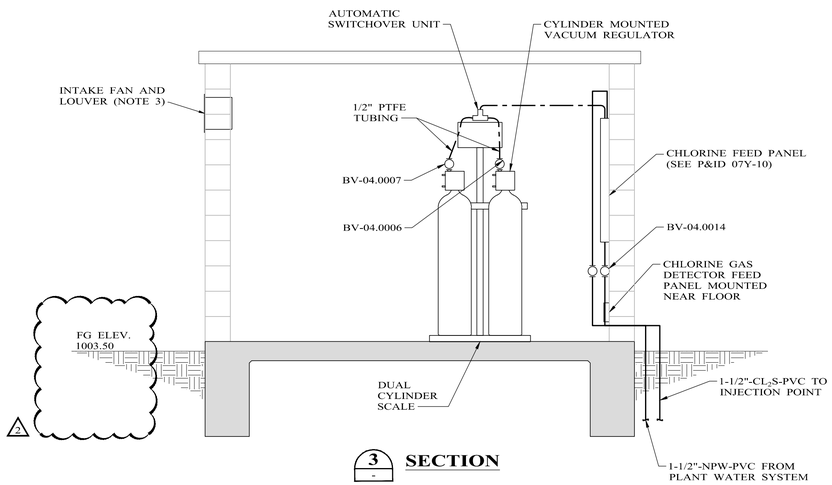


1 SECTION



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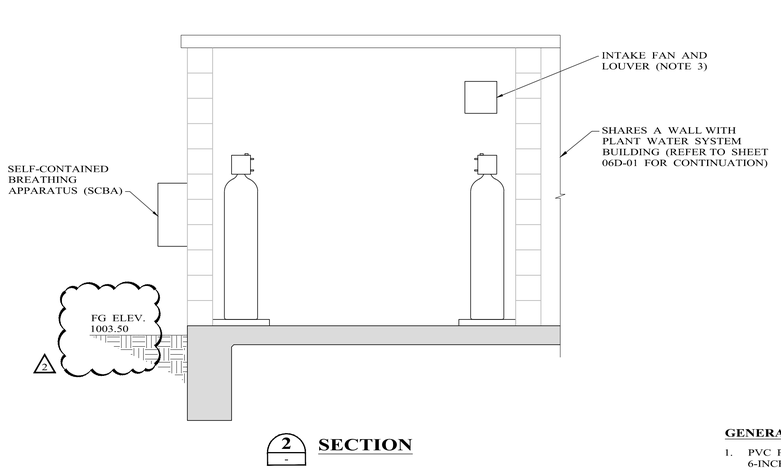

2 SECTION

GENERAL NOTES:

1. PVC PIPING, VALVES, AND FITTINGS 6-INCH AND SMALLER SHALL BE EITHER FLANGED OR SOLVENT WELDED PUSH-ON JOINT. CONTRACTOR SHALL BE RESPONSIBLE FOR ANY REQUIRED CHANGES TO THE MECHANICAL LAYOUT PROVIDED.
2. REFER TO SPECIFICATION 11260 FOR ADDITIONAL DETAILS ON CHLORINATION EQUIPMENT REQUIREMENTS.
3. INTAKE FAN/LOUVER SHALL BE INSTALLED A MAXIMUM DISTANCE OF 1 FOOT FROM THE TOP OF THE UNIT TO THE CEILING.

NO.	REVISION	DATE
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2	ADDENDUM No. 3	10/04/2024

10/04/2024

Brittany D. White

STATE OF TEXAS — BRITTANY D. WHITE — 128714 — LICENSED PROFESSIONAL ENGINEER

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CHECKED BY	C.RICH
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DATE	10/04/2024

CITY OF TOLAR
WASTEWATER TREATMENT PLANT IMPROVEMENTS

DISINFECTION FEED SYSTEM PLAN AND SECTIONS

PROJECT NO.: 8434
SEQUENCE No. 51 OF 123
SHEET No. 04D-03

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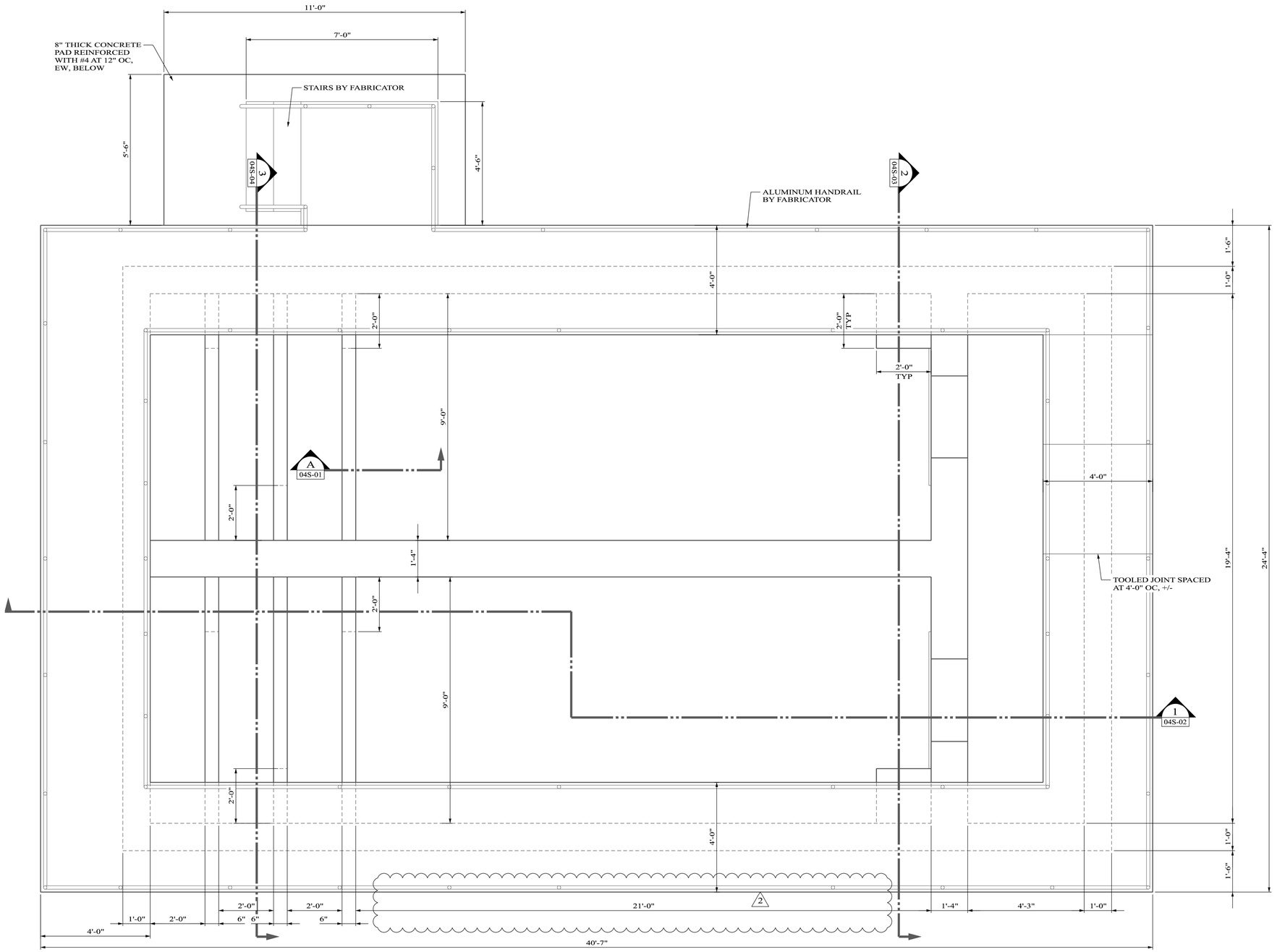
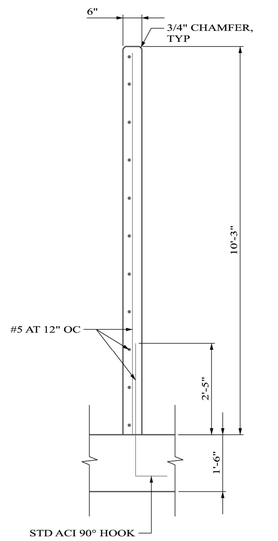


1 - STRUCTURAL PLAN
SCALE: 1/2" = 1'-0"

NOTES:

1. CONTRACTOR SHALL FIELD VERIFY ALL DIMENSIONS. NOTIFY ENGINEER IN CASE OF DISCREPANCIES.
2. CONTRACTOR SHALL COMPARE PLANS AND SECTIONS WITH EQUIPMENT FABRICATOR REQUIREMENTS AND NOTIFY ENGINEER IN CASE OF DISCREPANCY.
3. REFER 1/09S-01 FOR BACKFILL AND EMBEDS.
4. REFER 3/09S-01 FOR WALL CORNER DETAILS.
5. REFER 1/09S-02 FOR WALL INTERSECTION DETAILS.
6. REFER CIVIL DRAWINGS FOR WEIR PLATE ATTACHMENT DETAILS AND ADDITIONAL REQUIREMENTS.
7. REFER STRUCTURAL NOTES FOR EARTHWORK, CONCRETE, AND OTHER REQUIREMENTS.
8. STAIRS AND LANDING SHALL BE DESIGNED AND DETAILED BY THE FABRICATOR TO SUPPORT A LIVE LOAD OF AT LEAST 100 PSF.
9. HANDRAILS SHALL BE DESIGNED BY THE FABRICATOR TO WITHSTAND A LOAD OF 200 LB APPLIED IN ANY DIRECTION TO ANY MEMBER.
10. HANDRAILS, STAIRS, AND LANDING SHALL COMPLY WITH ALL OSHA REQUIREMENTS.
11. ALL STEEL SHALL BE HOT DIP GALVANIZED.
12. ALUMINUM SHALL BE 6061-T6 PER ASTM B308.
13. INCOMPATIBLE METALS SUCH AS STEEL AND ALUMINUM SHALL NOT BE FABRICATED TO BE IN CONTACT.
14. CONTRACTOR SHALL SUBMIT COMPLETE FABRICATION DRAWINGS FOR STAIRS, HANDRAILS, AND CONNECTIONS.



A - BAFFLE WALL SECTION
SCALE: 1/2" = 1'-0"

PIERCE ENGINEERING IS RESPONSIBLE FOR THE CONTENTS OF THIS SHEET.
TX PE FIRM NO. 9186
PHONE: 940-937-8600

NO.	REVISION	DATE
0	ISSUED FOR ADVERTISEMENT	08/27/2024
1	ADDENDUM NO. 2	09/24/2024
2	ADDENDUM NO. 3	10/01/2024

STATE OF TEXAS — BRIAN G. PIERCE — 94837 — LICENSED PROFESSIONAL ENGINEER — 10/01/2024

Celebrating 35 years

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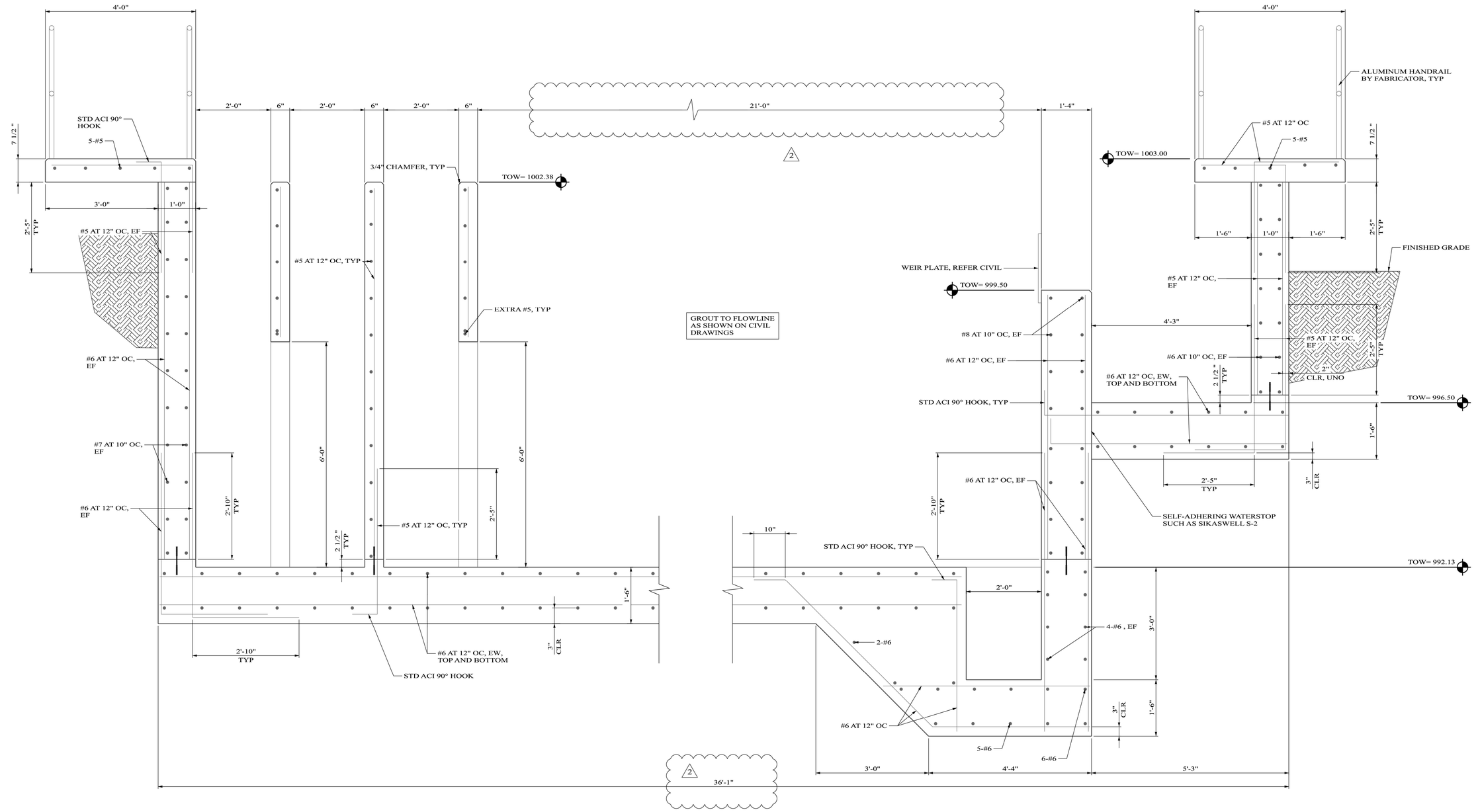
DRAWN BY	BGP
CHECKED BY	BGP
SCALE	AS NOTED
DATE	10/01/2024

CITY OF TOLAR
WASTE WATER TREATMENT PLANT IMPROVEMENTS

CHLORINE CONTACT BASIN STRUCTURAL PLAN

PROJECT NO.:	8434
SEQUENCE No.	52 OF 123
SHEET No.	04S-01



1 04S-01 CCB STRUCTURAL SECTION
SCALE: 3/4" = 1'-0"

PIERCE ENGINEERING IS RESPONSIBLE FOR THE CONTENTS OF THIS SHEET.
TX PE FIRM NO. 9186
PHONE: 940-937-8600

NO.	REVISION	DATE
0	ISSUED FOR ADVERTISEMENT	08/27/2024
1	ADDENDUM NO. 2	09/24/2024
2	ADDENDUM NO. 3	10/01/2024

REGISTERED PROFESSIONAL ENGINEER
BRIAN C. PIERCE
94837
LICENSED
10/01/2024

Celebrating 35 years

Enprotec | Hibbs & Todd
402 Cedar Street • Abilene, Texas 79601 • T: (325) 698-5560 • F: (325) 690-3240 • www.e-ht.com
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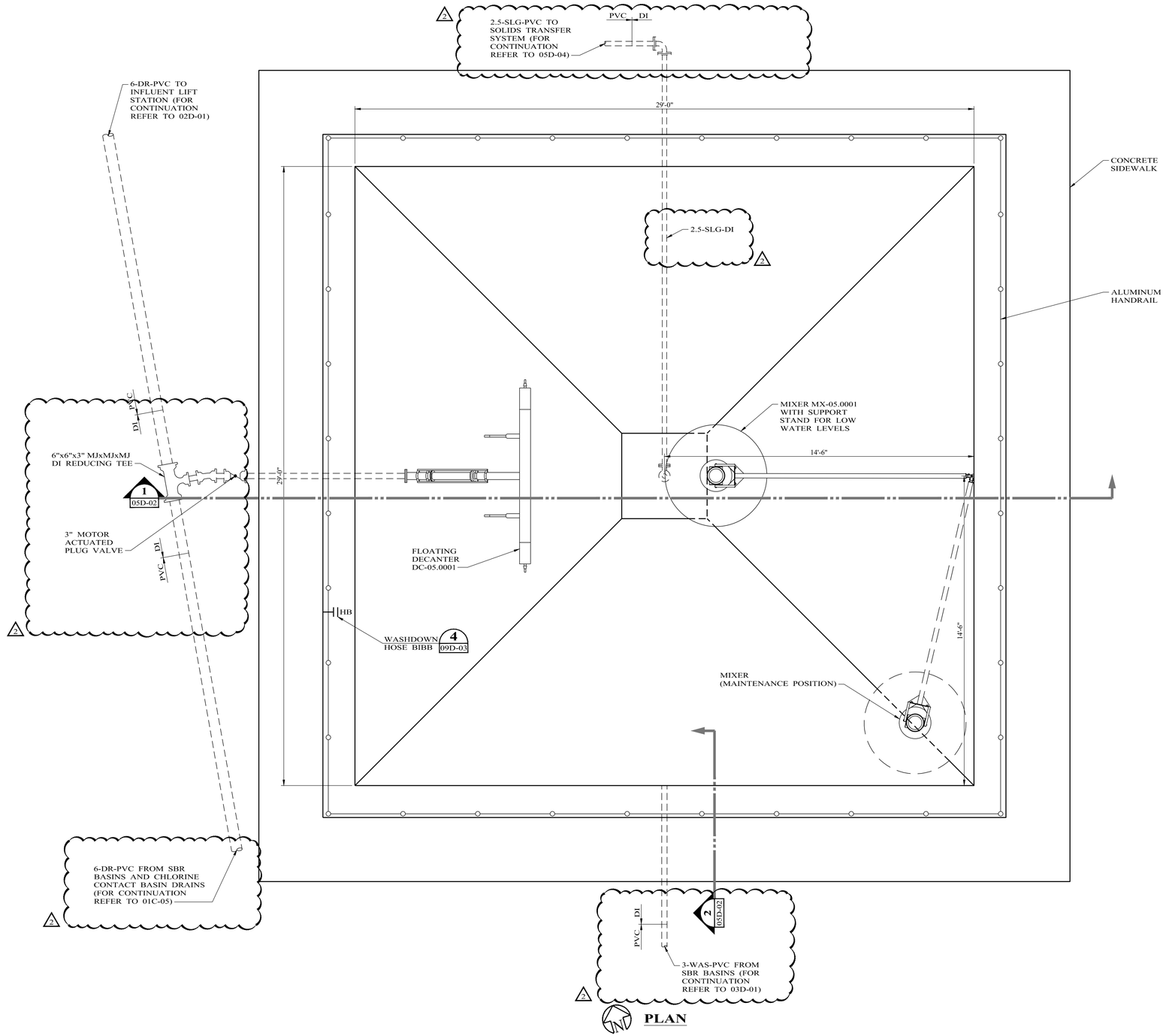
DRAWN BY BGP
CHECKED BY BGP
SCALE AS NOTED
DATE 10/01/2024

CITY OF TOLAR
WASTE WATER TREATMENT PLANT IMPROVEMENTS
CHLORINE CONTACT BASIN STRUCTURAL SECTION (1 OF 3)

PROJECT NO.: 8434
SEQUENCE No. 53 OF 123
SHEET No. 04S-02



NO.	REVISION	DATE
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2	ADDENDUM No. 3	10/04/2024

10/04/2024

Brittany D. White

STATE OF TEXAS
BRITTANY D. WHITE
128714
LICENSED
PROFESSIONAL ENGINEER

Celebrating 35 years

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CHECKED BY	C.RICH
SCALE	3/8"=1'-0"
DATE	10/04/2024

CITY OF TOLAR
WASTEWATER TREATMENT PLANT IMPROVEMENTS

SLUDGE STORAGE BASIN PLAN

PROJECT NO.:	8434
SEQUENCE No.	59 OF 123
SHEET No.	05D-01

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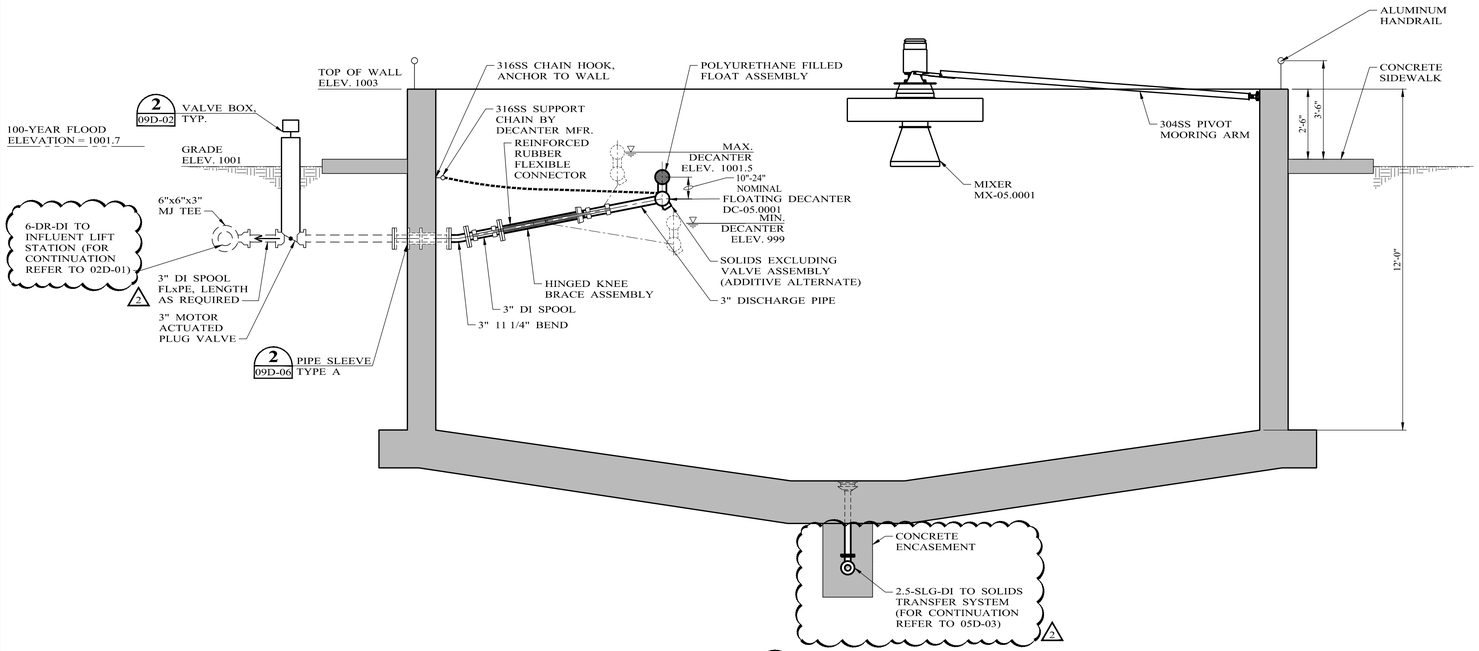

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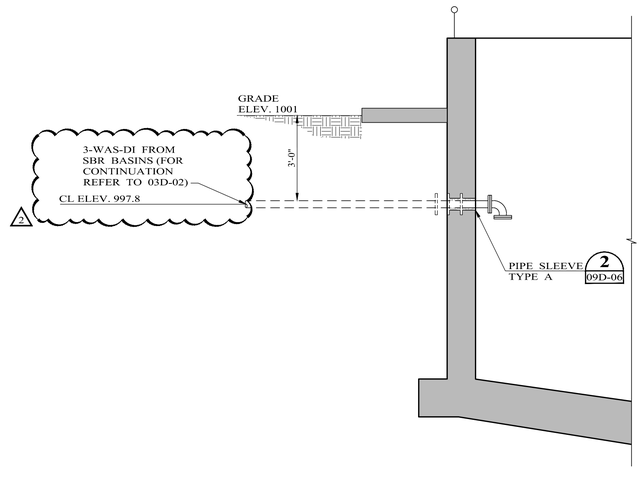

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NO.	REVISION	DATE
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1	ADDENDUM No. 2	09/24/2024
2	ADDENDUM No. 3	10/04/2024

10/04/2024

Brittany D. White

STATE OF TEXAS
BRITTANY D. WHITE
128714
LICENSED
PROFESSIONAL ENGINEER

Enprotec | Hibbs & Todd
402 Cedar Street • Abilene, Texas 79601 • T: (325) 698-5560 • F: (325) 690-3240 • www.e-ht.com
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SCALE 3/8"=1'-0"
DATE 10/04/2024

CITY OF TOLAR
WASTEWATER TREATMENT PLANT IMPROVEMENTS

SLUDGE STORAGE BASIN SECTION

PROJECT NO.: **8434**
SEQUENCE No. **60 OF 123**
SHEET No. **05D-02**

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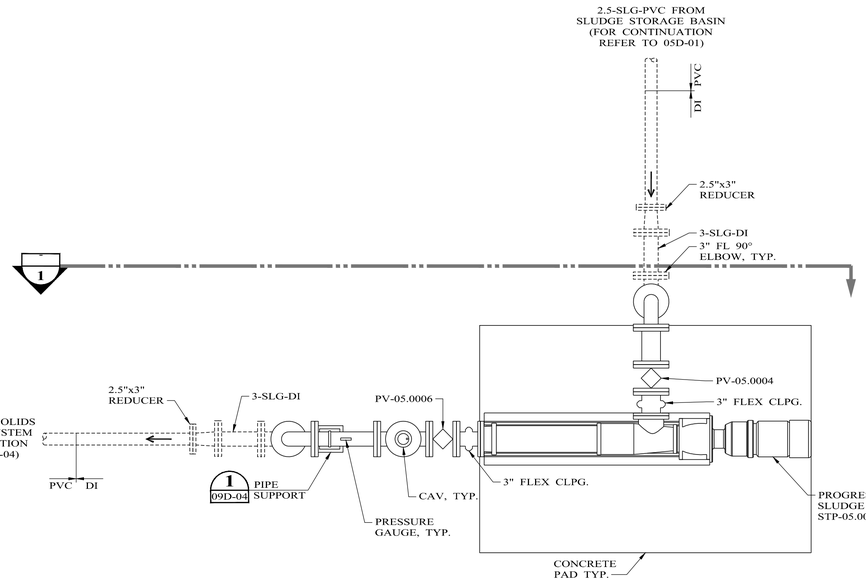

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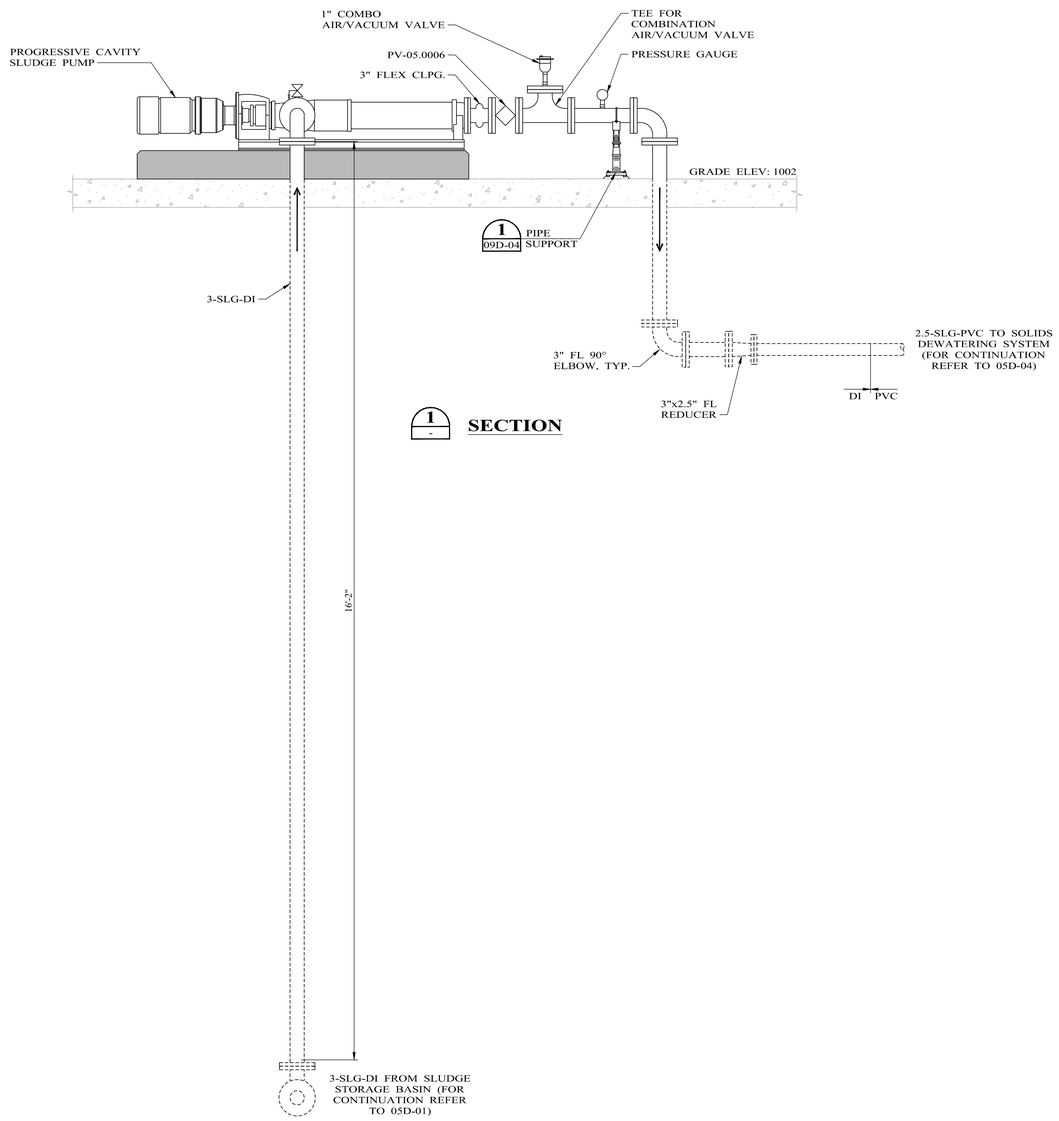

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NO.	REVISION	DATE
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10/04/2024

Brittany D. White

STATE OF TEXAS
BRITTANY D. WHITE
128714
LICENSED
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CHECKED BY C.RICH
SCALE 3/4"=1'-0"
DATE 10/04/2024

CITY OF TOLAR
WASTEWATER TREATMENT PLANT IMPROVEMENTS

SOLIDS TRANSFER SYSTEM PLAN

PROJECT NO.: 8434
SEQUENCE No. 61 OF 123
SHEET No. 05D-03

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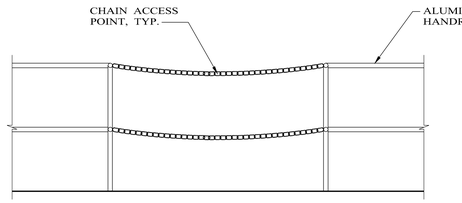

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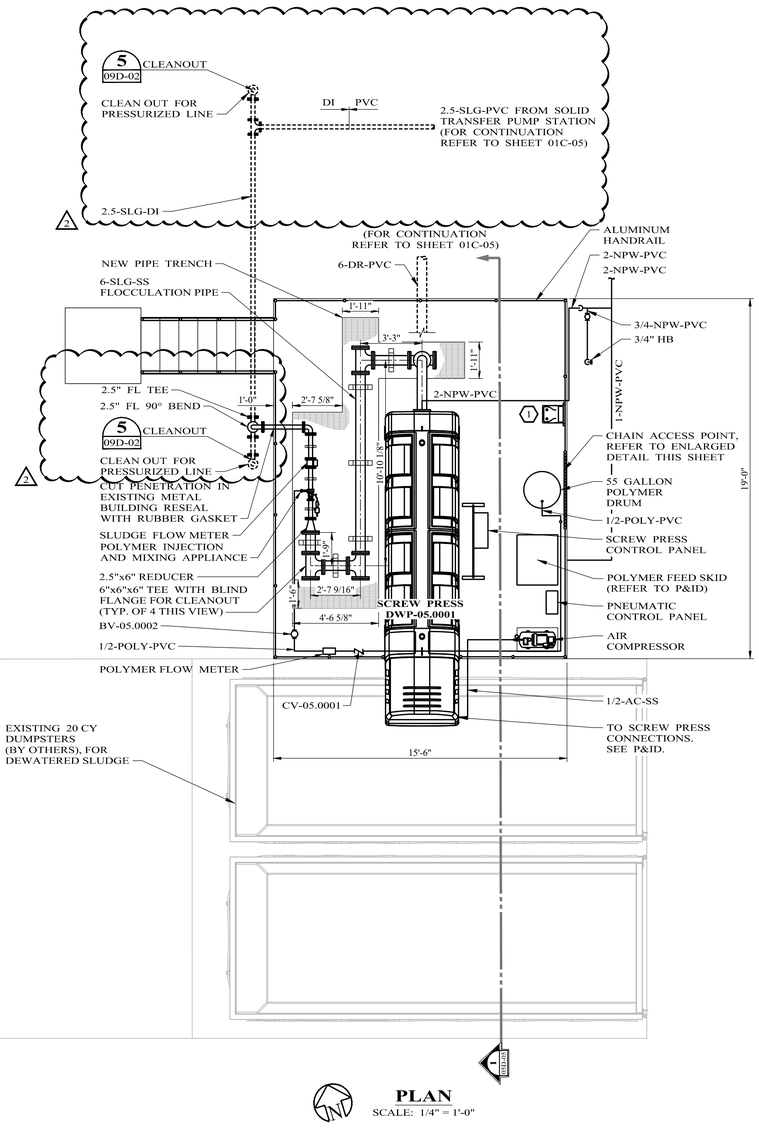
SCALE: NO SCALE



PLAN
SCALE: 1/4" = 1'-0"

NOTES INDICATED ON DRAWING BY (#):

1. STAND ALONE EYEWASH STATION, HONEYWELL 32-000400-0000 OR ENGINEER APPROVED EQUAL.

NO.	REVISION	DATE
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10/04/2024
Brittany D. White

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Celebrating 35 years

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SCALE	AS NOTED
DATE	10/04/2024

CITY OF TOLAR
WASTEWATER TREATMENT PLANT IMPROVEMENTS

SOLIDS DEWATERING SYSTEM PLAN

PROJECT NO.:	8434
SEQUENCE No.	62 OF 123
SHEET No.	05D-04

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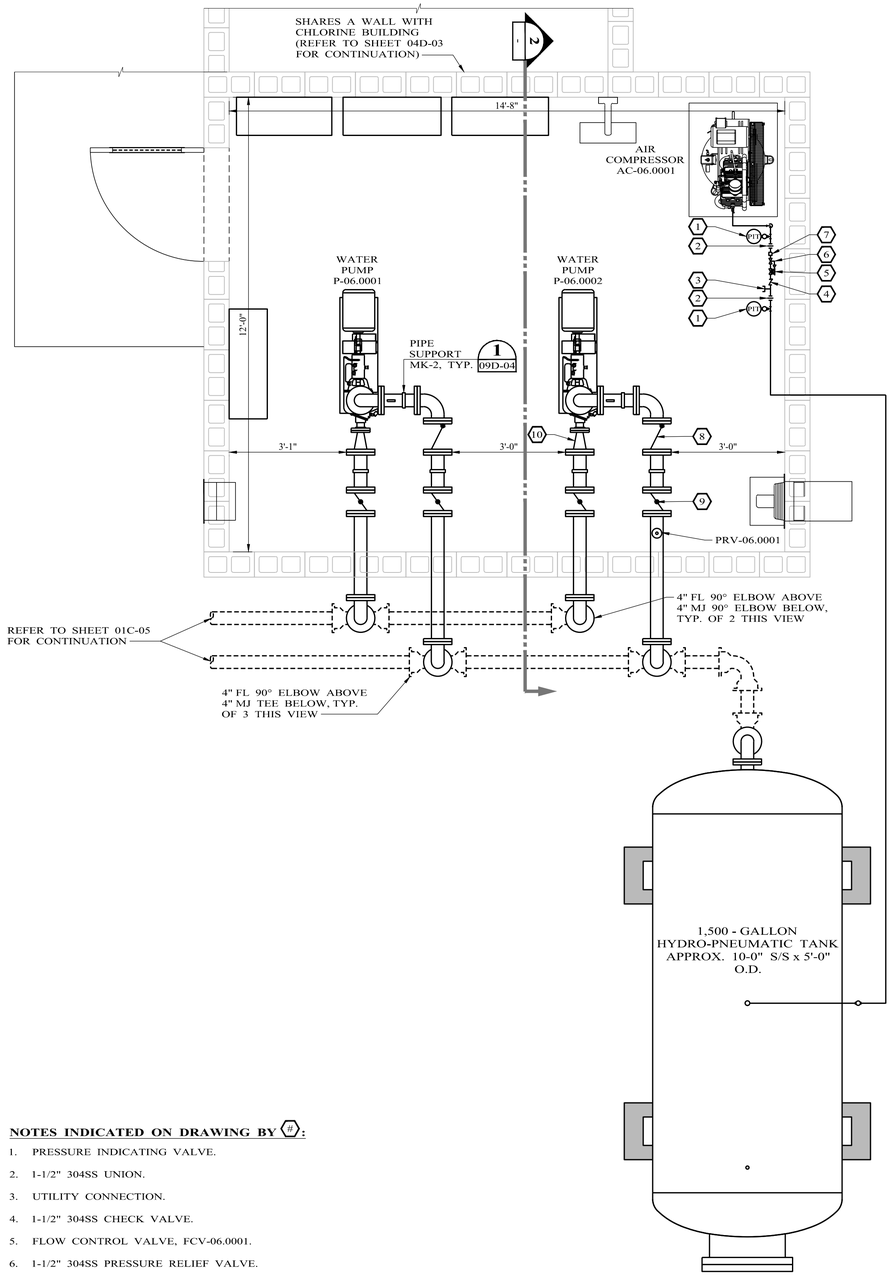
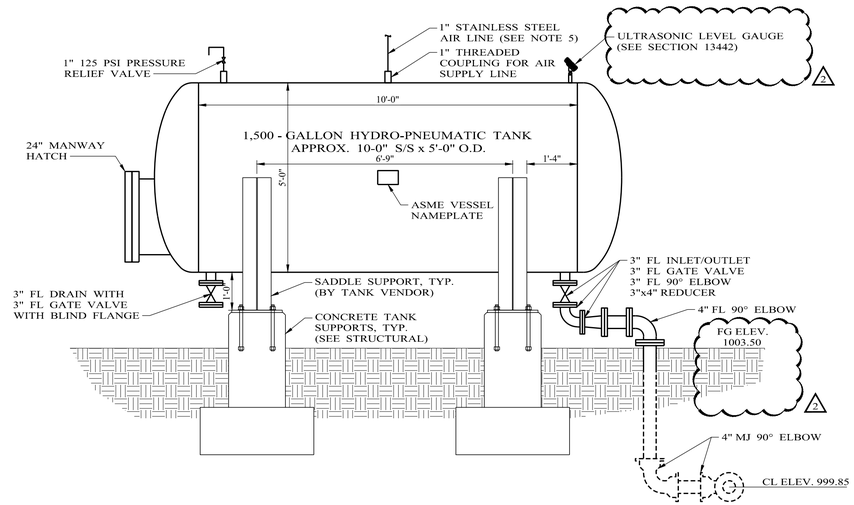


PLAN



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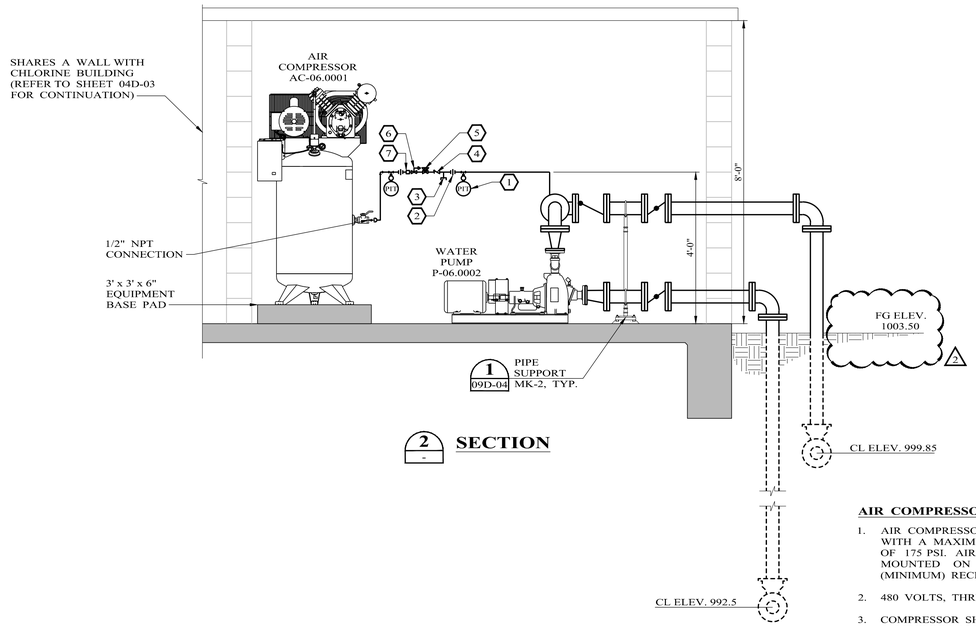

2 - SECTION

NOTES INDICATED ON DRAWING BY (#):

1. PRESSURE INDICATING VALVE.
2. 1-1/2" 304SS UNION.
3. UTILITY CONNECTION.
4. 1-1/2" 304SS CHECK VALVE.
5. FLOW CONTROL VALVE, FCV-06.0001.
6. 1-1/2" 304SS PRESSURE RELIEF VALVE.
7. OIL COALESCING FILTER.
8. 4" CHECK VALVE TYP. OF 2 THIS VIEW.
9. 4" BUTTERFLY VALVE, TYP. OF 4 THIS VIEW.
10. 4"x2" REDUCER TYP. OF 4 THIS VIEW. (2 CONCENTRIC / 2 ECCENTRIC)

AIR COMPRESSOR SPECIFICATIONS:

1. AIR COMPRESSOR SHALL BE TWO STAGE, WITH A MAXIMUM OPERATING PRESSURE OF 175 PSI. AIR COMPRESSOR SHALL BE MOUNTED ON TOP OF A 80-GALLON (MINIMUM) RECEIVER AIR TANK.
2. 480 VOLTS, THREE PHASE.
3. COMPRESSOR SHALL BE ABLE TO SUPPLY A MINIMUM 15.8 CFM AT 90 PSI.

NO.	REVISION	DATE
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10/04/2024

Brittany D. White

BRITTANY D. WHITE 128714 LICENSED PROFESSIONAL ENGINEER

Celebrating 35 years

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DRAWN BY J.CASSIDY
CHECKED BY C.RICH
SCALE 1/2"=1'-0"
DATE 10/04/2024

CITY OF TOLAR
WASTEWATER TREATMENT PLANT IMPROVEMENTS

NON-POTABLE REUSE PLANT WATER SYSTEM PLAN & SECTIONS

PROJECT NO.: 8434
SEQUENCE No. 69 OF 123
SHEET No. 06D-01

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CLARIFICATIONS

Enprotec | **Hibbs & Todd**

August 7, 2023

Tucker Stone
Xylem Water Solutions USA, Inc.
247 W Freshwater Way, Suite 200
Milwaukee, WI 53204

Re: Proposal Rankings
City of Tolar Wastewater Treatment Plant
Sequencing Batch Reactor Equipment
Tolar, TX 76476

Dear Tucker Stone:

Proposals for the referenced project were opened on June 1st, 2023. A total of four (4) proposals were received. The proposals were evaluated, scored, and ranked based upon the criteria outlined in the Criteria for Award section of the Request for Proposals. The final ranking of the submitted proposals is as follows:

1. Xylem – Sanitaire
2. Alfa Laval Inc.
3. Parkson Corporation
4. Vision Equipment – ISS

Based upon these rankings, the City of Tolar has awarded the SBR Equipment Package to Xylem - Sanitaire.

Thank you for your efforts in developing these proposals and your interest in this project. We look forward to working with Xylem – Sanitaire as this project moves forward. eHT will be in contact to begin the execution of the Contract Documents shortly.

Sincerely,

Enprotec / Hibbs & Todd, Inc.

Brittany D. White

Brittany D. White, P.E.
Project Manager

12.11.23 Scope and Price Clarification
Base Bid Scope per Xylem Sanitaire's Proposal dated 6/1/2023,
Including the Adder for OIS SBR SCADA Package
Total Price: $749,500.00

Initial & Date to Confirm Scope & Price: BDW 12-19-23

BDW/jd
c: Daniel Wilson – Public Works Director – City of Tolar, TX
Michell Burdette – City Administrator – City of Tolar, TX
Project File: 8434

Xylem Water Solutions USA, Inc.
SANITAIRE® Proposal

for

City of Tolar, TX

Wastewater Treatment Plant Improvements
Request for Proposals for
Sequencing Batch Reactor Equipment

Engineer: Enprotec | Hibbs & Todd

Bid Date: 06/01/23

Sanitaire, a Xylem Brand
247 W Freshwater Way, Suite 200
Milwaukee, WI 53204
(414) 365-2200

Sanitaire Project No. a32101-23

Table of Contents

CITY OF TOLAR, TEXAS
REQUEST FOR PROPOSALS FOR SEQUENCING BATCH REACTOR EQUIPMENT
PROPOSAL PRICE SHEET

This Proposal Price Sheet shall be completed in full. All blank spaces for bid items shall be filled in, in ink or typewritten, and the Sheet shall be fully completed and executed when submitted.

As part of its Proposal document, the Respondent may offer alternate bid items or terms that in its assessment may serve to benefit the Owner and facilitate the completion of the project as desired by the Owner. Such items are subject to the Owner's acceptance.

BASE ITEMS AS SPECIFIED AND PER ATTACHED SCOPE LETTER, COMMENTS AND EXCEPTIONS	PROPOSAL PRICE
Furnish a **Sequencing Batch Reactor (SBR) System** including all required equipment, controls, appurtenances, and manufacturer's services as shown and specified herein for a lump sum of Six-Hundred Forty-Nine Thousand and Five-Hundred Dollars and Zero Cents/Lump Sum.	$649,500.00

Note: Referencing attached scope letter, adder prices shown on following page.

Respectfully Submitted (Proposer): Xylem Water Solutions

By: Tucker Stone, Application Engineer; Fran Pastors, Territory Manager

In submitting this Proposal, Proposer represents, as set forth in the Agreement, that:

A. Proposer has examined and carefully studied the Documents, the other related data identified in the Documents, and the following Addenda, receipt of all which is hereby acknowledged.

Addendum No.	Addendum Date
_____	_____
_____	_____
_____	_____

B. Proposer certifies Proposer is qualified to do business in the state where the Project is located as required by laws, rules, and regulations or, if allowed by stature, covenants to obtain such qualification prior to contract award.

C. The Proposer shall provide values for specific performance parameters for the equipment being bid. The Proposer understands and agrees that the values stated in this Section for the associated performance parameters will be compared to the performance standards required in the equipment specifications. Proposers understand and agree to guarantee the performance values stated herein for the equipment bid in accordance with the guidelines specified herein.

D. Proposer understands and agrees that this PROPOSAL shall form the basis for an agreement with the OWNER. Therefore, the Proposer agrees to enter into an agreement to perform and furnish all Work as specified or indicated in these Specifications for the amount indicated in this Bid and in accordance with the other terms and conditions of these RFP Documents.

E. Proposer accepts all of the terms and conditions of these RFP Documents. This Proposal shall remain subject to acceptance for a period of 365 days after the day of opening.

F. Proposer has given ENGINEER written notice of all conflicts, errors, ambiguities, or discrepancies that Proposer has discovered in the Documents, and the written resolution thereof by ENGINEER is acceptable to Proposer.

G. The RFP Documents are generally sufficient to indicate and convey understanding of all terms and conditions for the performance of the Work for which this Proposal is submitted.

Note: Xylem's standard T&C's are attached for reference. Final T&C's for the contract to be negotiated.

Adder - Aerzen Blowers:	$30,000
Adder - Two (2) Aeration Grids per Basin:	$10,000
Adder - OIS SCADA Package:	$100,000
Adder - ControlLogix PLC:	$80,000

added via email
6/11/2024

Our Engineering Group took a look at outdoor enclosures for the following:

1. ICEAS Control Panel (Estimated Size: 84" x 40" x 18") – Free Standing
   NOTE: Previously considered to be installed indoors (NEMA 4X – No AC unit).

2. Cabinet with Blower VFD's, Decanter VFD's and WAS Pump Motor Starters (Estimated Size: 84" x 78" x 18") – Free Standing
   NOTE: Previously we had considered wall mounting blower VFD's, Decanter VFD's and a small enclosure with WAS pump starters (indoor with NO AC units).

The adder to provide these enclosures for covered outdoor application (SS NEMA 4 Panels with 8,000 BTU Air Conditioners in each) is $42,000.

APPENDIX A - STATEMENT OF QUALIFICATIONS

EXECUTIVE SUMMARY

CITY OF TOLAR, TX
XYLEM SANITAIRE ICEAS/SBR

Xylem Water Solutions - Sanitaire is a market leader in biological process solutions with an extensive global installed base. We offer a wide-array of innovative process solutions optimized to provide reliable treatment performance and enhanced energy efficiency, including Sanitaire, Flygt, YSI, and other product offerings complementing our SBR offering. Information on Xylem brands, company history, and financial are available on our website, https://www.xylem.com/en-us/.

The ICEAS® advanced SBR process offered for the City of Tolar WWTP project is an innovative batch process with continuous in-flow to optimize plant operation simplicity and flexibility. With over 1,000 ICEAS® installations world-wide, Xylem's in-depth process knowledge, and experience coupled with our world-leading brands of Sanitaire, Flygt and YSI, has allowed us to optimize our process designs, enhance our energy efficiency, and to provide sustainable, reliable, easy-to-operate plant performance at lowest life cycle cost.

The Sanitaire ICEAS® process proposed for Tolar, TX is an advanced SBR with continuous influent into each of the reactors and a batch discharge with batch decant periods. The continuous feed inflow eliminates the need for any kind of equalization tank before the ICEAS® process, and it is sized such that when one tank is taken out of service for maintenance, the remaining plant can still treat 75% of the daily average design flow. Each ICEAS® reactor will have a pre-react wall dividing the reactor into two chambers. Among other advantages the pre-react wall prevents short-circuiting of influent during the settle and decant phases of the cycle. With this arrangement one reactor can be taken out of service, as the other remains operational. Note that all reactors can receive influent during all phases of the cycle, even the decant phase, without risk of discharging untreated waste. This is a significant advantage of the ICEAS® process over true batch SBR's. Other advantages are listed in the "Introduction to ICEAS®" following this Summary.

This 2-basin ICEAS® process design is based on the influent parameters listed in the Design Proposal in the following Section. Some of the design highlights:

- Blowers – Note that due to ICEAS's time-based cycle, dedicated blowers for each basin are not required. Pairs of basins share blowers because the cycle is set up such that the air is never required simultaneously in both basins. In this case we are offering (2) 50% blowers which will feed either Basin 1 or 2. A third blower will function as a standby unit. The 50% blowers are sized so that during initial or low load conditions, only one blower will be required. During diurnal or peak loads the

second blower will be brough online. Xylem is offering two blower options: Gardner Denver 408 "Heliflow" PD blowers as our base offering, and an adder option for Aerzen PD blowers.

- Aeration System – The ICEAS® SBR utilizes the time proven, energy efficient Sanitaire aeration system. The ICEAS® Basins will have the Sanitaire Silver Series II membrane disc diffusers for maximum oxygen transfer efficiency. Silver Series membranes are the best available in the industry and often have a life exceeding 12 years. The aeration system itself is designed for a 20 year life but there are many Sanitaire aeration systems in operation for more than 30 years.
- Continuous Flow ICEAS® Process – The time-proven process requires no influent valves, no effluent valves. The influent flows from a splitter box, through the reactors and discharges through the decanter effluent withdrawal, all by gravity as the decanter lowers allowing effluent to overflow over the weir. This greatly simplifies the system design compared to conventional SBRs.
- The ICEAS® SBR offered for the Tolar facility utilizes an NIT (nitrification) Cycle which processes the wastewater in cycles which include 12 hours of aerated aerobic time per day per reactor. This cycle is ideal for achieving the 3 mg/l NH3 limit. Process and cycle adjustments can be accommodated in the future to enhance either N or P removal or both by adding anoxic and/or anaerobic periods as well as adding additional cycles to process peak flows. The ICEAS® process offers a multitude of options for upgrading system performance, and it can often be handled by upgrading the operating program adjusting cycle times, rather than requiring major civil works additions of anoxic/anaerobic reactors and recycle pumping systems. The Sanitaire ICEAS process has many plants achieving as low as 3 mg/l TN and 0.5 mg/l TP. We also offer several control options such as NURO and SIMS which assist the operator in maintaining ideal conditions to meet these more stringent operating requirements. For further discussion of these, please refer to the ICEAS Operation Flexibility write-up in this section.
- Note that our offering includes not only a process performance guarantee, but we are also including a 1-year warranty on our equipment.

Every effort has been made to provide a complete and concise proposal document. Appendix B – Technical Elements details our Scope of Supply including all equipment, pricing, delivery times, shipping and service information. Also included in this section are our O&M Requirements, Power Requirements and Spare Parts Pricing along with details around our process design for both the ICEAS® SBR. It includes detailed process calculations, aeration design and includes the draft Process Performance Guarantee. Appendix A includes experience and performance information. Appendix B also includes technical information on all of our equipment including brochures, data sheets and drawings.

Xylem would like to thank the evaluators for consideration of this proposal, and we are more than pleased to provide additional information or clarify any questions with regard to this technical proposal.

Biological Systems Partial Installation List

Job #	Plant	Location	Process	MGD ADWF	MGD PWWF	Start	Contact	Engineer
08-6923a	Alvarado	TX	Iceas NIT	0.60	1.6		Alvarado WWTP, TX Alvarado, TX	Dannenbaum Engineering Houston, TX 713-520-9570
1432	Atlanta			2.0	5.0	1995	Atlanta, TX WWTP Atlanta, TX 903-799-4063	Brannon Corporation Tyler, TX 903-597-2122
11-7699a	Atlanta WWTP						City of Atlanta, TX Atlanta, TX 903-799-0643	
05-5923a	Aubrey WWTP			0.25	0.75	2005	Aubrey WWTP, TX Aubrey, TX	Brannon Corporation Tyler, TX 903-597-2122
06-6333a	Big Lake			0.35	1.3	2007	Big Lake WWTP, TX Big Lake, TX 325-884-2814	Hibbs and Tobb, Inc Abilene, TX 915-698-4330
12-7921a	Big Lake WWTP			0.17	0.64			Enprotec/Hibbs & Todd
95-4008a	Bonham, TX - ABJ Plt			2.5	6.6	1996	Bonham, TX - City of Bonham, TX 903-583-4033	Hayter Engineering Paris, TX 903-785-0303
02-5005	Celina WWTP			0.25	0.82	2002	Celina, TX Celina, TX 972-382-2682	Hunter Assoc Austin, TX 972-712-6400
99-4230a	Clifton WWTP		Iceas NDNP	0.65	1.8	2000	Clifton WWTP, TX Clifton, TX 254/386-7431	Brannon Corporation Tyler, TX 903-597-2122
15-8678a	Cypress Hill MUD 1		Iceas NIT	1.0	3.0			Dannenbaum Engineering Houston, TX 713-520-9570
09-7106a	Eden			0.44	1.3		Eden, TX Eden, TX 325-456-0582	Burgess & Niple
05-6214a	Fort Bend County MUD 118- Upper Oyster Creek WWTP			0.75	3.0	2007	ECO Resources Inc. Sugarland, TX 281-253-8273/240-1700	Carter and Burgess Houston, TX 713-869-7900
06-6483a	Hico WWTP		Iceas NDNP	0.25	0.75		Hico WWTP, TX Hico, TX 254-977-4431	Brannon Corporation Tyler, TX 903-597-2122

Biological Systems Partial Installation List

Job #	Plant	Location	Process	MGD ADWF	MGD PWWF	Start	Contact	Engineer
09-7118a	Hico WWTP	TX	Iceas NDN				Hico WWTP, TX Hico, TX 254-977-4431	KSA Engineers Lufkin, TX 936 637-6061
02-4985a	Houston - Cypress Hill MUD # 1 - WWTP		Iceas NIT	0.80	2.1	2002	Aqua Source Houston, TX 832-347-0232	Dannenbaum Engineering Houston, TX 713-520-9570
06-6447a	Italy WWTP			0.65	1.5	2007	Italy, TX Italy, TX 254-687-2642	Brannon Corporation Tyler, TX 903-597-2122
10-7471a	La Joya			1.4	4.8			S & B Infrastructure
1358	Livingston			2.3	6.8	1991	Livingston, TX WWTP Livingston, TX 409-327-3251	Brannon Corporation Tyler, TX 903-597-2122
09-7256a	Livingston WWTP							
1530	Mineral Wells			1.3	3.2	1995	Mineral Wells - Pollard Creek WWTP Mineral Wells, TX 817-325-3861	Freese and Nichols Ft. Worth, TX 817-735-7300
16-8977a	Pearland							CDM
99-4395a	Reno WWTP			0.52	1.6	2000	City of Reno Reno, TX 903-785-6581	Hayter Engineering Paris, TX 903-785-0303
1381	Rio Vista			0.10	0.22	1992	Rio Vista, TX WWTP City of Rio Vista, TX 817 373 2588	Brannon Corporation Tyler, TX 903-597-2122
97-3759a	Saint Jo			0.15	0.52	1998	City of Saint. Jo Saint Jo, Texas 940-995-2337	Chiang, Patel and Yerby, Inc Dallas,, TX 214 638-0500
97-3717a	Sinton			0.80	2.4		Sinton WWTP, TX Sinton, TX 361-364-1964	Naismith Engineering, Inc. Corpus Christi, TX 361-814-9900
15-8620a	Sinton WWTP							
01-4832a	Sweetwater WWTP			2.2	8.0	2002	Sweetwater WWTP, TX Sweetwater, TX 325-235-8130	Hibbs and Todd, Inc Arlington, TX 915 698-4330
12-7752a	Tex Americas Center WWTP			1.5	4.5			

Biological Systems Partial Installation List

Job #	Plant	Location	Process	MGD ADWF	MGD PWWF	Start	Contact	Engineer
11-7652a	Weston Mud	TX	Iceas NDNP	0.70	2.8			Jacobs Engineering Baton Rouge, LA 225 768-5077

29 Installations

Technical Support Services & Capabilities

CITY OF TOLAR, TX
XYLEM SANITAIRE ICEAS/SBR

- Control systems are shop tested prior to shipment. This provides quality assurance and fast, trouble-free startup.
- Two one-week onsite commissioning visits, one by each the mechanical and electrical technical staff to ensure proper installation and startup.
- One week process training visit by process engineer approximately 90-180 days after startup to ensure operator has time to work with the system and develop questions and comments.
- EWON access to control program for troubleshooting electrical control system
- Complete 24/7 phone support, including weekends and holidays. Phone technicians have capabilities to dial in for troubleshooting.
- Complete electronic mail (e-mail) support.
- Mechanical and Electrical Engineer assigned to the project for the life of the installation.
- Local Representative (Hartwell Environmental and Hahn Equipment) available for basic services and immediate contact and to coordinate responses with project support team, see resumes following.
- Engineering Staff
    - (6) Mechanical Project Engineers
    - (4) Dedicated Process Engineers
    - (7) Dedicated Electrical Engineers/Technicians
    - (10) Service Technicians
      (Includes mechanical/process/electrical Engineers counted above)

Local Representatives/Parts and Service Support:

Hartwell Environmental Corporation
5211 West Arkansas Lane
Arlington, TX 76016
817.446.9500

Hahn Equipment (Xylem-Flygt Distributor)
Houston, TX

Local Sanitaire Service Technician
Tim Hunt
Austin, TX

APPENDIX B - TECHNICAL ELEMENTS

BIOLOGICAL TREATMENT AND THE ABJ PROCESS

INTRODUCTION

This Biological Treatment and ABJ Process section begins with a general discussion regarding the philosophy and principles of biological treatment. The following discussions include a summary of both the conventional activated sludge process and conventional SBR technology. The final discussion focuses specifically on the ABJ ICEAS process; it's features, benefits and differences from conventional processes.

PRINCIPLES OF BIOLOGICAL TREATMENT

Biological treatment is achieved by creating an environment suitable for the survival and reproduction of various bacterial cultures and exposing them to organic substances present in the wastewater. This is a natural process that also occurs in any natural body of water.

The activated sludge process that is used for treatment of wastewater originating from domestic and industrial sources is a biological system. It is designed to optimize the efficiency or the degree of treatment that occurs in a natural body of water. In order to understand the activated sludge process, it is of paramount importance to be familiar with the principles of biological treatment.

MEASUREMENT OF ORGANIC MATTER

The organic strength of the wastewater is measured experimentally using various test procedures such as Biochemical Oxygen Demand (BOD_5), Ultimate Biochemical Oxygen Demand (BOD_U), Chemical Oxygen Demand (COD) and Total Organic Carbon (TOC). Of these, BOD_5 is the most commonly used parameter.

BIOCHEMICAL OXYGEN DEMAND (BOD_5)

Biochemical Oxygen Demand (BOD_5) is a measurement of the amount of oxygen demand exerted by microorganisms to oxidize the organics present in wastewater during a 5-day test period. The task of biological treatment is to reduce the oxygen demand exerted by the microorganisms to a level that will have no significant impact on the receiving stream. The BOD removal process is illustrated by the following equation:

$$BOD_5 + O_2 \xrightarrow[\text{Nutrients}]{\text{Bacteria}} \text{New Cells} + CO_2 + H_2O + \text{Nutrients} + \text{Energy} \quad (1)$$

NUTRIENTS

Nitrogen and phosphorus serve as essential nutrients in the growth of living organisms including human beings, plants and microorganisms. High concentrations of these nutrients discharged into receiving water bodies can result in eutrophication. Controlled discharge of these nutrients necessitates their removal during treatment of the wastewater. The forms, in which these nutrients exist in the wastewater and how they are removed during wastewater treatment, are described below.

NITROGEN

The sources of nitrogen in domestic wastewater are urea, feces and other organic material. Inorganic nitrogen is a combination of ammonia nitrogen, nitrite nitrogen and nitrate nitrogen. Total Kjeldahl Nitrogen (TKN) is a combination of ammonia nitrogen and organic nitrogen.

BIOLOGICAL NITROGEN REMOVAL

This process can be divided into two steps:

1. Nitrification - ammonia nitrogen is converted to nitrate by bacteria in the presence of oxygen
2. Denitrification - nitrate is converted to nitrogen gas in the absence of oxygen. Since biological denitrification is performed only on the nitrate ion, nitrification is essential for complete nitrogen removal.

NITRIFICATION

In biological nitrification, two sequential reactions occur:

1. Conversion of ammonia to nitrite by *Nitrosomonas* organisms

$$\text{Ammonia Nitrogen} + 1.5\ O_2 \quad \text{------>} \quad \text{Nitrite} + H_2O + \text{Loss of Alkalinity} \qquad (2)$$

2. Conversion of nitrite to nitrate by *Nitrobacter* organisms

$$\text{Nitrite Nitrogen} + 0.5\ O_2 \quad \text{------>} \quad \text{Nitrate Nitrogen} \qquad (3)$$

The overall nitrification reaction can be expressed as:

$$\text{Ammonia Nitrogen} + 2\ O_2 \quad \text{------>} \quad \text{Nitrate Nitrogen} + H_2O + \text{Loss of Alkalinity} \qquad (4)$$

DENITRIFICATION

In the biological denitrification process, nitrates are converted to nitrogen gas. The gas is ultimately released to the atmosphere. In contrast to nitrification, biological denitrification occurs in the absence of oxygen and uses organic compounds present in wastewater as a source of carbon. Energy is obtained by oxidizing the organic substrates. During denitrification, nitrate acts as an electron acceptor in the absence of free oxygen. The overall denitrification reaction is expressed in Equation 5.

$$\text{Nitrate Nitrogen} + \text{Organic Carbon} \quad \text{------>} \quad \text{Nitrogen Gas} + \text{Gain of Alkalinity} \qquad (5)$$

BIOLOGICAL PHOSPHORUS REMOVAL

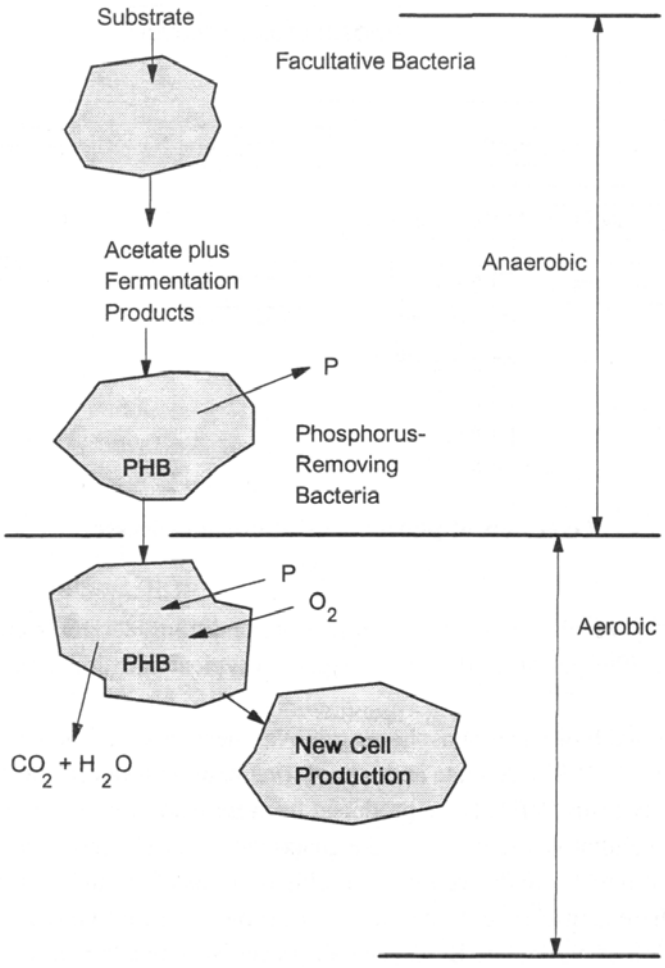
Phosphorus exists in the forms of orthophosphate, polyphosphate and organic phosphates in wastewater. The major sources of phosphorus in domestic wastewater are human excrement, synthetic laundry detergents and water treatment chemicals.

In biological treatment, the phosphorus in wastewater is removed through incorporation into the cell tissue of microorganisms during BOD removal. This two step process is described in Figure 1:

1. Certain microorganisms, when subjected to anaerobic (absence of oxygen and nitrates) conditions, assimilate and store fermentation products produced by other facultative bacteria. These microorganisms derive energy for this assimilation from stored polyphosphates, which are hydrolyzed to liberate energy. The free phosphorus that results from the hydrolysis reaction is released to the mixed liquor.

2. These same microorganisms, when subsequently exposed to aerobic conditions, consume both phosphorus (which is used for cell synthesis and stored as polyphosphates) and oxygen to metabolize the previously stored substrate for energy production and cell synthesis. The organisms take up the phosphorus in excess to remedy their phosphorus-starved condition. That is, they take in more phosphorus than they previously released. The phosphorus is removed from the system during the normal sludge wasting procedure.

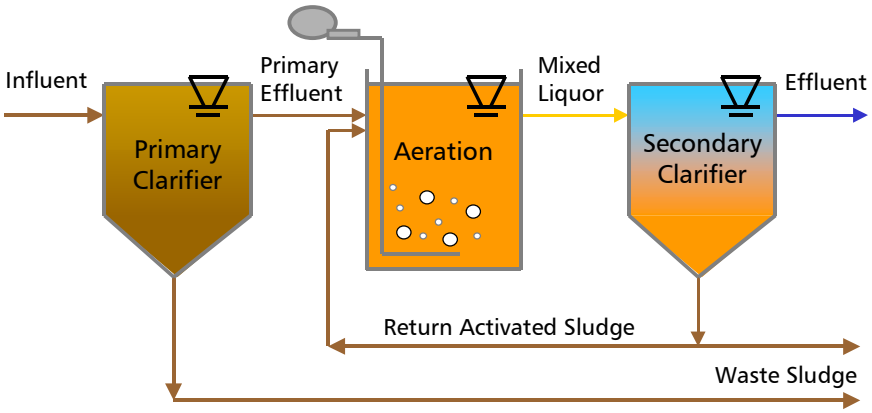
Figure 1



CONVENTIONAL ACTIVATED SLUDGE PROCESS

A typical conventional activated sludge process as shown in Figure 2, consists of separate tanks to accomplish unit processes of primary clarification, BOD removal and secondary clarification with recycle pumping and piping.

Figure 2 Typical Conventional Activated Sludge Process



PRIMARY CLARIFIER

The wastewater from the plant headworks is received in the primary clarifier. The primary clarifier is typically equipped with a sludge collection mechanism and an effluent overflow weir. In this unit process, solids (or sludge) with a higher density settles to the bottom of the clarifier and partially treated primary effluent is discharged over the weirs to the aeration basin. The sludge settled in the primary clarifier is sent to the sludge handling facilities.

AERATION BASIN

The aeration basin is typically equipped with diffusers installed on the floor of the basin. The blowers located in a building near the basins are used to supply the air to the basins via the diffusers. The effluent received from the primary clarifier is continuously mixed and aerated in this basin with return sludge resulting in the oxidation of the BOD. The combination of treated water and sludge from the aeration basin ("mixed liquor") is discharged to the secondary clarifier.

SECONDARY CLARIFIER

The mixed liquor discharge from the aeration basin enters the secondary clarifier through the feed well. Similar to the primary clarification, the liquid solids separation occur in the clarifier where sludge is settled to the bottom and the treated effluent is discharged over the weirs to the downstream facilities. A major portion of the sludge that settled in the secondary clarifier is recycled back as return "activated sludge" to the aeration basin and the remainder is wasted to the sludge handling facilities.

Additional tanks are added to the unit processes discussed above to create the aerobic, anoxic and anaerobic environments required for biological nitrogen and phosphorous removal.

The principle of the conventional activated sludge process discussed above is being used for wastewater treatment in various forms and operational methodologies. One of these variations is the Sequencing Batch Reactor (SBR) process.

CONVENTIONAL SBR

The Sequential Batch Reactor (SBR) process is a variant of the Activated Sludge process. It uses the fill and draw principal in which unit processes occur sequentially on a cyclical basis. The SBR process eliminates the need for primary and secondary clarifiers.

A typical SBR cycle consists of the following phases as illustrated in Figure 3:

Fill: Raw wastewater that has been screened and degritted flows into the basin and mixes with the mixed liquor settled during the previous phase. After the fill phase, the influent valve is closed and the influent is routed to the other basin.

React: The basin is aerated and biological oxidation takes place similar to the aeration basin in the conventional activated sludge process.

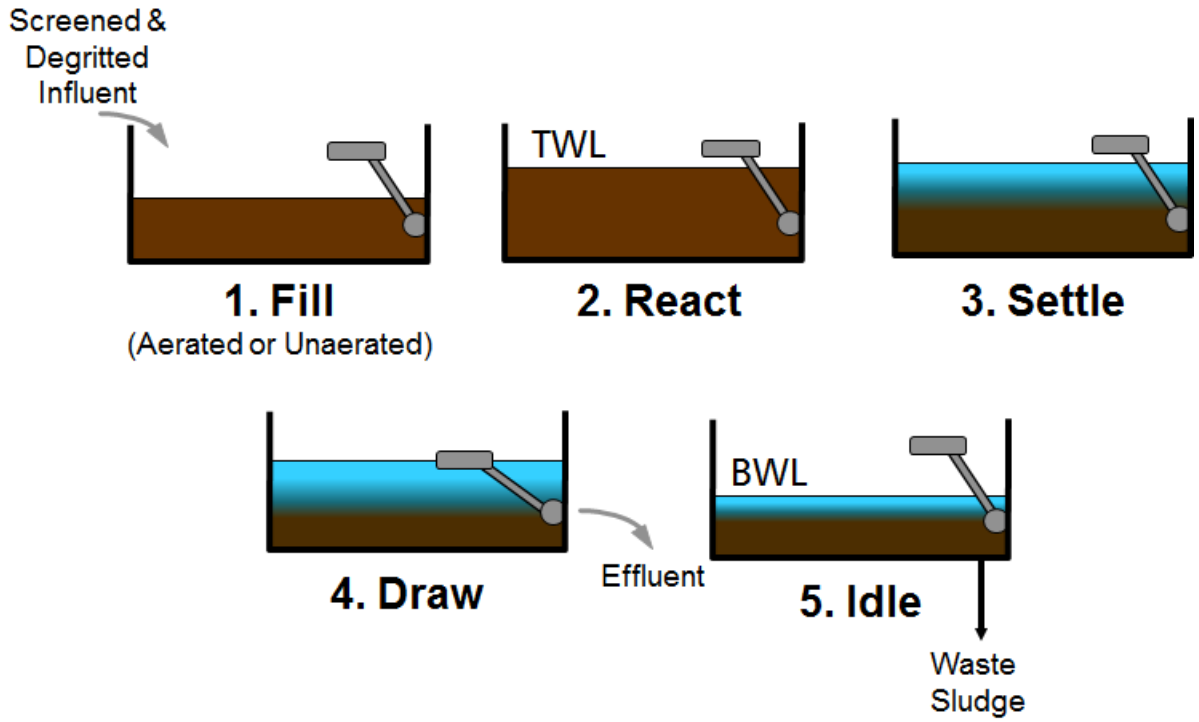
Settle: Aeration is stopped and the solids settle to the bottom of the basin leaving the clear water on the top.

Draw: The clear water is discharged using a decant mechanism.

Idle: Sludge is wasted from the bottom of the basin using pumps.

Figure 3

SBR Fill and Draw Basic Theory



At the end of the idle phase, the cycle begins again with the fill phase. The SBR carries out the functions of primary clarification, aeration and secondary clarification in one basin.

In the conventional activated sludge process, various unit processes such as primary clarification, aeration and secondary clarification are carried out in separate basins. These "trains" of unit processes generally occupy a significant land area as compared to an SBR. In the conventional activated sludge process, a limited amount of flexibility can be exercised by adjusting the rate of return activated sludge (RAS) and waste activated sludge (WAS) or through varying the rate of air introduced in the aeration basin.

In an SBR, the same unit processes that are carried out in the conventional activated sludge process occur sequentially in one basin. As a result, the "footprint" of a SBR is typically much smaller than that of a conventional activated sludge plant. The SBR process is automated through the use of a control system ranging in sophistication from simple timers to PLC or PC based systems. The control system automatically coordinates equipment operation through various phases of the SBR cycle. This feature offers a high degree of flexibility allowing adaptation of the process cycle to meet the changing influent conditions through simple changes in control setpoints.

This difference in system configuration gives the SBR system several advantages over the conventional activated sludge process including:

LOWER CAPITAL COST

- No primary or secondary clarifiers and accompanying pumping systems are needed
- Requires smaller footprint
- Simpler and faster installation
- Lower construction costs

ENHANCED BIOLOGICAL PERFORMANCE

- Low sludge volume
- Enhanced nutrient removal
- Quick response to changing influent conditions
- No washout of activated sludge during peak storm flows

LOWER OPERATING COST

- Reduced power
- Reduced maintenance
- Nutrient removal without costly chemicals

DESIGN FLEXIBILITY

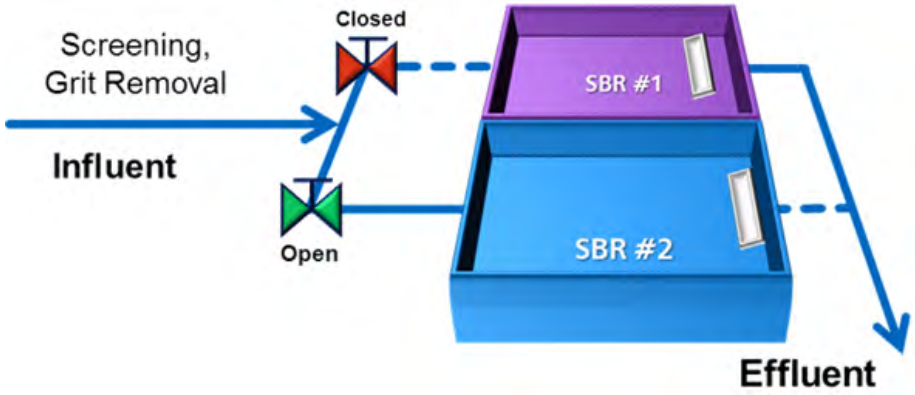
- Easily expandable
- Hydraulic peaks easily accommodated
- Handles shock loads without degradation of final effluent quality
- Control system provides high flexibility

While the conventional SBR system has many advantages, it does have some shortcomings. These include:

- It must be designed with a minimum of either two reactors, (see Figure 4) or an equalization/storage tank in conjunction with a single reactor. These configurations are required to allow continuous acceptance and treatment of the influent. During the react, settle and decant phases of the cycle, flow is diverted to the other basin or to the storage tank.

Figure 4

Conventional SBR
Batch Mode



- When conventional SBR systems are considered for smaller treatment plant applications, two basin designs are typically evaluated. However, due to the batch nature of the process, one basin can not be readily taken out of service for maintenance purposes. In addition, a single tank operational mode cannot be easily utilized for low flow situations.

- For most municipal treatment facilities and some industrial applications, flow and loadings to a plant vary according to a diurnal cycle. With a conventional SBR system, this results in unequal mass and hydraulic loadings to each reactor in a multi-reactor facility. The loadings to a specific reactor are dependent on when it is receiving flow during the diurnal flow variation. The variation in loadings causes differences in the biomass and oxygen demand of the individual reactors. This complicates the operational control of the treatment plant resulting in the need for additional testing, a more intensive instrumentation/control system and greater operator attention to the system.

- The batch treatment approach of conventional SBRs typically incorporates a water level based control system. That is, the duration of the daily process cycles are subject to change based on the specific inflow to a reactor. Since diurnal flow variations occur, the cycling results in different actual aeration times for the biological reactions. This can lead to difficulty in controlling the process and cycling/switchover of the blowers.

- For Biological Nutrient Removal systems, a continuous carbon source is beneficial in maintaining consistent performance. Organic compounds in the raw influent to such secondary treatment systems are typically used as the source of the carbon. Conventional SBR systems however periodically interrupt this food source especially during the react phase. This lowers the removal of nitrogen and phosphorus and may necessitate expensive chemical additions to enhance biological nutrient removal.

ABJ® ICEAS® PROCESS

The ABJ ICEAS process is a modification and enhancement of the superior technology of the conventional SBR. ICEAS, an acronym for Intermittent Cycle Extended Aeration System, allows continuous inflow of wastewater to the basin. Influent flow to the ICEAS basin is not interrupted during the settle and decant phases or at any time during the operating cycle.

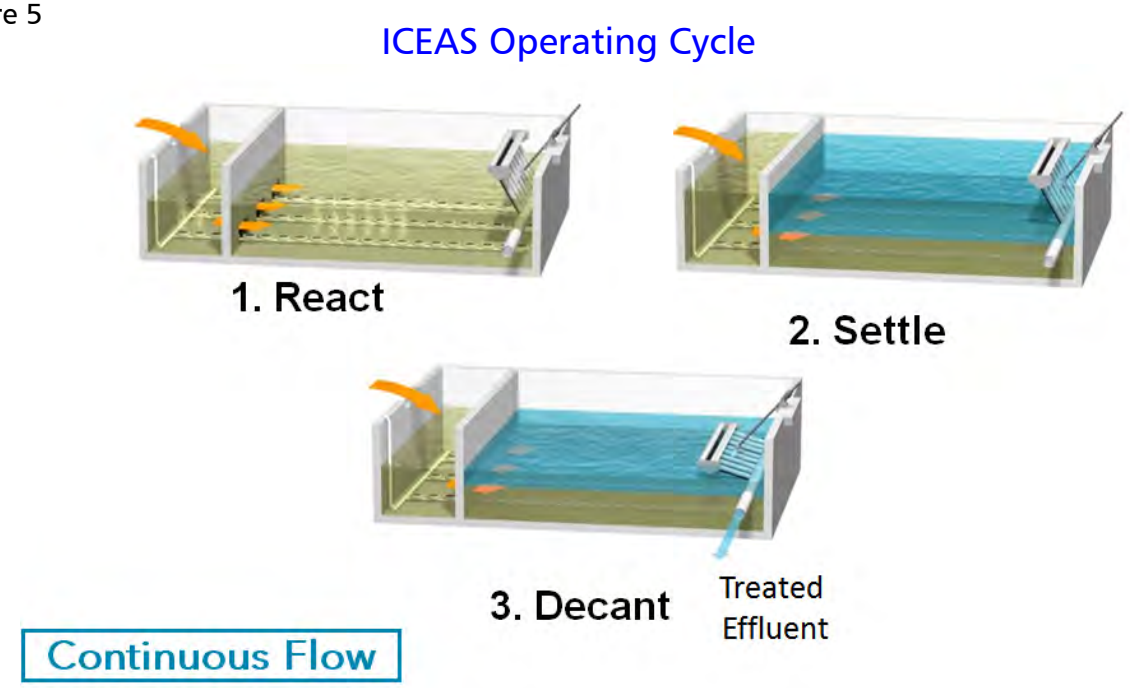
A typical ICEAS process consists of the following time-based phases as illustrated in Figure 5:

Aerate: Raw wastewater from screening and grit removal flows into the basin and mixes with the mixed liquor. The basin is aerated while filling and biological oxidation takes place simultaneously.

Settle: Aeration is stopped and the solids settle to the bottom of the basin leaving clear water on top. The basin continuously receives the influent.

Decant: The clear water is discharged from the top of the basin, while the basin continuously receives the influent. Typically, sludge is wasted during this phase of the cycle.

Figure 5



Influent is received continuously during all phases of the cycle, including settle and decant. This allows the ICEAS process to be controlled on a time, rather than flow basis and ensures equal loading and flow to all basins. Use of a time-based control system in the ABJ ICEAS process facilitates simple changes to the process control program. The duration of each cycle and segment of each operating cycle are the same among all basins in a time-based system. Therefore, changes to the process are made simply by changing the duration of individual segments. In a flow-based conventional SBR, cycle times and individual segments of each cycle may be different among basins due to diurnal flow variations. Thus, it is not possible to simply affect a change to the entire system. In essence, separate control must be maintained over each basin in the SBR system.

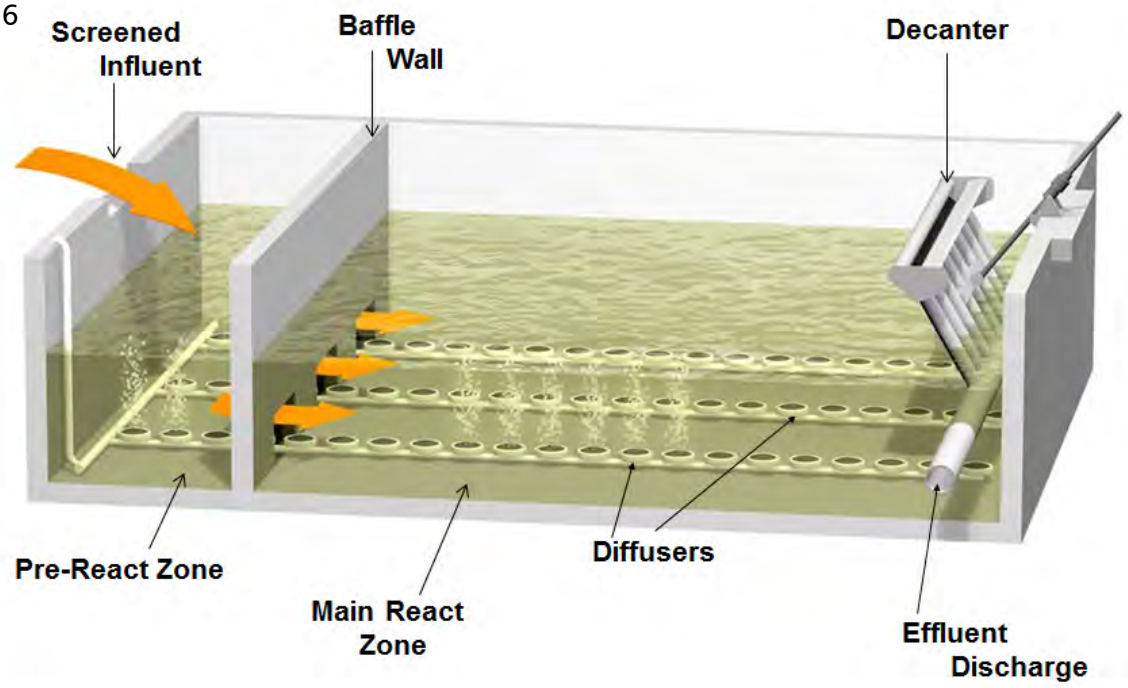
Single basin operation is also possible in the ICEAS process. The process does not require automatic influent control valves or an additional basin to hold diverted flow. This eliminates the need for designated fill and idle phases resulting in smaller basins.

The ICEAS process can be designed to accommodate peak flows up to 6 times the average flow to the plant. This flexibility is facilitated by the ability of the ICEAS to accommodate influent during all phases of the cycle. Peak flows are spread evenly among all operating basins. Typically, a separate cycle with a shorter duration is used to accomplish this flexibility.

ICEAS BASIN

The ICEAS basin is divided into two zones, the pre-react zone and the main react zone as shown in Figure 6. A non-hydrostatic baffle wall with openings at the bottom is constructed to divide the ICEAS basin into the two zones. The influent flows continuously into the pre-react zone and is directed down through engineered orifice openings at the bottom of the baffle wall into the main react zone. The pre-react wall baffles the incoming flow and prevents short-circuiting. The volume of the pre-react zone is typically 10 to 15 percent of the total basin volume.

Figure 6



BIOLOGICAL SELECTOR

The pre-react zone also provides pre-treatment of the wastewater before it enters the main react zone. Since influent flows continuously into the pre-react zone, a high concentration of soluble BOD is available to the microorganisms in a relatively small basin volume. This situation creates a high "Food to Microorganisms" (F:M) ratio. The high F:M ratio encourages the maximum bio-sorption of food by the microorganisms. The pre-react zone therefore acts as a biological selector encouraging the proliferation of the most desirable organisms. The presence of the biological selector at the front end of the ICEAS basin minimizes the growth of filamentous bacteria that cause sludge bulking and poor settling.

ICEAS BASIN SIZING

BASINS

Typically, concrete basins are used. However, in some cases, steel is used depending on the cost evaluation of the plant construction. The number of basins used in the ICEAS process is a function of flow and loading to the plant and the guidelines established by individual Government Agencies. Sanitaire has experience in designing systems built using a single basin to a multitude of parallel basins. The continuous flow feature of the ICEAS process facilitates single basin system design and operation without the need for influent flow equalization or a second basin.

BASIN HYDRAULICS

Time based cycles are used in sizing the ICEAS process. A normal cycle is designed to handle the Average Dry Weather Flow (ADWF) and Peak Dry Weather Flow (PDWF) to the plant. A storm cycle is used to handle the storm flows. The storm cycle operates with a shorter duration compared to the normal cycle so that higher flows can be processed by the system. Typically, the ICEAS process can be designed to handle 3 to 6 times the average flow conditions. The maximum volume required for the average, peak and storm flows are determined based on the cycle times. This volume is the total flow received by the basin from the start of the cycle until the beginning of the decant phase and is defined as basin "Drawdown". The basin drawdown extends from the designated Top Water Level (TWL) to the Bottom Water Level (BWL). The ability to accommodate a Peak Wet Weather Flow (PWWF) of 6 times the ADWF is due to many ICEAS concepts. The ability to have a special "storm" cycle with decanter speed control is very important. ***This cannot be achieved with conventional SBRs using fixed or floating decanters***. SBR's with floating decanters are usually limited to a PWWF of 3 times the ADWF.

PROCESS KINETICS

The influent BOD and ammonia loadings determine the mass of biomass required in the basin. Typically, F:M ratios are used in determining the mass of the biomass for a given BOD loading in conjunction with minimum sludge age requirements for the nitrification process. The typical Food:Microorganism (F:M) ratios used in design of the ICEAS process are in the range of 0.05 to 0.12 lb. BOD/lb. MLSS/day. The Sludge Volume Index (SVI) is used to determine the volume occupied by the calculated mass of biomass in the basin. The Typical SVI value used in the design of the ICEAS process is in the range of 150 to 200 ml/g. In each cycle, a measured amount of sludge is wasted. This allows the ICEAS process to operate in a steady state condition maintaining a desired Mixed Liquor Suspended Solids (MLSS) concentration and Mean Cell Residence Time (MCRT) or Sludge Age (SA).

BUFFER ZONE

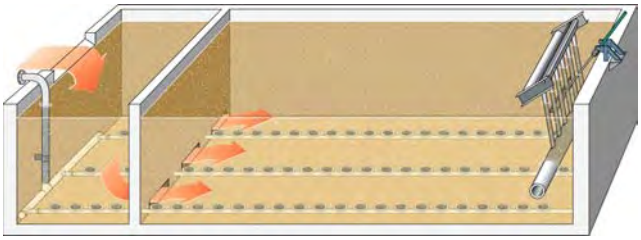
The design volume of the basin is based on a combination of the volume required for the hydraulics based on the peak wet weather flow conditions and the volume occupied by the sludge. A "Buffer Zone" is included in the design as a safety factor to ensure the ICEAS process's ability to withstand the unusual flows and loadings that are typical in wastewater treatment plants. This zone is typically a minimum of three feet deep, extending from the top of sludge blanket to the BWL after decanting.

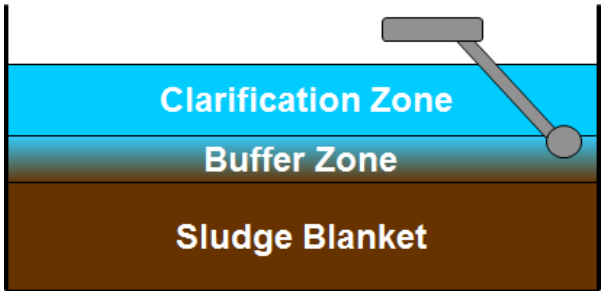
BASIN DIMENSIONS

The basin depth is a combination of the sludge blanket, the buffer zone and the drawdown as shown in Figure 7. The basin area is calculated using a designated TWL. Typically, the length and

width of the basin is calculated such that, a L:W ratio of 3:1 is maintained. This ratio creates a plug flow pattern in the ICEAS basin.

Figure 7





ICEAS PROCESS DESIGN & OPERATION

The ICEAS process offers the following design options to maximize the flexibility of the plant operation and to meet its discharge permit requirements.

ICEAS-NIT Process

Designed for the Removal of:

- BOD
- TSS
- Ammonia and Total Nitrogen (Partial Denitrification)

Typically Used for:

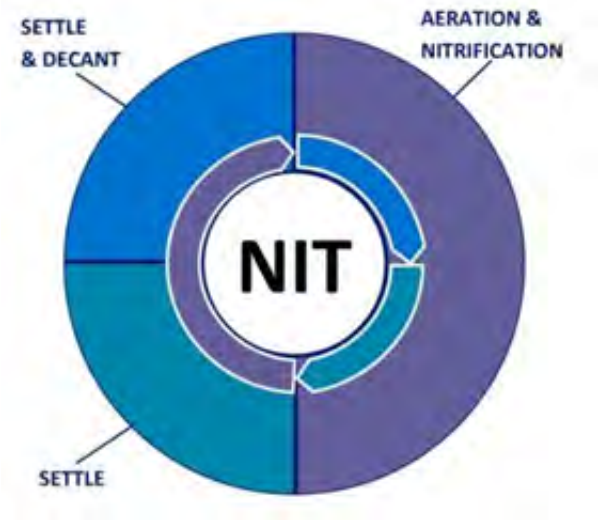
- Municipal Wastewater
- Industrial Wastewater

Nitrification and BOD removal is accomplished in the ICEAS process during the aeration phase of the cycle as shown in Figure 8. The ICEAS basin is designed with F:M ratios and sludge ages suitable to maintain sufficient MLSS in the basin and to achieve the required degree of nitrification based on the temperature range and pH of the influent wastewater. The blowers and aeration system are designed to ensure a sufficient supply of oxygen as required for the process.

A typical operating cycle for a two-(2) basin ICEAS-NIT process is shown in Figure 9. The first half of the cycle is continuously aerated to achieve BOD removal and nitrification. After the aeration phase, the system enters a settling phase where liquid/solids separation occurs. The system then enters the decant phase, where treated effluent is decanted from the basin. The duration of the aeration phase in the four-hour cycle allows one blower to provide air to two basins using motorized air control valves. When Basin #1 is in the aeration phase, Basin #2 is in the settle or decant phase. When Basin #2 is in the aeration phase, Basin #1 is in the settle or decant phase.

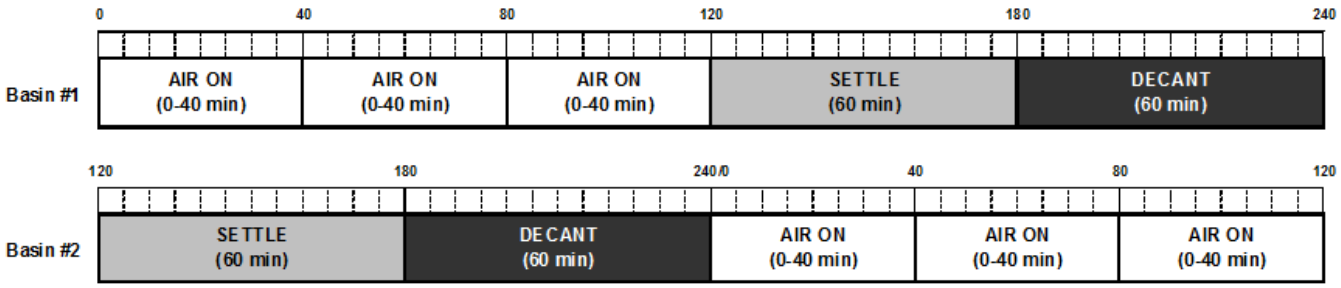
The 3-hour storm cycle for the same application is shown in Figure 10. It is of interest to note that the overall aeration, settle and decant times per day remain the same as the normal cycle. It is only the duration per cycle that is changed to accommodate higher flows to the plant. ***SBR systems using fixed or floating type decanters cannot offer this flexibility without affecting the overall duration of the aeration and settle phases on a daily basis***.

Figure 8



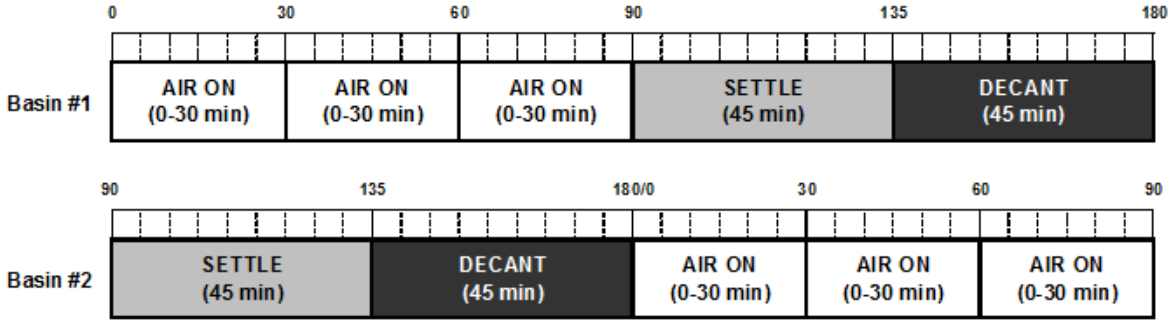
Normal Cycle Operational Sequence of ICEAS-NIT Process

Figure 9



Storm Cycle Operational Sequence of the ICEAS-NIT Process

Figure 10



Cycle bar charts depicting the normal and storm cycles for the ICEAS-NIT process using four basins are shown in Figures 11 and 12. The control system provides the flexibility of changing blower run time proportional to the influent flow and loading to the plant. Additional controls such as dissolved oxygen probes in the ICEAS basin with blower output control can be provided.

Figure 11

Normal Cycle Operational Sequence of ICEAS-NIT Process

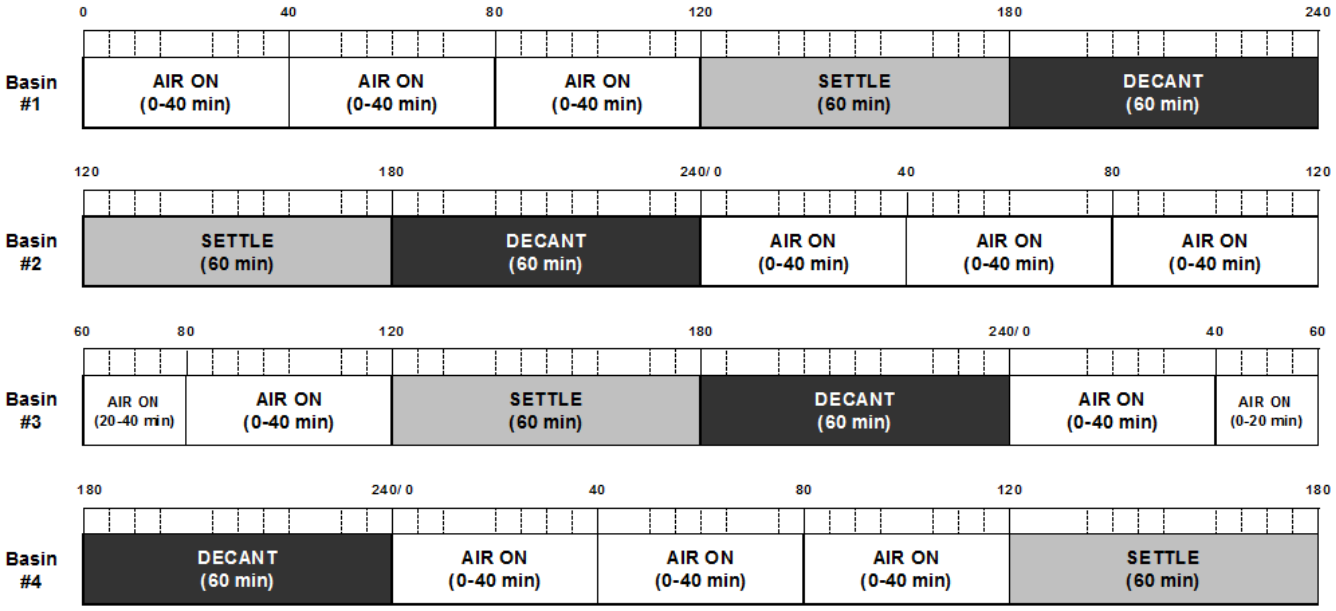
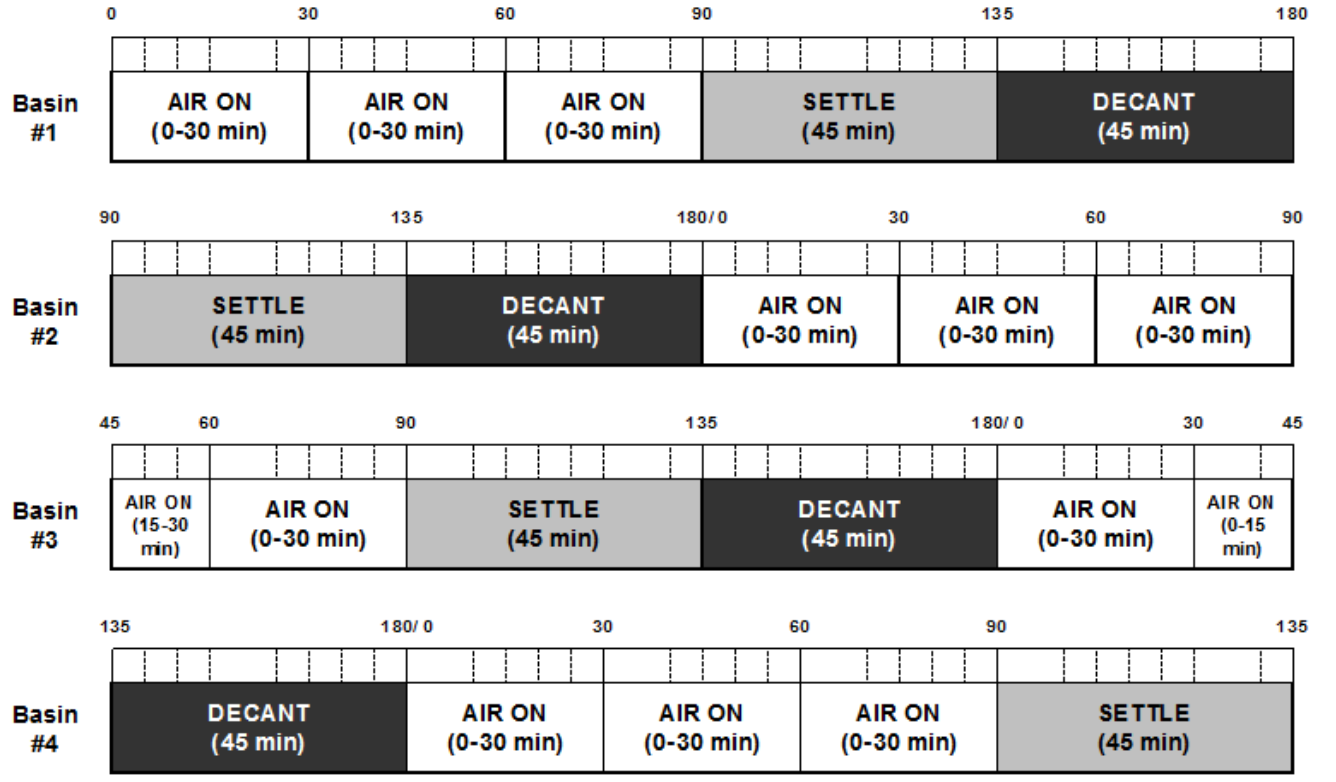


Figure 12

Storm Cycle Operational Sequence of the ICEAS-NIT Process



ICEAS-NDN PROCESS: BIOLOGICAL NUTRIENT REMOVAL (BNR)

Designed for the Removal of:

- BOD
- TSS
- Ammonia
- Total Nitrogen
- Total Phosphorous

Typically Used for:

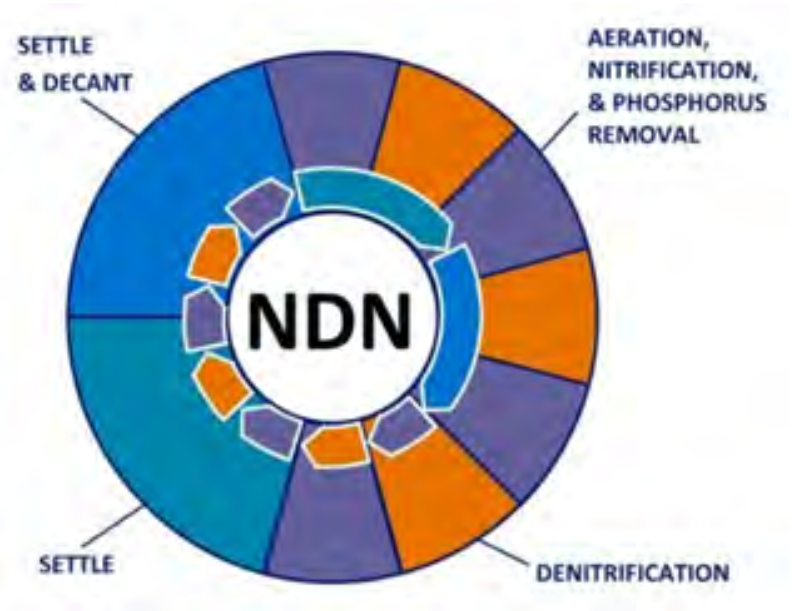
- Municipal Wastewater
- Industrial Wastewater

Biological nutrient removal is accomplished in the ICEAS-NDN process by incorporating alternating phases of oxic-anoxic/anaerobic (air on-air off) conditions in the cycle as shown in Figure 13. The ICEAS basin is sized to ensure complete nitrification, denitrification and to maximize the total biological phosphorus removal.

Typical normal and storm cycles using 2 basins for the ICEAS-NDN process are shown in Figure 14 and 15. The aerobic phases promote BOD removal, nitrification and phosphorus uptake. The anoxic/anaerobic (air off) phases promote denitrification and phosphorus release. Nitrification rates and sludge age requirements for the nitrification process are calculated based on the temperature range and pH of the influent wastewater.

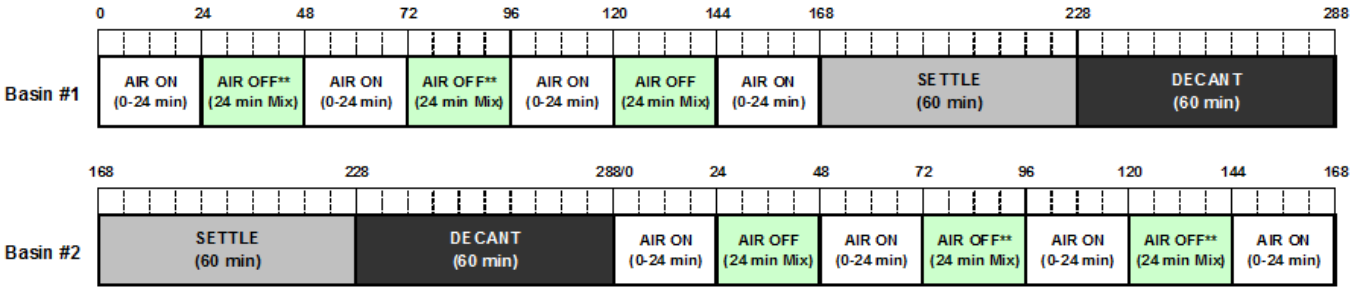
The degree of denitrification and phosphorus removal achieved by the ICEAS-NDN process is dependant on the influent BOD/TN and BOD/TP ratios. The typical blower control for the ICEAS-NDN process involves a D.O. control system with blower output control.

Figure 13



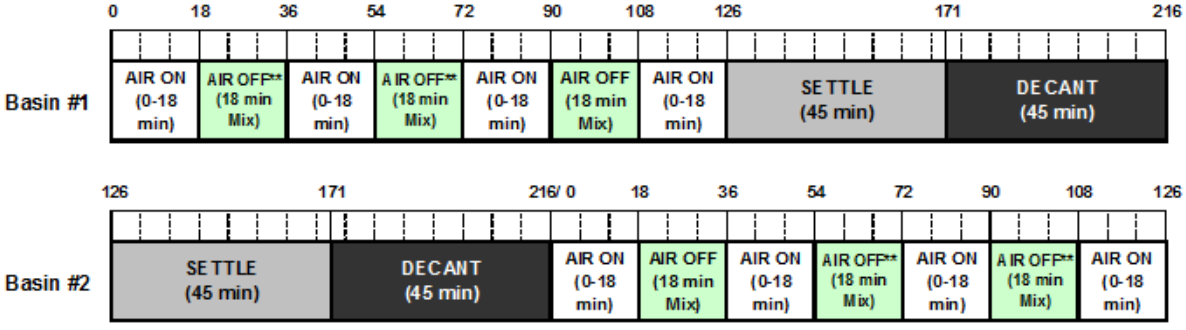
Normal Cycle Operational Sequence of ICEAS-NDN Process

Figure 14



Storm Cycle Operational Sequence of the ICEAS-NDN Process

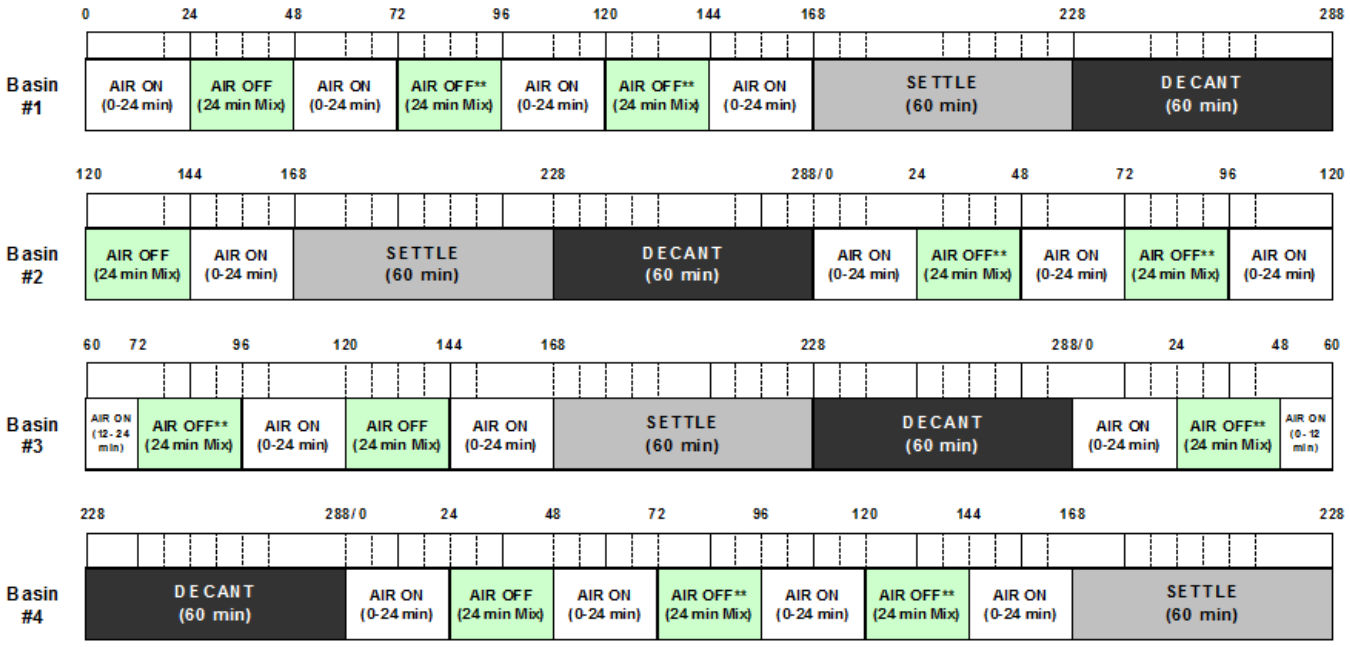
Figure 15



The cycle charts for the ICEAS-NDN process operating in normal and storm cycles using four basins are shown in Figures 16 and 17.

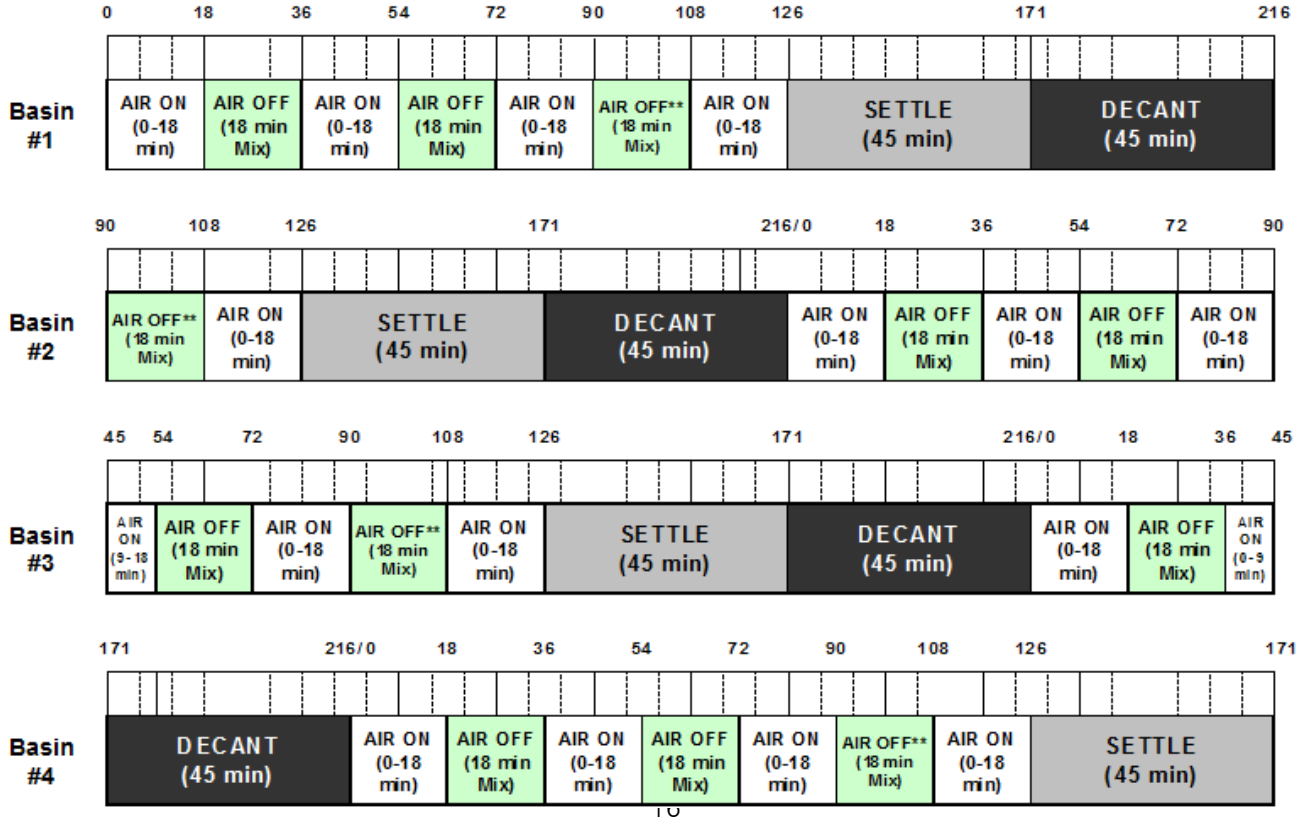
Figure 16

Normal Cycle Operational Sequence for the ICEAS-NDN Process



Storm Cycle Operational Sequence of the ICEAS-NDN Process

Figure 17



EXPANSION POTENTIAL

The ICEAS process design allows simplified expansion because each basin forms a modular treatment unit. The ICEAS process is ideal for a growing community requiring wastewater treatment. The installation shown in Figure 18 is a facility designed for an ultimate flow of 2.0 MGD. During Phase-I, the plant was built with a design capacity of 0.25 MGD using two basins. It was expanded to 0.5 MGD in Phase-II by adding one additional basin with a capacity of 0.25 MGD. In serving the growth of the community, the plant was expanded again in Phase-III through the addition of one basin with 0.5 MGD capacity bringing the overall capacity to 1.0 MGD. This plant will continue to expand in the future.

It is of interest to note that all the basins have been built with common wall construction. This is achieved by maintaining the same length for all tanks and increasing the width appropriately. The blower equipment is also sized proportionately to the capacity of each basin such that the same blowers are used before and after expansion.

Figure 18

Phased Expansion of the ICEAS-NDN Process for a Growing Community

GENERAL ADVANTAGES OF THE ABJ ICEAS PROCESS COMPARED TO BATCH SYSTEMS

- Proven process which enhances the standard SBR system through strategic cost, operating and biological advantages
- Continuous inflow provides equal loading and flow to all basins, simplifying operation and process control. It enables single basin operation for maintenance and low flow conditions.
- Incorporates a time, not flow-based control system that enables a constant relationship between aeration, settling and decanting. Provides the same aeration time per day regardless of the cycle time.

BIOLOGICAL AND PROCESS ADVANTAGES

Biological Effluent Quality

- Proven effluent quality below 10 mg/l BOD_5 and TSS
- Proven nutrient removal quality below 1 mg/l Ammonia-N, 1 mg/l total phosphorus and 5 mg/l total nitrogen
- Low volume of highly stabilized sludge – dewaters easily
- Pre-react Zone
  - Enhances bacterial growth with good settling characteristics while minimizing the formation of filamentous organisms
  - Allows continuous operation without short-circuiting
  - Enhances nutrient removal
  - Confines floating material for manual removal
- No chemicals/filters required
- Suitable for municipal/industrial wastewater treatment

Hydraulic and Organic Loading

- Can be designed to accommodate hydraulic peaks up to 6 times average design flow without sludge washout
- No separate influent equalization basin needed, redundant tankage eliminated
- Automatic activation of storm cycle during storm flows
- Equal loading to all basins at all times
- Easily expandable for future needs (modular system)

EQUIPMENT DESIGN ADVANTAGES

Decanter Design

- Easy to install
- Easy accessibility from basin walkway
- In "Park Position," acts as safety overflow weir
- Stainless steel design – robust/corrosion resistant
- Prolonged life
- No flexible, costly, high maintenance knee joints, as needed for floating decanters
- No submerged valves or orifices, which are prone to plugging

Electrical Design

- In-house electrical engineers to coordinate control requirements with biological functions to maximize flexibility with ease of maintenance
- Control system designed to suit overall plant control needs
- Modem to facilitate fault-finding
- SCADA system for remote access

COST ADVANTAGES

- Reduced capital cost when designed as an ICEAS continuous flow process
- Up to 30% less basin volume to achieve same operating performance as an SBR
  - Less Concrete
  - Less Excavation
  - Smaller Land Area
- If others size basins as an SBR, then operating the process as an ICEAS will allow up to 30% greater flow

Reduced Operating Cost

- No supplemental mixing required for aeration system
- Proven D.O. control system for optimizing energy usage
- Ultra high efficient SANITAIRE® Fine Bubble Aeration minimizes energy used for aeration

Reduced Installation Cost

- No influent or effluent control valves
- No retrievable equipment required
- Decanter easy to install

Reduced Maintenance Cost

- No influent or effluent control valves
- Continuous flow enables shut down of one basin to facilitate maintenance of equipment when required
- Retrievable aeration facilities not required
- Decanter easy to service from walkway

INDUSTRIAL WASTEWATER TREATMENT

Inherent flexibility gained through automated control systems and adaptability to high flow and loading fluctuations make SBR systems well suited for the treatment of wastewater originating from industrial facilities. ABJ SBR and the ICEAS process technology are applicable for both pre-treatment and complete secondary treatment.

ABJ SBR and ICEAS technology have been applied in the treatment of several types of industrial effluent including:

Pulp and Paper
Meat Packaging
Pharmaceutical
Food Processing
Dairy Industry
Textile
Bottling Plants
Chemical & Agricultural Products
FGD

SANITAIRE® Fine and Coarse Bubble Aeration systems are tailored specifically for each application to sustain the performance and longevity of the diffusers. Special supports and piping fixtures are used to provide redundancy, thus eliminating the need to take tanks out of service for maintenance.

The decanter mechanisms are constructed completely of 304L or 316L stainless steel to provide maintenance free operation in corrosive environments.

The ergonomic and robust system design facilitates a simple process with minimal mechanical and electrical components. In addition, the state of the art control system design with SCADA runs the process with minimal input from the plant operators.

Typical plant profiles are included for your review.

Sanitaire ICEAS™ Advanced SBR

SANITAIRE®
a xylem brand

Harnessing a simple and reliable solution for quality water

The Sanitaire ICEAS Advanced SBR is a continuous flow biological treatment system that provides multiple advantages over conventional activated sludge and other SBRs by bringing together process, aeration, decanting and control in a single treatment tank. It is fully automated and includes a completely integrated process design consisting of the aeration system, blowers, pumps, mixers, effluent decanters, monitoring and control equipment and comprehensive process control system.

Simplifying operations for reliable results

The ICEAS SBR is designed to reduce complexity of operation. Unlike conventional activated sludge plants, there is no need for primary or secondary settlement tanks or return sludge pumps. All treatment is done in a single basin. Continuous inflow distributes variations in flows and loads evenly across all basins - simplifying day to day operations and operational changes as well as accommodating single basin operation for low flow and maintenance conditions.

The intelligently designed process control system with simple, intuitive time-based control and trending capability provide a full system overview, making it easy to optimize plant performance, predict maintenance and reduce operating costs – taking the complexity out of SBRs.

The ICEAS SBR can handle flows from 25,000 GPD to over 100 MGD. It can be designed to accommodate up to six times average daily flow while assuring high effluent quality across the entire flow range with the unique basin design and actively controlled decanter. Sanitaire's proprietary Sludge Inventory Management System (SIMS) automatically maintains the preset solids retention time, resulting in reliable settling characteristics and effluent quality, all while reducing operator attention requirements.

The ICEAS process also effectively removes nitrogen and phosphorus from wastewater through biological nutrient removal (BNR) process.

Sanitaire ICEAS SBR has proven performance in nearly 1,000 treatment system installations worldwide.

1 Blowers 2 Pre-react 3 Mixer 4 Aeration 5 WAS Pump
6 Decanter 7 Process control

ICEAS products: Sanitaire Silver Series aeration system, Flygt compact mixers, Flygt submersible N-Pumps, Sanitaire decanters, ICEAS control systems.

Designed with life-time efficiency in mind

Sanitaire is focused on producing cost-saving water technologies that use less energy throughout the lifetime of the project by not only using highly efficient aeration grids and blower technology but also cutting edge controls and instrumentation which use innovative algorithms to control the aeration and process, minimizing energy use by up to 50%.

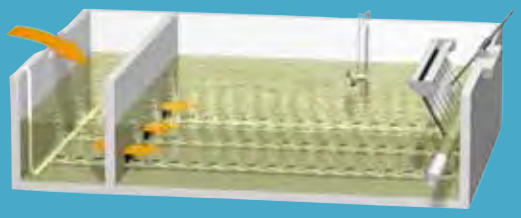
Using Sanitaire's continuous inflow distribution technology, the peak load is spread across all basins simplifying operation and saving up to 30% on the footprint. Continuous inflow also reduces up-front capital expenditure by requiring less equipment, and provides for reduced construction costs. With almost 1000 installations, our experienced design team can put together an optimized, flexible solution to meet not only your current needs but also provide the expandability to meet your future emerging requirements.

A partner from start to finish

Xylem products have been helping to solve water and wastewater challenges for decades. With a broad portfolio of advanced solutions and technologies, we apply our process capability, engineering expertise and regulatory insight to help design systems that are right for you. As your single source provider, we work to reduce your risks by providing equipment-control integration, and the support needed to ensure a successful installation and ownership. Xylem stands behind our solutions with both equipment warranties and process performance guarantees.

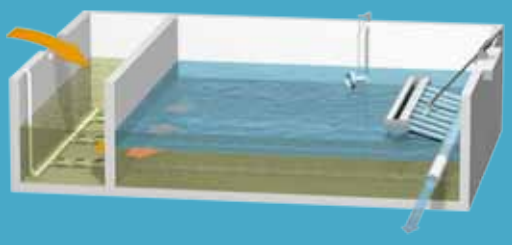
The ICEAS phases

With its continuous flow process, Sanitaire ICEAS SBR features three distinct treatment phases:



React phase: Screened and de-gritted wastewater flows continuously into the pre-react zone and enters the main react zone through submerged ports in the non-hydrostatic baffle wall. Biological oxidation and reduction occur through aeration, anoxic and anaerobic sequences within the react phase to predictively achieve the desired treatment.

Settle phase: Basin agitation from the react phase (i.e. aeration and mixing) is stopped to allow the solids to settle to the bottom of the basin. Raw wastewater continues to flow into the pre-react zone while the main react zone settles. As the solids settle, a clear layer of water develops on top of the basin.



Decant phase: The decanter descends gradually downward to draw off the clarified supernatant. Wastewater continues to flow into the pre-react zone as the treated and clarified effluent is decanted from the main react zone at a constant rate. Waste activated sludge is typically removed from the basin during this phase.

Xylem |'zīləm|

1) The tissue in plants that brings water upward from the roots;
2) a leading global water technology company.

We're 12,000 people unified in a common purpose: creating innovative solutions to meet our world's water needs. Developing new technologies that will improve the way water is used, conserved, and re-used in the future is central to our work. We move, treat, analyze, and return water to the environment, and we help people use water efficiently, in their homes, buildings, factories and farms. In more than 150 countries, we have strong, long-standing relationships with customers who know us for our powerful combination of leading product brands and applications expertise, backed by a legacy of innovation.

For more information on how Xylem can help you, go to **www.xyleminc.com**

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xylem
Let's Solve Water

Xylem, Inc.
14125 South Bridge Circle
Charlotte, NC 28273
Tel 704.409.9700
Fax 704.295.9080
www.xyleminc.com

DESIGN PROPOSAL

Tolar, TX - Tolar WWTP Sanitaire #a32101-23

Avg. Daily Design Flow*	MGD	0.30	
Max 4.0hr Cycle Flow	MGD	0.60	
Max 2.0hr Cycle Flow	MGD	1.20	
		mg/l	lb/day
BOD_5 (20°C)		340	851
Suspended Solids		270	676
TKN		75	188
NH3-N		62	155
Total Phosphorus		8	20
Max Wastewater Temperature	°C	20	
Min Wastewater Temperature	°C	12	
Ambient Air Temperature	°F	20 - 90	
Site Elevation	ft	1,020	

*** - Maximum 30 day period mass flow**

Table B: ICEAS® EFFLUENT QUALITY (MONTHLY AVERAGE)

BOD_5 (20°C)	mg/l	10
Suspended Solids	mg/l	15
NH_3-N	mg/l	3

Table C: ICEAS PROCESS DESIGN CRITERIA

Operating Basins		2
Operating Top Water Level	ft	18.00
F / M	BOD5/DAY/MLSS	0.080
SVI (after 30 minutes settling)	ml/g	140
MLSS at Bottom Water Level	mg/l	5,460
Waste Sludge Produced (Approx.)	lb/day	585
Volume of Sludge Produced (Approx., 0.85% solids)	GPD	8,250
Avg. Daily Design Flow Decant Rate	GPM	833
Max 2.0hr Cycle Flow Decant Rate	GPM	1,667
Hydraulic Retention Time	Days	0.90
Sludge Age	Days	17.3

Sufficient Alkalinity must be provided to maintain basin pH of 6.8

Bold, italicized text indicate assumptions made by Sanitaire

Cycle Timing

Note: Cycle Charts Provided		ADF*	
		Normal	Min
Air-On	min	120	40
Air-Off	min		
Settle	min	60	50
Decant	min	60	30
Total	min	240	120

Table D: KEY ICEAS DESIGN DETAILS

Top Water Level	ft	18.00
Basin Width (Inside)	ft	20.0
Basin Length (Inside)	ft	58.0
Bottom Water Level	ft	13.60

ICEAS EQUIPMENT(Base Design)				Motor HP	No. Req.
Decanter Mechanism	10	' Weir length			2
Decanter Drive Unit				1/2	2
ICEAS Blower	324	SCFM	8.2 PSIG	25	3
ICEAS Fine Bubble Aeration System	364	Disc Diffusers/Basin			2
Air Control Valve	6	"			2
Waste Sludge Pump	110	GPM		2.4	2
ICEAS Controls					1

ICEAS POWER REQUIREMENTS AD	ADF			(At Average Aeration Depth)			Kwh/Day
Decant Drive Unit	0.4	BHP	2 run	@	6	Hrs/day	3.6
ICEAS Air Blowers	17.9	BHP	2 run*	@	24	Hrs/day	641.0
Waste Sludge Pump	1.9	BHP	2 run	@	0.6	Hrs/day	1.8
					KWH/DAY		646.4
				AVERAGE	KWH/HR		26.93

* Shared ICEAS Blowers Note: Two (2) 50% blowers alternating between basins, one (1) stand-by blower.

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SANITAIRE ICEAS Detailed Design Calculations
BOD Removal and Nitrification Process

SANITAIRE Project #a32101-23
Tolar, TX - Tolar WWTP

Design Parameters

A. Flow

Avg. Daily Design Flow	300,000	GPD
Max 4.0hr Cycle Flow	600,000	GPD
Max 2.0hr Cycle Flow	1,200,000	GPD

B. Treatment

	Influent Quality	Effluent Requirement
BOD_5 (20°C), mg/l	340	10
Suspended Solids, mg/l	270	10
TKN, mg/l	75	
NH_3-N, mg/l		2
TN, mg/l		
Phosphorus	8	

C. Environment

Sufficient Alkalinity must be provided to maintain basin pH of 6.8

Max Wastewater Temperature	20	°C
Min Wastewater Temperature	12	°C
Ambient Air Temperature	20 - 90	°F
Site Elevation	1,020	ft

D. ICEAS Process Design Criteria

F / M	0.086	BOD_5 / MLSS / day
SVI (after 30 minutes settling)	140	ml/g
Number of ICEAS Basins	2	
Top Water Level	18	ft

E. Cycle Timing

		Normal	Storm
Air-On	min	120	60
Air-Off	min		-20
Settle	min	60	50
Decant	min	60	30
Total	hrs	4	2

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F. Detailed Calculations

Mass of BOD

$$BODL = \frac{Q \times BODin \times 8.34}{1{,}000{,}000} = \frac{150{,}000 \times 340 \times 8.34}{1{,}000{,}000} = \mathbf{425\ lb/day/basin}$$

where: BODL = BOD Load (lb/day/basin)
Q = Average Dry Weather Flow per basin (gal/day)
BODin = Influent BOD concentration (mg/l)
1,000,000 = Conversion (l/mg)
8.34 = Conversion (lb/gal)

Mass of Biomass

$$BMOB = \frac{BOD_L}{F/M} = \frac{425}{0.0862} = \mathbf{4{,}933\ lb/basin}$$

where: BMOB = Mass of Biomass (lb/day/basin)
F / M = Food to Microorganism ratio (day^{-1})

Volume of Biomass

$$Vbio = BMOB \times SVI = 4{,}933 \times 2.24 = \mathbf{11{,}838\ ft^3/basin}$$

where: Vbio = Volume of Biomass (ft^3/basin)
SVI = Sludge Volume Index (ft^3/lb)

Maximum Volume Above Bottom Water Level

Peak Dry Weather Flow:

$$Vbwld = \frac{PDWF \times (NCT - NDT)}{24 \times 7.48} = \frac{300{,}000 \times (4.0 - 1.00)}{24 \times 7.48} = \mathbf{5{,}013\ ft^3/basin}$$

where: Vbwld = Maximum Volume Above BWL at Peak Dry Weather Flow (ft^3/basin)
PDWF = Peak Dry Weather Flow (gal/day)
NCT = Normal Cycle Time (hr/cycle)
NDT = Decant Time (hr/cycle)
7.48 = Conversion (gal/ft^3)
24 = Conversion (hours/day)

Peak Wet Weather Flow:

$$Vbwls = \frac{PWWF \times (SCT - SDT)}{24 \times 7.48} = \frac{600{,}000 \times (2.0 - 0.50)}{24 \times 7.48} = \mathbf{5{,}013\ ft^3/basin}$$

where: Vbwls = Maximum Volume Above BWL at Peak Wet Weather (Storm) Flow (ft^3/basin)
PWWF = Peak Wet Weather Flow (gal/day)
SCT = Storm Cycle Time (hr/cycle)
SDT = Storm Decant Time (hr/cycle)

MVAB (Maximum Volume Above Bottom Water Level) is larger of Peak Dry Weather and Peak Wet Weather Calculation

MVAB = **5,013 ft^3/basin**

Decant Rates

Peak Dry Weather Flow:

$$PDR = \frac{MVAB \times 7.48}{NDT} + \frac{PDWF}{1{,}440} = \frac{5{,}013 \times 7.48}{60.0} + \frac{300{,}000}{1{,}440} = \mathbf{833\ gal/min}$$

where: PDR = Normal Decant Rate (gal/min)
NDT = Normal Decant Time (min/cycle)
1440 = Conversion (min/day)

Peak Wet Weather Flow:

$$PWR = \frac{MVAB \times 7.48}{SDT} + \frac{PWWF}{1{,}440} = \frac{5{,}013 \times 7.48}{30.0} + \frac{600{,}000}{1{,}440} = \mathbf{1{,}667\ gal/min}$$

where: PWR = Peak Decant Rate (gal/min)
SDT = Storm Decant Time (min/cycle)

Decanter Sizing

Peak Dry Weather Flow:

$$DLa = \frac{PDR}{\text{Weir Loading Rate} \times 7.48} = \frac{833}{20 \times 7.48} = \mathbf{5.57\ ft}$$

where: DLa = Decanter Length for Average Dry Weather Flow (ft)
20 = Weir Loading Rate (ft^3/min/ft of decanter weir)

Peak Wet Weather Flow:

$$DLp = \frac{PWR}{\text{Weir Loading Rate} \times 7.48} = \frac{1{,}667}{25 \times 7.48} = \mathbf{8.91\ ft}$$

where: DLp = Decanter Length for Peak Wet Weather (Storm) Flow (ft)
25 = Weir Loading Rate (ft^3/min/ft of decanter weir)

Design Decanter Length = **10.0 ft**

Basin Working Volume

$$BWV = MVAB + Vbio = 5{,}013 + 11{,}838 = \mathbf{16{,}851\ ft^3/basin}$$

where: BWV = Basin Working Volume (ft^3/basin)

Basin Area

$$BA = \frac{BWV}{TWL - BZ} = \frac{16{,}851}{18.0 - 3.2} = \mathbf{1{,}140\ ft^2/basin}$$

where: BA = Basin Area (ft^2)
TWL = Top Water Level (ft)
BZ = Buffer Zone (ft) (Safety Factor)

Sludge Depth

$$SD = \frac{Vbio}{BA} = \frac{11{,}838}{1{,}140} = \mathbf{10.38\ ft}$$

where: SD = Sludge Depth (ft)

Decanter Draw Down

$$DD = \frac{MVAB}{BA} = \frac{5{,}013}{1{,}140} = \mathbf{4.40\ ft}$$

where: DD = Draw Down (ft)

Bottom Water Level

$$BWL = SD + BZ = 10.38 + 3.22 = \mathbf{13.60\ ft}$$

where: BWL = Bottom Water Level (ft)

Top Water Level

$$TWL = BWL + DD = 13.60 + 4.40 = \mathbf{18.00\ ft}$$

where: TWL = Top Water Level (ft)

Hydraulic Retention Time

$$HRT = \frac{BA \times MAFD \times 7.48}{QT}$$

where: HRT = Hydraulic Retention Time (days)
MAFD = Maximum Average Flow Depth (ft)
QT = Fill Rate at Average Dry Weather Flow (gal/day)

$$MAFD = \frac{Q \times [(NCT \times 60) - NDT]}{BA \times 1{,}440 \times 7.48} + BWL = \frac{150{,}000 \times [(4.0 \times 60) - 60.0]}{1{,}140 \times 1{,}440 \times 7.48} + 13.60 = \mathbf{15.80\ ft}$$

$$HRT = \frac{1{,}140 \times 15.80 \times 7.48}{150{,}000} = \mathbf{0.90\ days}$$

MLSS Concentration at Bottom Water Level

$$MLSS = \frac{Mbio \times 1{,}000{,}000}{BWL \times BA \times 62.42} = \frac{4{,}933 \times 1{,}000{,}000}{13.60 \times 1{,}140 \times 62.42} = \mathbf{5{,}460\ mg/l}$$

where: MLSS = Mixed Liquor Suspended Solids concentration at Bottom Water Level (mg/l)
62.42/1E+06 = Conversion (lb/mg x l/ft³)

Mass of Sludge Produced

$$\Delta M = \left(\frac{Y \times (BOD_{in} - BOD_{out})}{1 + (B \times \theta^{(T-20)} \times SRT)} + Zio + Zno \right) \times \frac{Q \times 8.34}{1{,}000{,}000} + Csludge$$

$$\Delta M = \left(\frac{0.6 \times (340 - 10.0)}{1 + (0.07 \times 1.02^{(12-20)} \times 17.3)} + 54.0 + 81.0 \right) \times \frac{1.5E+05 \times 8.34}{1{,}000{,}000} + 0 = \mathbf{292\ lb/day/basin}$$

(Lawrence-McCarty Equation as presented in WEF MOP/8 4th Edition, pg 11-11, Eqn. 11.7)

where:
- ΔM = Mass of Sludge Produced (lb/day/basin)
- Y = Volatile cell yield (VSS/BOD removed)
- q = Arrhenius Temperature Correction Factor
- B = Decay Rate (day^{-1})
- BOD_{out} = Anticipated Effluent BOD (mg/l)
- SRT = Solids Retention Time (days)
- Zio = Nonvolatile Influent suspended solids (mg/l)
- Zno = Volatile Non-Biodegradable solids (mg/l)
- T = Minimum Wastewater Temperature (°C)

Volume of Sludge Produced

$$V_{ws} = \frac{\Delta M}{SFws \times 8.34} = \frac{292}{0.0085 \times 8.34} = \mathbf{4{,}125\ gal/day/basin}$$

where: Vws = Volume of Waste Sludge (gal/day/basin)
SFws = Solids Fraction in Waste Sludge
8.34 = Density (lb/gal)

Observed Yield Factor

$$Yobs = \frac{\Delta M}{BOD_L} = \frac{292}{425} = \mathbf{0.688}\ \frac{\mathbf{MLSS}}{\mathbf{BOD}}$$

Observed Yield Factor (lb/day MLSS/lb/day BODremoved)

Mean Cell Residence Time

$$MCRT = \frac{Mbio}{\Delta M + ((Q - Vws) \times TESS \times 8.34 / 1E{+}06)}$$

$$MCRT = \frac{4{,}933}{292 + ((150{,}000 - 4{,}125) \times 10.0 \times 8.34 / 1{,}000{,}000)} = \mathbf{17.3\ days}$$

where: MCRT = Mean Cell Residence Time (days)
TESS = Anticipated Effluent Total Suspended Solids (mg/l)
8.34E-06 = Conversion (lb/mg x l/gal)

Sludge Age for Nitrification

Refer to Metcalf and Eddy, Edition IV pages 614 and 705

Constants and Temperature Corrections:

Coefficient	Base Value	Theta	Temperature Corrected	Symbol
Maximum Specific Growth Rate of Nitrifying bacteria, g VSS/g VSS.day	0.75	1.07	0.437	$\mu_{nm}(T)$
Half-Velocity constant for nitrifiers	0.74	1.053	0.490	Kn(T)
Nitrifier decay rate	0.08	1.04	0.058	Kdn(T)
Dissolved Oxygen, mg/l	2		2	DO
Half-Velocity Constant for Dissolved Oxygen, mg/l	0.5		0.5	Ko
Minimum Water Temperature, °C	12		12	T
Safety Factor	1.9		1.9	SF

Calculations:

$$\mu_n = \left(\mu_{nm}(T) \times \frac{TENH_3}{TENH_3 + Kn(T)} \times \frac{DO}{DO + Ko} \right) - Kdn(T)$$

$$\mu_n = \left(0.437 \times \frac{2.0}{2.0 + 0.490} \times \frac{2.0}{2.0 + 0.5} \right) - 0.058 = \mathbf{0.222\ days^{-1}}$$

$$SRTmin = \frac{1}{\mu_n} = \frac{1}{0.222} = \mathbf{4.5\ days}$$

$$SRTaerobic = SRTmin \times SF = 4.5 \times 1.9 = \mathbf{8.7\ days}$$

$$SRToverall = \frac{SRTaerobic \times 24}{TA} = \frac{8.7 \times 24}{12.0} = \mathbf{17.3\ days}$$

Design sludge age adequate for nitrification.

where: µnm(T) = Maximum Temperature Corrected Nitrifier Growth Rate ($days^{-1}$)

μ_n = Specific Nitrifier Growth Rate at Temperature, DO, and Effluent NH_3 (g/g-days)

SRTmin = Minimum Sludge age required for Nitrification (days)

SRTaerobic = Design Aerobic Sludge Age (days)

SF = Safety Factor

SRToverall = Sludge Age accounting for entire ICEAS cycle (days)

TA = Aeration Time (hrs/day)

$TENH_3$ = Anticipated Effluent Ammonia (mg/l)

Waste Sludge Pump Capacity

$$WSP = \frac{Vws \times NCT}{24 \times SPT} = \frac{4{,}125 \times 4.0}{24 \times 6.25} = \mathbf{110\ gal/min}$$

where: WSP = Waste Sludge Pump Capacity(gal/min)
SPT = Sludge Pumping Time (min/cycle)

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SANITAIRE ICEAS Aeration Design Calculations
BOD Removal and Nitrification Process

SANITAIRE Project #a32101-23
Tolar, TX - Tolar WWTP

Carbonaceous Oxygen Demand

$$AOR1 = A \times \frac{Q \times BODin}{1{,}000{,}000} \times 8.34 = 2.20 \times \frac{150{,}000 \times 340}{1{,}000{,}000} \times 8.34 = \textbf{936 lb/day/basin}$$

where AOR1 = Actual Oxygen Required for BOD oxidation (lb/day/basin)
A = O2 / BOD
Q = Average flow (gal/day/basin)
BODin = Influent BOD received (mg/l)
1,000,000 = Conversion (g x mg)
8.34 = Conversion (lb x gal)

Nitrification Oxygen Demand

$$AOR2 = NLOAD \times 0.00 = 93.8 \times 0.00 = \textbf{0 lb/day/basin}$$

where AOR2 = Actual Oxygen required for Ammonia Oxidation (lb/day/basin)
TKNox = Nitrogen available for oxidation(lb/day/basin)

Total Actual Oxygen Transfer

$$AOR = AOR1 + AOR2 - AOR3 = \quad 936 + 0 + 0 = \quad \mathbf{936\ lb/day}$$

where AOR = Total Actual Oxygen Required (lb/day/basin)

Total Standard Oxygen Transfer

$$SOR = \frac{AOR}{AOR / SOR} = \frac{936}{0.4500} = \mathbf{2{,}079\ lb/day/basin}$$

$$\frac{AOR}{SOR} = \frac{\alpha \times \theta^{(TSite - 20)} \times (\beta \times C^{*}sat_{20} \times Psite / Pstd \times Csurf_{T} / Csurf_{20} - D.O.)}{C^{*}sat_{20}}$$

$$\frac{AOR}{SOR} = \frac{0.45 \times 1.024^{(20 - 20)} \times (0.95 \times 10.44 \times 14.21 / 14.70 \times 9.07 / 9.07 - 2.0)}{10.44} = \mathbf{0.4500}$$

where SOR = Standard Condition Oxygen Requirement (lb/day/basin)
α = Alpha factor
θ = Temperature coefficient
Tsite = Water temperature (°C)
β = Beta factor
Psite = Site Atmospheric Pressure
Pstd = Standard atmospheric pressure (psig)
$C^{*}sat_{20}$ = Dissolved oxygen solubility at standard conditions (mg/l)
$Csurf_{T}$ = Dissolved oxygen solubility at site water temperature (mg/l)
$Csurf_{20}$ = Dissolved oxygen solubility at 20°C (mg/l)
D.O. = Residual dissolved oxygen concentration (mg/l)

Aeration System Standard Oxygen Transfer Rate

$$SOTR = \frac{SOR}{TA} = \frac{2{,}079}{12} = \mathbf{173\ lb/hr/basin}$$

where SOTR = Standard oxygen transfer rate (lb/hr/basin)
TA = Aeration Time, (hrs/day)

Aeration Depth

Average Aeration Depth

$$AADad = \frac{Q \times [(NCT \times 60) - (NDT + NST)]}{2 \times 1{,}440 \times 7.48 \times BA} + BWL$$

$$AADad = \frac{150{,}000 \times [(4.0 \times 60) - (60 + 60)]}{2 \times 1{,}440 \times 7.48 \times 1{,}140} + 13.60 = \mathbf{14.34\ ft}$$

where AADad = Average Aeration Depth at Average Dry Weather Flow (gpd)
Q = Average Dry Weather Flow (gpd/basin)
NCT = Normal Cycle Time (hr)
NDT = Normal Decant Time (min)
NST = Normal Settling Time (min)
BA = Basin Area (ft²)
1440 = Conversion (min/day)
2 = Calculate Aeration Depth at Middle of Normal Reaction Phase (NCT - NST - NDT)
7.48 = Conversion (gal/ft³)

Maximum Aeration Depth

$$MADpw = \frac{PWWF \times [(SCT \times 60) - (SDT + SST)]}{1{,}440 \times 7.48 \times BA} + BWL$$

$$MADpw = \frac{600{,}000 \times [(2.0 \times 60) - (30 + 50)]}{1{,}440 \times 7.48 \times 1{,}140} + 13.60 = \mathbf{15.56\ ft}$$

where MADpw = Maximum Aeration Depth at Peak Wet Weather Flow (gpd)
PWWF Peak Wet Weather Flow (gpd/basin)
SCT = Storm Cycle Time (hr)
SDT = Storm Decant Time (min)
SST = Storm Settle time (min)
MAD = Maximum Aeration Depth (ft)

MAD is larger of MADad and MADpw

$$MAD = \mathbf{16.53\ ft}$$

Air Flow Requirement

$$Process\ Air = \frac{SOTR \times 10{,}000}{\rho \times SOTE \times Opw \times 60} = \frac{173 \times 10{,}000}{0.075 \times 28.69 \times 23.2 \times 60} = \mathbf{579\ scfm}$$

where Process Air = Process air flow requirement (scfm)
ρ = Air density (0.075 lb/day/ft³)
SOTE = Standard Oxygen Transfer Efficiency @ Submergence of 13.34 ft
Opw = Fraction of Oxygen in air by Weight

10,000 = Conversion (100% * 100%)
60 = Conversion (min/hr)

Mixing Air = MI x BA = 0.13 x 1,140 = **143 scfm**

where Mixing Air = Mixing air flow requirement (scfm)
MI = recommended air flow per unit area of basin (scfm/ft²)

Blower Unit Capacity

Blower unit capacity (BUC) is the larger of the process air requirement and the mixing air requirement.

Process Air	579	scfm
Mixing Air	143	scfm

Use 2 blowers per tank

BUC = **290 scfm**

Blower Pressure

psig = MAD x 0.432 + H_L = 15.56 x 0.432 + 1.00 = **8.2 psig**

where psig = blower pressure (rounded to next psig)
0.432 = water density (psi/ft)
H_L = Cumulative piping and diffuser headloss (psig)

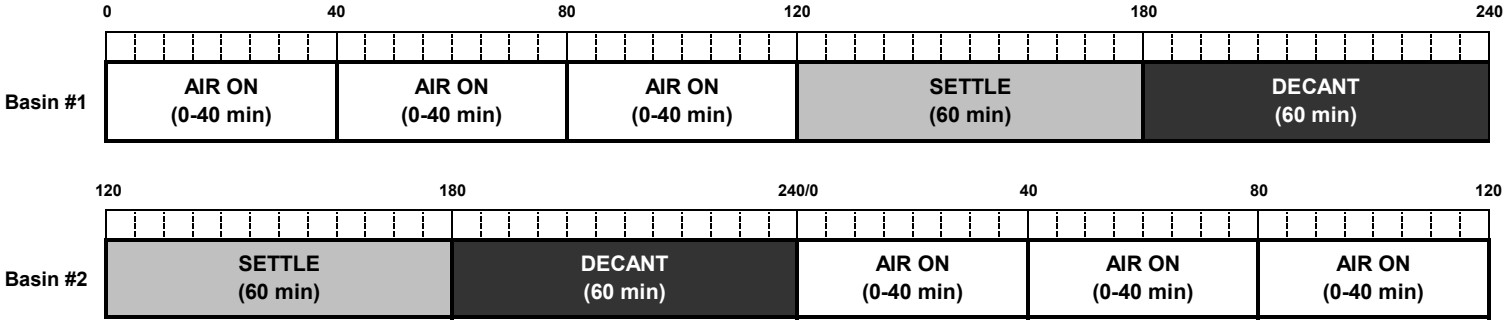
Average Blower Power

Blower power based on vendor curves, BUC, and Average Aeration Depth (13.34 ft)

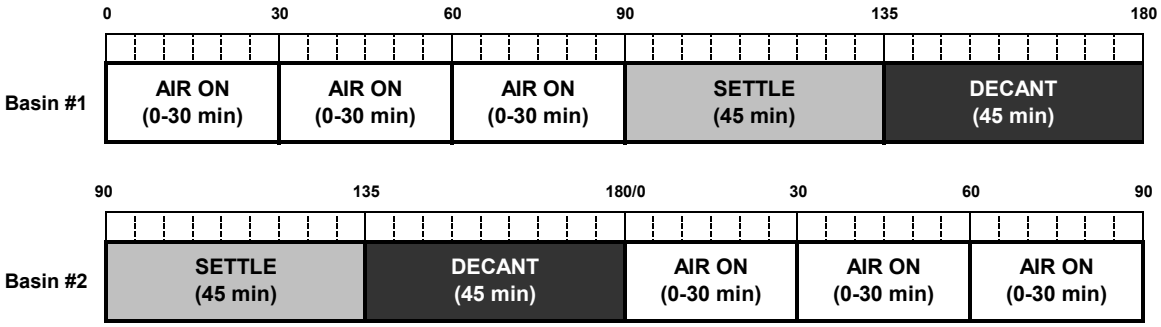
$Power_{avg}$ = **18.9 bhp**

Project Name: Tolar, TX WWTP
Sanitaire Number: s32101-23

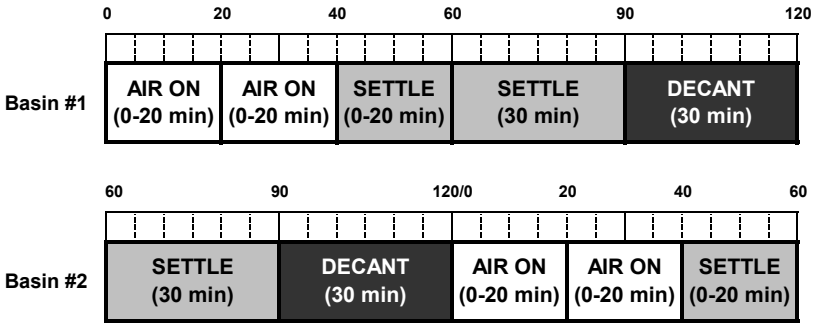
ICEAS 2-Basin NIT Normal Cycle 240 mins (4 hours)



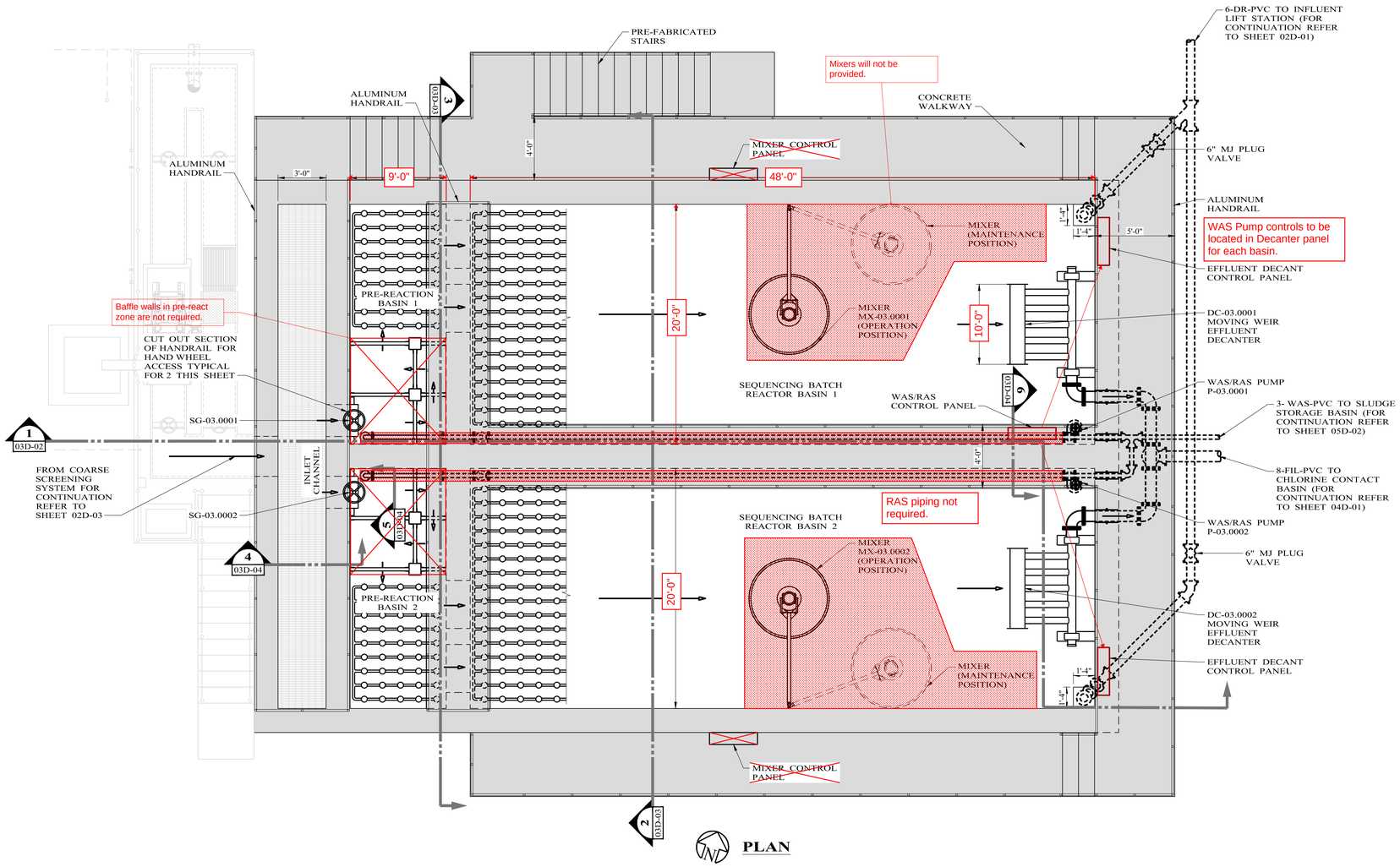
ICEAS 2-Basin NIT High Flow Mode 180 mins (3 hours)



ICEAS 2-Basin NIT Second High Flow Mode 120 mins (2 hours)



Notes:
Each basin fills continuously over entire cycle. Basins #1 and #2 share blowers.
"Air On" periods in the react phase are programmable from 0 to 40 minutes in a normal cycle, 0 to 30 in a first storm cycle and 0 to 20 in a second storm cycle.
Sludge wasting occurs during the decant phase, pump run time is programmable.
During the storm cycle, the time segments are reduced by 25% to accommodate additional flow.



NOTES:

1. CONTRACTOR TO FIELD VERIFY ALL EXISTING PIPING, STRUCTURES, AND UTILITIES PRIOR TO CONSTRUCTION. CONTRACTOR TO NOTIFY ENGINEER IMMEDIATELY OF ANY DEVIATIONS.
2. INSTALL SURFACE MIXER PER MANUFACTURER'S WRITTEN INSTRUCTIONS.
3. HANDRAILS SHALL BE TOP MOUNTED AND INSTALLED AS PER LAYOUT SHOWN ON THIS SHEET.

NO.	REVISION	DATE
A	ISSUED FOR EQUIPMENT PROPOSAL	04/27/2023

04/27/2023

Brittany D. White

BRITTANY D. WHITE 128714 LICENSED PROFESSIONAL ENGINEER

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PE Firm Registration No. 1151 • PG Firm Registration No. 50103 • RPLS Firm Registration No. 10011900

BAR IS ONE INCH ON ORIGINAL DRAWING
0 1
IF NOT ONE INCH ON THIS SHEET. ADJUST SCALES ACCORDINGLY.

DESIGNED BY B.D.W.
DRAWN BY J.C.
CHECKED BY B.D.W.
SCALE 1/4" = 1'-0"
DATE 04/27/2023

CITY OF TOLAR
WASTE WATER TREATMENT PLANT IMPROVEMENTS

SBR BASIN - OVERALL PLAN

PROJECT NO.: 8434
SEQUENCE No. 23 OF 52
SHEET No. 03D-01

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SCADA AND HUMAN MACHINE INTERFACE COMPUTER (IN NEW MAINTENANCE BUILDING)

SBR CONTROL PANEL PLC (VENDOR PROVIDED) FIELD

LAHH LEVEL ALARM HIGH-HIGH
LAH LEVEL ALARM HIGH
LLLO LOW LEVEL LOCK OUT
LI LEVEL, FEET
LAL LEVEL ALARM LOW
HS START / STOP
ZS LOCAL / REMOTE
YL RUN STATUS
AI DISSOLVED OXYGEN, mg/L
FR FLOW RECORDER
FI FLOW, GPM
ZS POSITION OPEN / CLOSED

LIT 03.0001 / LE 03.0001 — LEVEL, FEET
AIT 03.0001 / AE 03.0001 — DISSOLVED OXYGEN, mg/L (120V, DO)
LIT 03.0002 / LE 03.0002 — LEVEL, FEET
FIT 03.0001 / FE 03.0001 — FLOW, GPM
FM-03.0001

07Y-10 — FLOW PACE SIGNAL TO CHLORINE GAS FEED SYSTEM

Mixers not provided.

VENDOR LOCAL CONTROL PANEL MIXER
HOR ZS — RUN STATUS YL
HS SS

RAS piping not required or provided.

3-RAS-DI

LEVEL TRANSDUCER
DISSOLVED OXYGEN PROBE
LEVEL TRANSDUCER

PRE-REACTION BASIN 1
SEQUENCING BATCH REACTOR BASIN 1
INLET DISTRIBUTION CHANNEL
MIXER MX-03.0001
MOVING WEIR EFFLUENT DECANTER
WAS/RAS PUMP
SG-03.0001
BASIN CONTINUED ON 07Y-03
BFV-03.0001
PERMANENT DIFFUSER GRID
BFV-03.0002
BASIN CONTINUED ON 07Y-07
PERMANENT DIFFUSER GRID

WAS Pump local controls to be located in Decanter local panel. Panel will include leak sensor.

VENDOR LOCAL CONTROL PANEL EFFLUENT DECANTER
HOR ZS — RUN STATUS YL
HS SS

VENDOR LOCAL CONTROL PANEL WAS/RAS PUMP
HOR ZS — RUN STATUS YL
HS SS

8-EFF-PVC
MM — FM-03.0001
07Y-09 — TO DISINFECTION SYSTEM
8-EFF-PVC
07Y-07 — FROM SBR TRAIN 2

PI 03.0001
BV-03.0001
PV-03.0003
3-WAS/RAS-PVC
CV-03.0001
PV-03.0002
3-WAS-PVC
07Y-11 — TO SOLIDS HANDLING SYSTEM

Automated Air Control Valve (Open/Close). One (1) per basin.

One (1) grid per SBR basin. Only one (1) dropleg required.

07Y-08 — FROM PROCESS AERATION SYSTEM
8-ALP-SS
07Y-07 — FROM SBR TRAIN 2
8-WAS-PVC

Typical for both basins

NO.	REVISION	DATE
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04/27/2023

Brittany D. White

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0 1
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY.

DESIGNED BY B.D.W.
DRAWN BY J.C.
CHECKED BY B.D.W.
SCALE NO SCALE
DATE 04/27/2023

CITY OF TOLAR
WASTE WATER TREATMENT PLANT IMPROVEMENTS

P&ID - SBR TRAIN 1

PROJECT NO.: 8434
SEQUENCE No. 42 OF 52
SHEET No. 07Y-06

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SCADA AND HUMAN MACHINE INTERFACE COMPUTER (IN NEW MAINTENANCE BUILDING)

SBR CONTROL PLC (VENDOR PROVIDED) FIELD

VENDOR LOCAL CONTROL PANEL BLOWER 1

VENDOR LOCAL CONTROL PANEL BLOWER 2

VENDOR LOCAL CONTROL PANEL BLOWER 3

Blower controls to be located inside of the SBR control panel, located inside the Blower building.

120 VAC

120 VAC

12"x16"

12-ALP-SS

BFV-03.0005

CV-03.0003

1"

PI 03.0003

BLOWER No.1 BLR-03.0001

12"x16"

12-ALP-SS

BFV-03.0006

CV-03.0004

1"

PI 03.0004

BLOWER No.2 BLR-03.0002

12"x16"

12-ALP-SS

BFV-03.0007

CV-03.0005

1"

PI 03.0005

BLOWER No.3 BLR-03.0003

FM-03.0003

07Y-06

TO SBR TRAIN 1

FM-03.0004

07Y-07

TO SBR TRAIN 2

NO.	REVISION	DATE
A	ISSUED FOR EQUIPMENT PROPOSAL	04/27/2023

04/27/2023

Brittany D. White

BRITTANY D. WHITE 128714 LICENSED PROFESSIONAL ENGINEER

Enprotec | Hibbs & Todd

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PE Firm Registration No. 1151 • PG Firm Registration No. 50103 • RPLS Firm Registration No. 10011900

BAR IS ONE INCH ON ORIGINAL DRAWING

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IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY.

DESIGNED BY B.D.W.

DRAWN BY J.C.

CHECKED BY B.D.W.

SCALE NO SCALE

DATE 04/27/2023

CITY OF TOLAR WASTE WATER TREATMENT PLANT IMPROVEMENTS

P&ID - PROCESS AERATION SYSTEM

PROJECT NO.: 8434

SEQUENCE No. 44 OF 52

SHEET No. 07Y-08

P:\Projects\Tolar, City of\8434\WWTP Improvements\10\ CAD\7. CONST\4. SHEETS\8434 - 08_07Y-08.dwg

Xylem Water Solutions USA, Inc.
247 Freshwater Way, Suite 200
Milwaukee, WI 53204
Tel 414.365.2200 Fax 414.365.2210

DATE: **June 1, 2023**

TO: **Bidding Contractors**

RE: **WWTP Improvements**
City of Tolar, TX
Bid Date: June 1, 2023
Sanitaire #a32101-23

Engineer: **Enprotec | Hibbs & Todd**

Xylem-Sanitaire is pleased to present this bid proposal for the supply and startup of a complete Sanitaire® Intermittent Cycle Extended Aeration System (ICEAS®) for the Tolar, TX WWTP. Sanitaire is proposing the following equipment subject to the terms and conditions set forth herein:

Section 11375 Sequencing Batch Reactor and Associated Equipment

A. PROCESS DESIGN DETAILS

The Sanitaire ICEAS (SBR) system is designed around the following influent conditions:

Average Daily Design Flow:	0.300	MGD
2-hour Peak Flow:	1.200	MGD
BOD_5:	340	mg/L
Suspended Solids:	270	mg/L
TKN:	75	mg/L
NH_4-N:	62	mg/L
Total Phosphorus TP:	8	mg/L

NOTE: **Design mass loadings are based on Average Daily Design Flow and concentrations listed above.**

The process design is based on meeting the following effluent criteria (defined by a 30-day arithmetic average):

$CBOD_5$:	10	mg/L
Total Suspended Solids (TSS):	15	mg/L
Ammonia Nitrogen NH_3-N:	3	mg/L
TP:	None	

Sanitaire is providing a continuous influent process requiring non-hydrostatic baffle walls across the width of the tank. Influent control valves not required to transition flows between basins (i.e. true-batch SBR system).

B. EQUIPMENT AND SERVICE

The Sanitaire scope of supply for this project includes the following equipment and services:

1. **Positive Displacement Blowers:**
   Three (3) 25 HP Gardner Denver 408 "Heliflow" positive displacement blowers (2 duty, 1 standby) for air supply to the ICEAS basins. Each complete blower package will be supplied with all necessary accessories referenced in Paragraph 2.6 of the equipment specification, including:
   - 25 HP – 1800 RPM – TEFC – 3-phase 1.15 S.F. Motor
   - Motor with slide base
   - Flexible expansion joints
   - Drive guard
   - Common elevated structural steel base
   - Inlet filter
   - Inlet silencer
   - Discharge silencer
   - Pressure relief valve
   - Check valve
   - Discharge isolation valve
   - Pressure gauge (discharge)
   - Pressure gauge (inlet vacuum)
   - Temperature gauge (discharge)
   - Vibration isolator pads
   - Spare parts
   - Motor Overtemperature Switch
   - Sound Enclosure

NOTE: **Base bid includes Gardner Denver blower package. Adder for Aerzen Blowers provided on the Pricing Sheet.**

2. Air Control Valves:

Two (2) 6" diameter air control valves, one (1) for each ICEAS basin. Each valve will be supplied with 120 V, 1 Ph, 60 Hz electric operator, compartment heaters and handwheel for manual operation.

3. Fine Bubble Aeration:

Two (2) complete SANITAIRE® Fine Bubble Aeration grids, one (1) for each ICEAS basin. Each system to include:

- One 20 ft long 304L drop pipe including flange for connection to the airmain at the top of the tank and bottom connection to the air manifold.
- One PVC manifold with connections for each 4 inch diameter air distributor.
- 304 Stainless steel manifold supports with hold clamps and cradle.
- Four-inch diameter PVC air distribution headers including:
  - Fixed anti-rotational joint connection to the air manifold.
  - Factory installed diffuser holders.
  - Positive locking fixed anti-rotational joint connections.
- 316 Stainless steel air distribution header support stands with header hold down clamp and locating plate.
- SANITAIRE® Fine Bubble Diffuser Elements with gaskets and retainer rings.
- Flanges, bolts, nuts and neoprene gaskets necessary to assemble the system.
- One purge system with eductor piping and isolation valve.
- 316 Stainless steel anchor bolts for the manifold and header supports.

NOTE: **Anchor bolts are designed for installation in 4000 PSI Concrete Per ACI Committee 350 ("Concrete Sanitary Engineering Structures").**

NOTE: **One (1) grid will cover both the pre-react and main-react zones of each ICEAS basin. The air distributors will run through the ports located at the bottom of the pre-react wall.**

NOTE: **Baffle walls in the pre-react zone are not required. Short circuiting of the influent flow is eliminated by the pre-react divider wall.**

4. Decant Mechanism:

Two (2) 304L stainless steel decanters, (1) per ICEAS basin. Each decanter will include a 10 foot long stainless steel trough, scum exclusion float, downcomer pipes, swivel joint, wall connection, and anchors. Each decanter drive assembly will be provided with electro-mechanical actuator decanter drive with 0.5 HP, 460 V, 3 phase, 60 Hz variable speed

drive duty motor, decanter drive support, boot and end position limit switches.

5. **Waste Sludge Pump:**
Two (2) submersible Flygt pumps, one (1) for each ICEAS basin. Each pump will come equipped with a 2.4 HP, 460 V, 3 Ph, 60 Hz motor, discharge base, guide rails, guide rail brackets, lifting cable and power cable. Hoist sockets will be provided for each pump. One (1) Thern Commander Series 1000 portable davit crane with electric hoist will be provided per ICEAS basin. **Discharge piping and valves by others.**

6. **OSCAR Controls System:**
A complete control system including hardware and software for proper control of the SBR process.

- Control Panel
  - One (1) NEMA 12 control panel enclosure
  - Programmable Logic Controller (PLC) - CompactLogix
  - Human Machine Interface (HMI)
    - 15.5" Touchscreen Display
  - DV/DT filter for decanter VFDs, webport, control switches, and pilot lights
  - Wall mounted blower VFDs and soft starters
  - (3) 25 HP Blower VFDs
  - (2) 2.4 HP WAS Pump Starters
  - (2) 0.5 HP Decanter VFDs
- Local control panel to be shared between the WAS pump and decanter for each basin.
- One (1) shelf spare PLC with spare IO cards, one (1) of each type.

NOTE: One (1) level transducer will be required per basin.

NOTE: In-panel PLC spare not available with specified CompactLogix PLC. As noted above, a shelf spare is included. An adder price for in-panel spare PLC using ControlLogix is included on pricing sheet.

NOTE: OIS SCADA package provided as an adder on the pricing sheet.

NOTE: A local blower control panel for each blower will not be provided. Blower controls will be located in the SBR master control panel, located in the blower building.

NOTE: The local controls for the decanter and WAS pump in each basin will be put into the same panel. One (1) local panel per basin.

NOTE: **Due to the cyclical operation of the SBRs, only one basin will be receiving air at a time, therefor mass flow meters will not be required or provided.**

NOTE: **Class 1 Div 2 is not required or provided.**

7. **Aeration Control System:**
Two (2) YSI dissolved oxygen sensors, one (1) analyzer and D.O. Control logic. D.O. Control system will monitor and transmit D.O. signals to the PLC, and the PLC shall control the blower output via VFD to meet the D.O. set point.

8. **Level Indicators:**
Three (3) level transducers, one (1) for each ICEAS basin and one (1) for the post-equalization basin. The transducer shall have a stainless steel body with a head-pressure-sensing bottom Teflon faced diaphragm and an internal precision, gage pressure transducer assembly. The transducer shall be cable mounted and factory calibrated for the basin depth. The transducer shall be a 2-wire type and produce a 4-20 mA signal in direct proportion to the measured level.

9. **High Level Storm Float:**
Two (2) high level non-mercury float switches, one (1) per ICEAS basin.

10. **Engineering Drawings:** Required sets of engineering drawings.

11. **O & M Manuals:** Required sets of O & M Manuals.

12. **Field Installation Guidance and Start-Up Services:**

The following services will be provided as specified.

Start-Up, Training Fourteen (14) Days

Includes training session 90-180 days after process start-up.

Additional days available at $1,700

C. EXCLUSIONS

The following are specifically excluded from our proposal:

1. Submersible mixers.
2. Influent manifold.
3. Baffle walls located in the pre-react zone.
4. RAS pumps.

5. Mass flow meters.
6. Actuated influent/effluent valves.
7. All valves, air main piping and accessories.
8. All bolts, gaskets and connectors for attaching drop pipe to upper air main piping.
9. Installation of equipment furnished by Xylem-Sanitaire.
10. All costs associated with video recording services.
11. All field testing (anchor bolt strength testing, leakage, level, uniformity, mixing and pressure testing)
12. Equipment unloading or storage at jobsite. Contractor will offload and provide lay down area for equipment. Partial or split shipments of equipment, in excess of what is proposed, can be ordered at an additional cost. Special trucking requirements (flatbeds, or short flatbed, or special bridge/road) are also subject to additional cost.
13. Concrete tank or building design and installation.
14. All influent piping and influent piping supports (including those in-basin). All effluent piping downstream of the decanter effluent including through the wall piping. Effluent vent piping outside basin where required. All yard piping and valves not listed in Section A including influent, effluent and supernatant piping/valves. Any splitter boxes.
15. Air supply piping between the blower isolation valves and the SBR basins at top of basin drop pies including any valves not listed in Section A.
16. Inside and outside basin sludge piping and valves. All waste sludge piping and valves (including check and plug valves) downstream of each pump discharge elbow/slide-away fitting.
17. Platforms, gratings (including those over the influent flow splitter box), handrails, ladders, and stairs.
18. Power, water, and labor for operating equipment.
19. Any instrumentation including flow meters, or equipment including disinfection or chemical feed equipment not specifically listed in Section A.

D. ESTIMATED SUBMITTALS AND DELIVERIES

The submittal schedule begins after acceptance of purchase order by Sanitaire. Delivery schedule begins after receipt of approved drawings; Assume two week turnaround of submittals by the review engineer.

Certified engineered equipment drawings: 12 - 14 weeks

Equipment Shipment (after release for fabrication): 12 – 14 weeks*

*The lead-times stated are based on as of today lead-times for equipment shipment after written receipt of approved submittals, however due to the continuing disruptions of COVID-19, including extended production timeframes from our suppliers as a result of raw materials shortages, related labor constraints, and transportation and logistics-related delays due to a shortage of both truckers and containers, we can at this time only state what our current lead-time is expected to be. Once

submittals are approved, we will work closely with you to meet your needs as best possible in this uncertain time.

E. PRICING

Pricing for the equipment and field services outlined in this proposal, DAP Jobsite per Incoterms 2020, Full freight allowed to destination:

Base Bid:	**$**___SEE PRICING SHEET___
Adder – Aerzen Blowers:	**$**___SEE PRICING SHEET___
Adder – (2) Aeration Grids per Basin:	**$**___SEE PRICING SHEET___
Adder – OIS SCADA Package:	**$**___SEE PRICING SHEET___
Adder – ControlLogix PLC:	**$**___SEE PRICING SHEET___

F. PRICE NOTES

1. Taxes are not included. Purchaser to pay directly all applicable taxes separate from purchase order to Xylem Water Solutions USA.

2. All prices quoted shall be valid for 365 days from the date of bidding.

3. The prices are based on the equipment being released for shipment by the 4th Quarter, 2024.

4. Prices on orders received after the above deadline or specifying later shipping dates shall be subject to review and possible adjustment in line with the then existing economic conditions.

5. Terms of Payment:

   10% Net 30 days following initial submittal for approval.
   80% Net 30 days following shipment
   5% Net 30 days NTE 150 days – following installation (whichever comes first)
   5% Net 30 days NTE 180 days – following start-up (whichever comes first).

6. An interest charge of 1 1/2% per month will be added to past due accounts.

7. This order is subject to the Standard Terms and Conditions of Sale – Xylem Americas effective on the date the order is accepted. Terms are available at http://www.xyleminc.com/en-us/Pages/terms-conditions-of-sale.aspx and

incorporated herein by reference and made a part of the agreement between parties. Different terms are hereby rejected unless expressly assented to in writing.

G. WARRANTY AND PROCESS GUARANTEE

Xylem Water Solutions USA warrants all parts to be free from defective material and workmanship for a period of one (1) year after startup or eighteen (18) months after shipment (whichever comes first) and to furnish to the Owner replacements for any such items found to be defective within that period.

Process guarantee included. Validated at start-up with 30-day performance test.

Thank you for considering our proposal for this equipment.

Very truly yours,

Stone, Tucker - Xylem

cc: **Sanitaire Representative:**
Hartwell Environmental

O&M Requirements, Power Consumption & Parts Pricing

CITY OF TOLAR, TX
XYLEM SANITAIRE ICEAS/SBR

A. O & M Requirements

NOTE: We have provided the typical man-hours required for typical equipment operation and maintenance. The labor rate to be estimated by OTHERS.

The following lists estimated regular maintenance to be expected for each piece of equipment.

Decanters and Decanter Drives: Check actuator and motor gear box, and lubrication (monthly). ***Note that actuator is easily accessible from the walkway – no boat or crane required.*** Check seal on limit switch enclosure (monthly). Check actuator for free travel over entire operating stroke and any signs of binding/noise (monthly) [l hr/decanter/month].

Aeration Blowers: Check inlet filters, lubrication levels, and grease fittings (weekly). Clean or replace inlet filter when inlet manometer shows excess clogging. Inspect and adjust belt and sheaves between motor and blower per O&M manual (monthly). Change blower oil every 1000-1500 hours, per O&M manual. Grease blower bearings per O&M manual. Re-grease motor bearings per O&M manual [0.5hr/blower/month].

Fine Bubble Aeration System: The SANITAIRE® fine bubble aeration system is designed to give maintenance free service. Should any reason to enter the basin occur, the ICEAS® continuous influent feature allows the operator to take a basin out of service temporarily without disrupting the rest of the process. ***Only the ICEAS® process offers this feature***. [Diffuser Replacement @ 12 years, replacement time 25 diffusers per man-hour]

Valves: Check limit switches and seal on limit switch enclosure (monthly) [0.5hr/valve/month].

Control Panel: The control equipment needs no regular service.

Submersible Pumps: Inspect pump assembly monthly for signs of rag build up and/or binding. Inspect oil monthly for level and signs of water intrusion. Add oil as needed. Replace oil and seals as indicated if there is evidence of water intrusion [1.0hr/pump/month].

Probes. The YSI FDO DO probes are self-calibrating. The only maintenance required is replacement of the sensor cap every 3-5 years. The ViSolid TSS probe is factory calibrated and utilizes an ultrasonic cleaning system. It requires no regular maintenance. The pH probe which also provides temperature readings also requires no regular maintenance.

B. Power Consumption:

The following table gives estimated power consumption values for Design Average Daily flow. Calculations included in the proposal.

NOTE: Valve and control/instrument power does not contribute significantly to the total power requirements and is therefore excluded from the summary.

SBR POWER REQUIREMENTS (Average Daily Design Flow – Gardner Denver Heliflow Blowers)

					KWH/DAY
DECANT DRIVE UNIT	0.4 BHP	2 RUN	@	6 HRS/DAY	3.6
ICEAS AIR BLOWER (PD)	17.9 BHP	2 RUN	@	24 HRS/DAY	640.8
WAS PUMPS	1.9 BHP	2 RUN 4 RUN	@	@ 0.6 HRS/DAY	6 HRS/DAY 1.7
				KWH/DAY	646.1

C. Typical Maintenance Parts Costs:

EQUIPMENT	ACCESSORIES	QTY.	FREQ. (YRS)	UNIT COST (USD)
DECANTER	Limit Switch Sets	2	5	$200
	Actuator Spare Parts Kit: Seals, Bearings and Gaskets	2	5	$2,350
BLOWER	Oil and Grease	3	1	$400
	V-Belt Set	3	10	$290
	Inlet Filter/Blower	3	3	$75
FB AERATION*	Diffuser Replacement (SSII Membrane Disc)	728	12	$6.00
	Diffuser Retainer Rings	*	*	$3.00
	Air Distributor Supports	*	*	$20.00
	Air Distributor Repair Kits	*	*	$150
	Fixed Joint Assemblies	*	*	$15
PUMPS	Oil	2	1	$100.00
	Seals	2	3	$150.00
D.O Probe	Replacement of Sensor Cap	2	3	$150.00

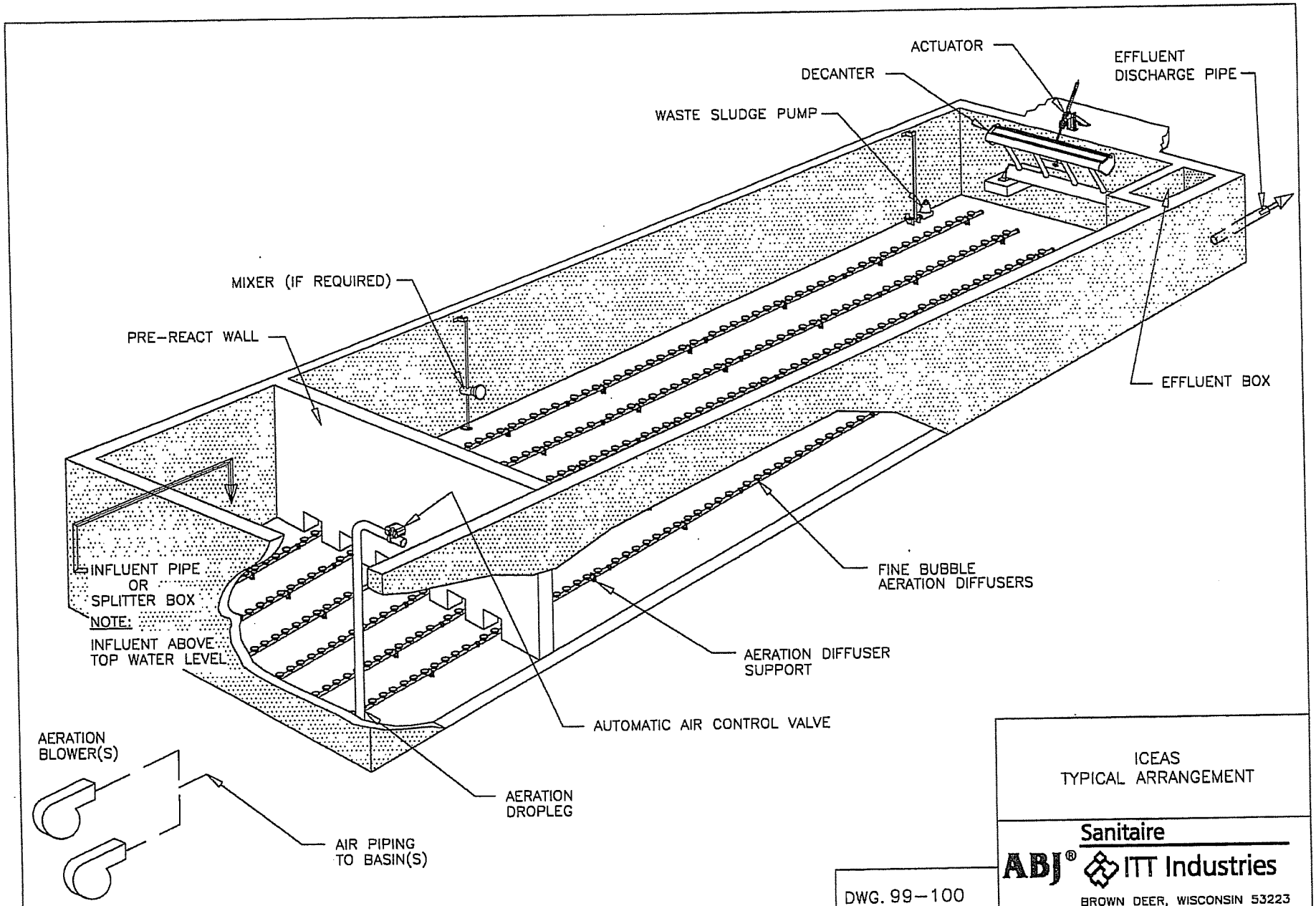
Note: Values quoted above, cover cost of materials only.

* The Sanitaire fine bubble aeration system is a fixed grid system with no moving or wearing parts, other than the membrane discs which require replacement every 12-15 years due to loss of elasticity. The listed aeration system spares are recommended be kept on hand in case of inadvertent damage.

TECHNICAL INFORMATION

SANITAIRE

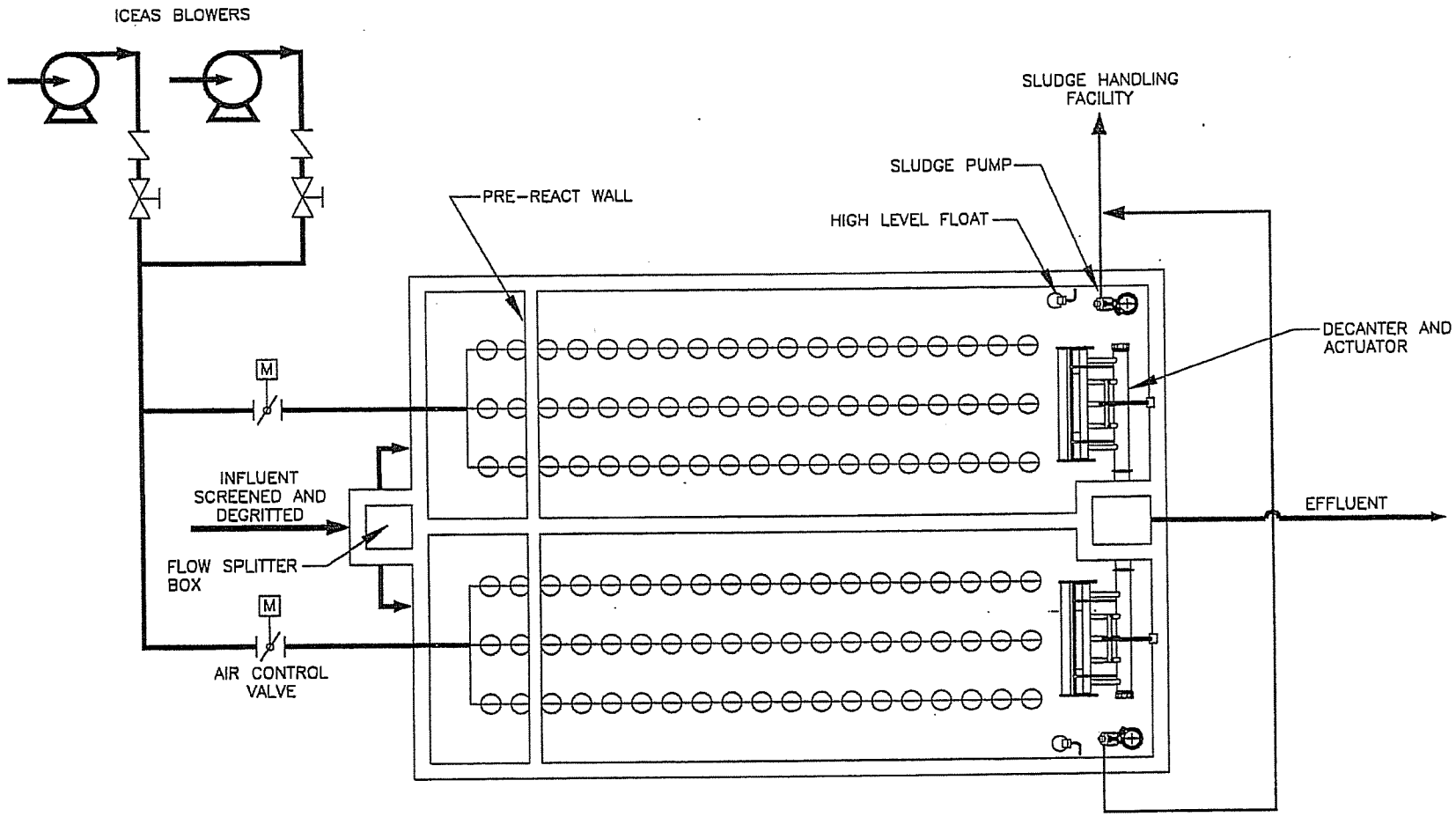
a xylem brand



ICEAS
TYPICAL ARRANGEMENT

Sanitaire
ABJ® ITT Industries
BROWN DEER, WISCONSIN 53223

DWG. 99-100

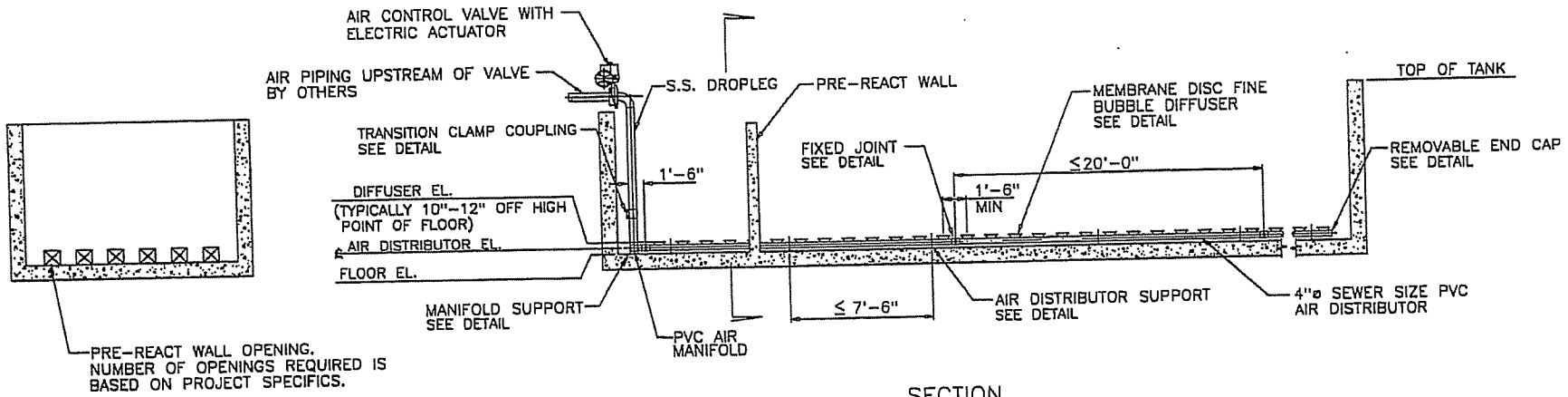


NOTE: CONTACT SANITAIRE FOR OTHER DESIGNS AND CONFIGURATIONS FOR SPECIFIC PROJECTS

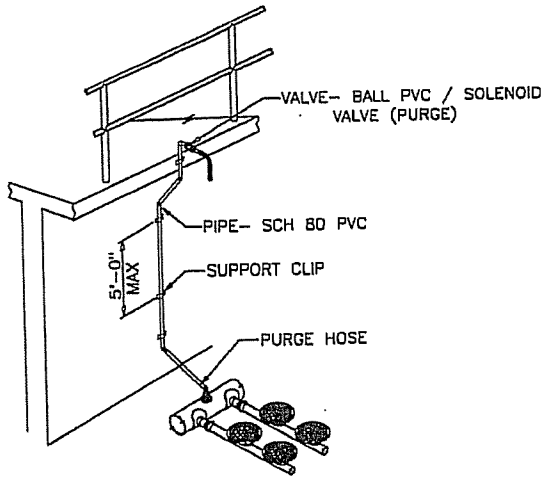
PROCESS FLOW DIAGRAM
DUAL BASIN ICEAS

Sanitaire
ABJ® ITT Industries
BROWN DEER, WISCONSIN 53223

DWG. 99-120



SECTION

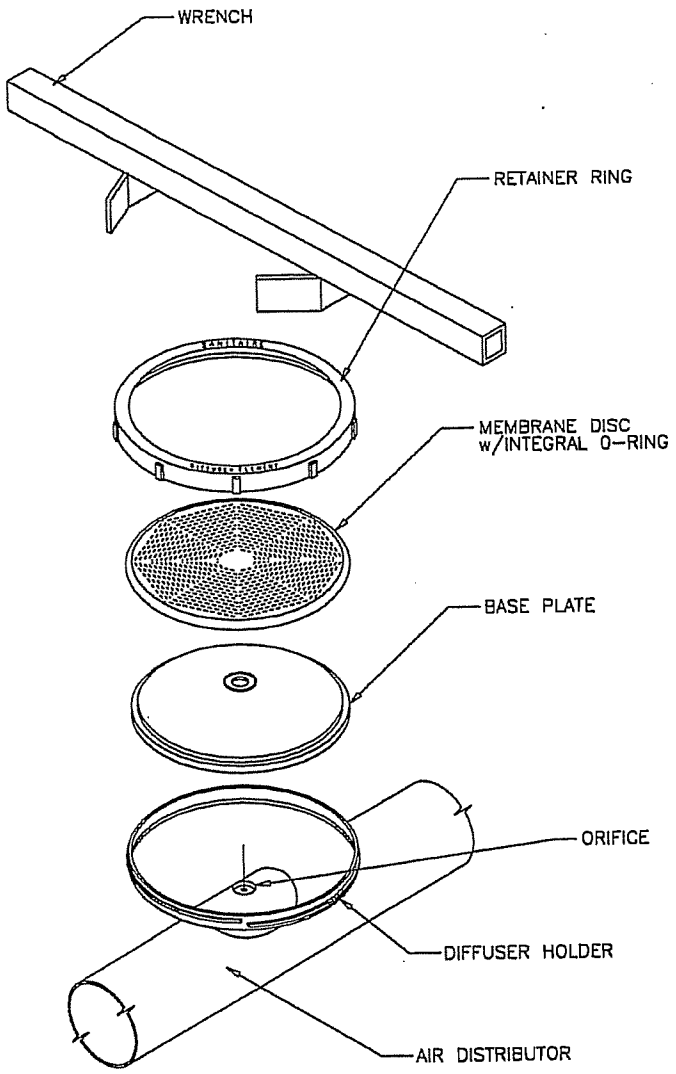


PURGE SUMP ASSEMBLY

FINE BUBBLE AERATION SYSTEM
SECTION AND DETAILS

Sanitaire
ABJ® ITT Industries
BROWN DEER, WISCONSIN 53223

DWG. 99-210

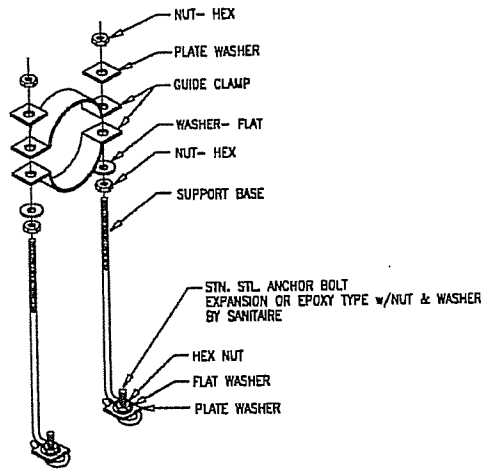


MEMBRANE DISC FINE BUBBLE DIFFUSER

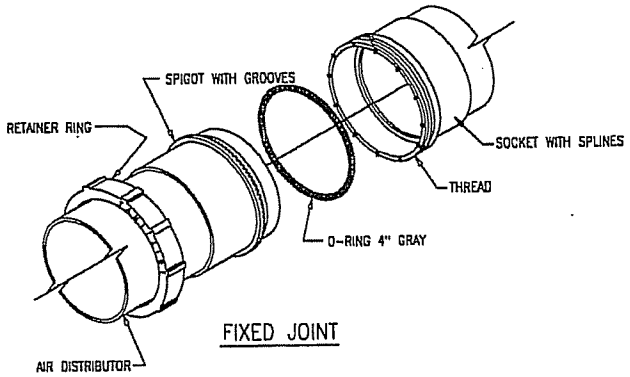
FINE BUBBLE DIFFUSER
ASSEMBLY

Sanitaire
ABJ® ITT Industries
BROWN DEER, WISCONSIN 53223

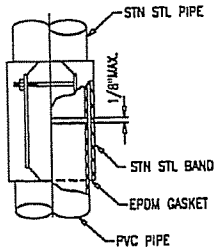
DWG. 99-220



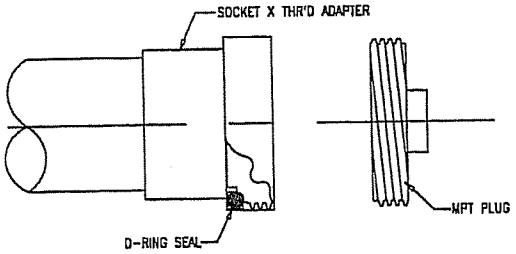
MANIFOLD SUPPORT
(STAINLESS STEEL)



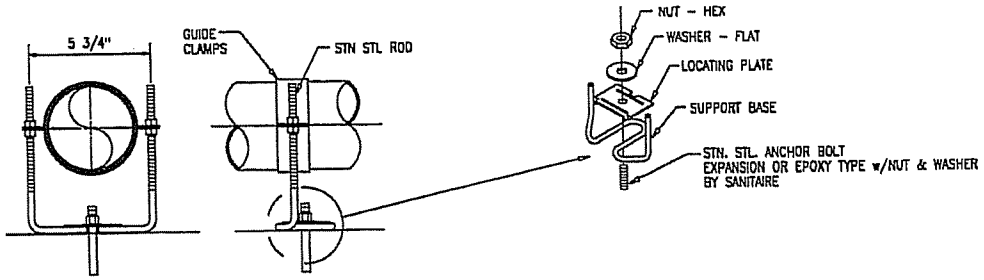
FIXED JOINT



TRANSITION CLAMP COUPLING
(FOR DROPLEG)



REMOVABLE END CAP

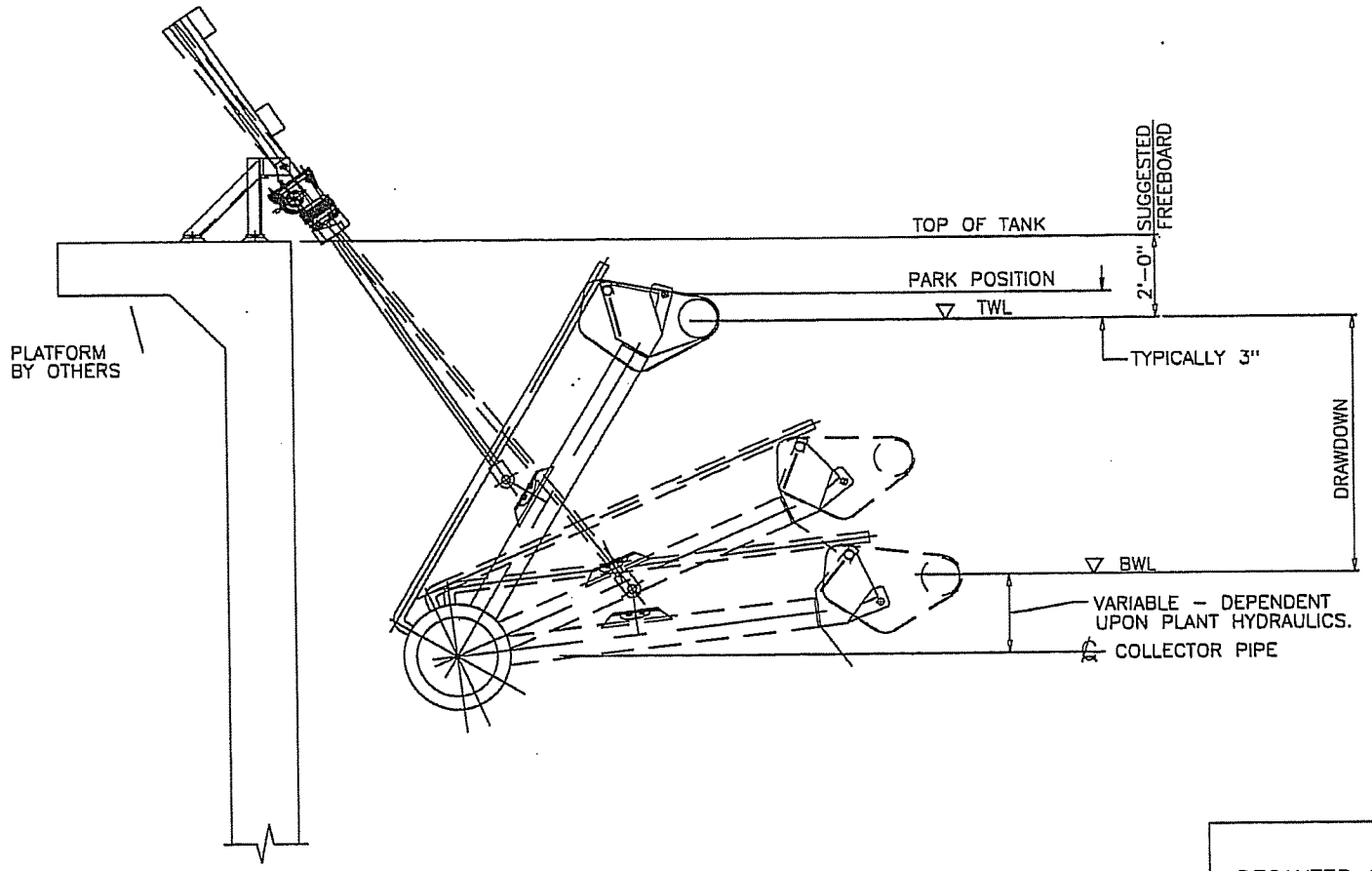


AIR DISTRIBUTOR SUPPORT
(STAINLESS STEEL)

FINE BUBBLE AERATION SYSTEM
TYPICAL DETAILS

Sanitaire
ABJ® ITT Industries
BROWN DEER, WISCONSIN 53223

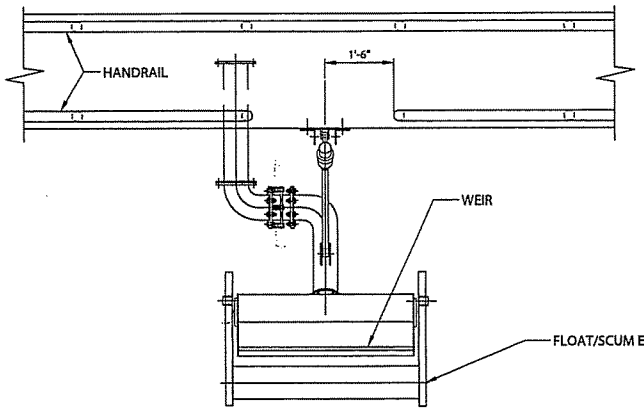
DWG. 99-230



DECANTER OPERATING POSITIONS

Sanitaire
ABJ® ITT Industries
BROWN DEER, WISCONSIN 53223

DWG. 99–400

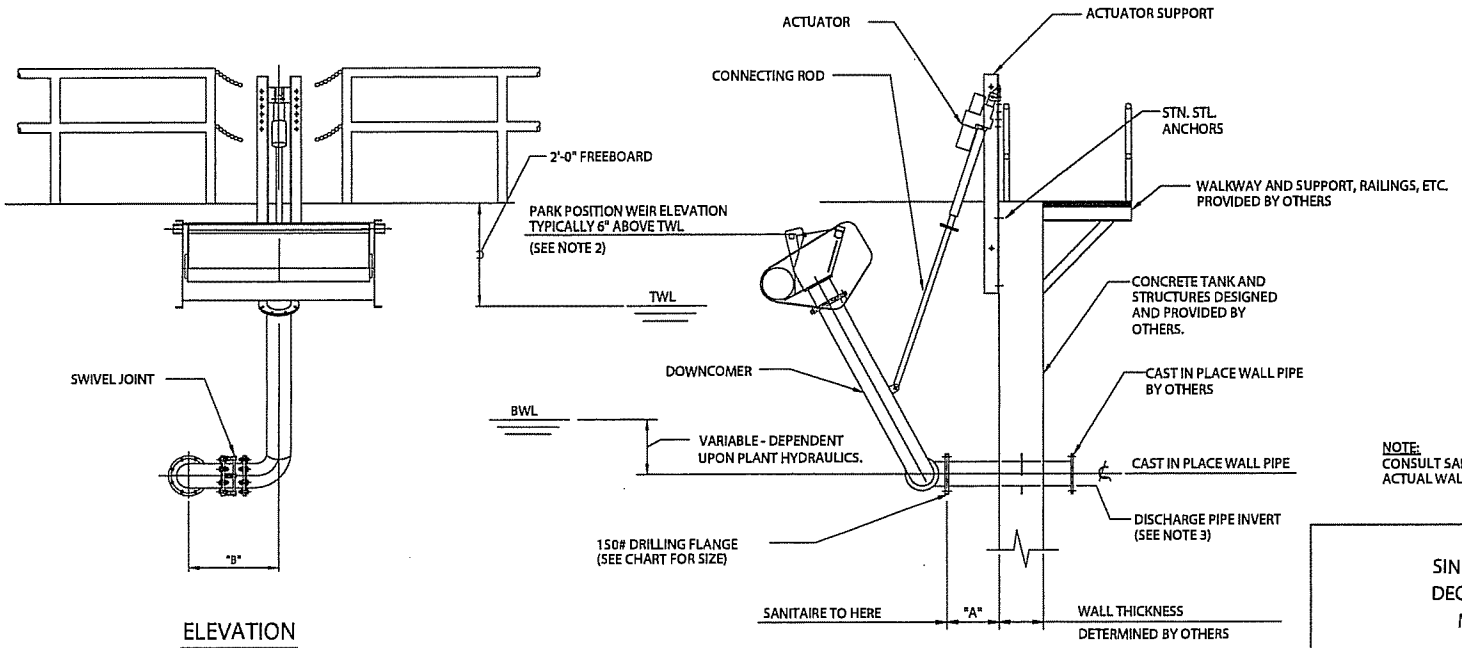


PLAN VIEW

NOTES:

1. ALL SUBMERGED MATERIALS ARE STAINLESS STEEL.
2. PARK POSITION IS USED TO KEEP THE FLOAT ABOVE THE WATER LEVEL DURING AERATION.
3. DOWNSTREAM WATER LEVEL SHOULD NOT EXCEED THIS INVERT ELEVATION.
4. ACTUATOR EQUIPMENT PLATFORM SHOULD BE LARGE ENOUGH TO ALLOW FOR INSPECTION AND SERVICE AND PROPERLY GUARDED FOR SAFETY AS NEEDED.

WEIR LENGTH	"A"	"B"	CAST IN PLACE PIPE SIZE
1'-6"	4"	18"	4"ø
3'-0"	11 3/4"	24 1/2"	6"ø
4'-0"	11 3/4"	24 1/2"	6"ø
5'-0"	11 3/4"	32 1/2"	8"ø
6'-0"	11 3/4"	32 1/2"	8"ø



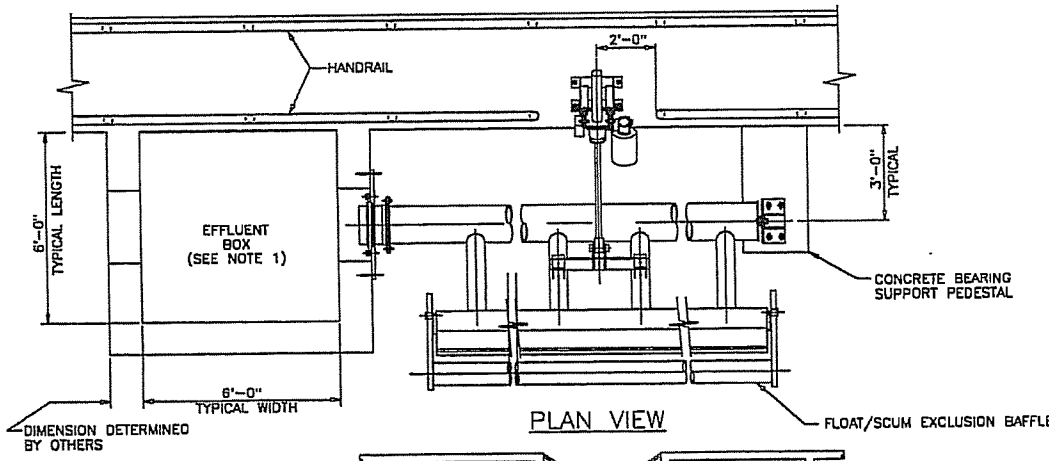
ELEVATION

NOTE:
CONSULT SANITAIRE FOR ACTUAL WALL PIPE ELEVATION.

SINGLE DOWNCOMER
DECANTER/ACTUATOR
MAIN ASSEMBLY

DWG. 99-410

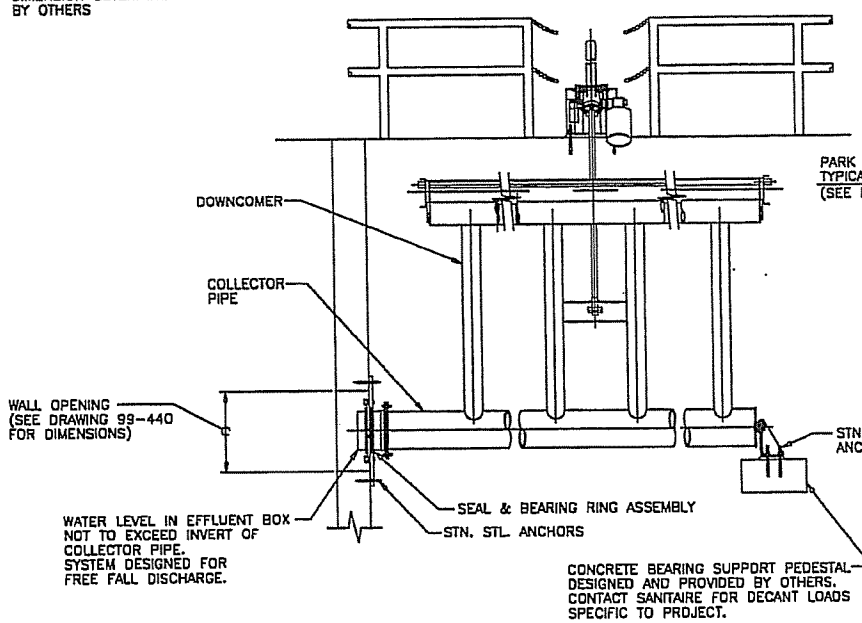
ABJ Sanitaire
ITT Industries
BROWN DEER, WISCONSIN 53223



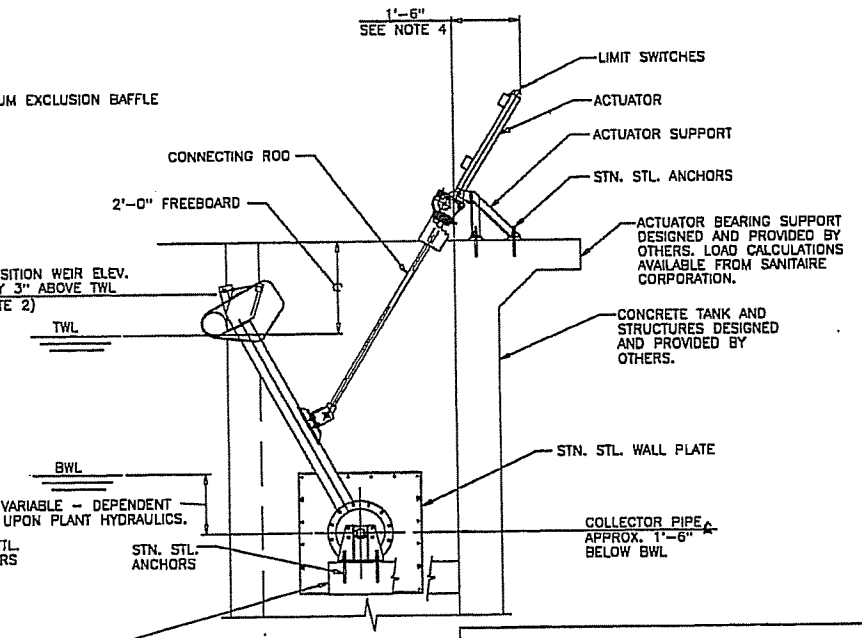
PLAN VIEW

NOTES:

1. EFFLUENT BOX SHOULD BE DESIGNED WITH THE FOLLOWING CONSIDERATIONS:
   - LARGE ENOUGH PLAN AREA TO ACCOMMODATE INSTALLATION AND MAINTENANCE OF THE DECANTER WALL PLATE.
   - DEEP ENOUGH TO KEEP THE PEAK WATER LEVEL AT OR BELOW THE COLLECTOR PIPE INVERT AT ALL TIMES.
2. PARK POSITION ELEVATION TO BE SET TO KEEP THE DECANTER FLOAT ABOVE THE WATER LEVEL DURING AERATION.
3. ALL SUBMERGED METALLIC MATERIALS ARE STAINLESS STEEL.
4. ACTUATOR EQUIPMENT PLATFORM SHOULD BE LARGE ENOUGH TO ALLOW FOR INSPECTION AND SERVICE AND PROPERLY GUARDED FOR SAFETY AS NEEDED.



ELEVATION



MULTIPLE DOWNCOMER DECANTER/ACTUATOR MAIN ASSEMBLY

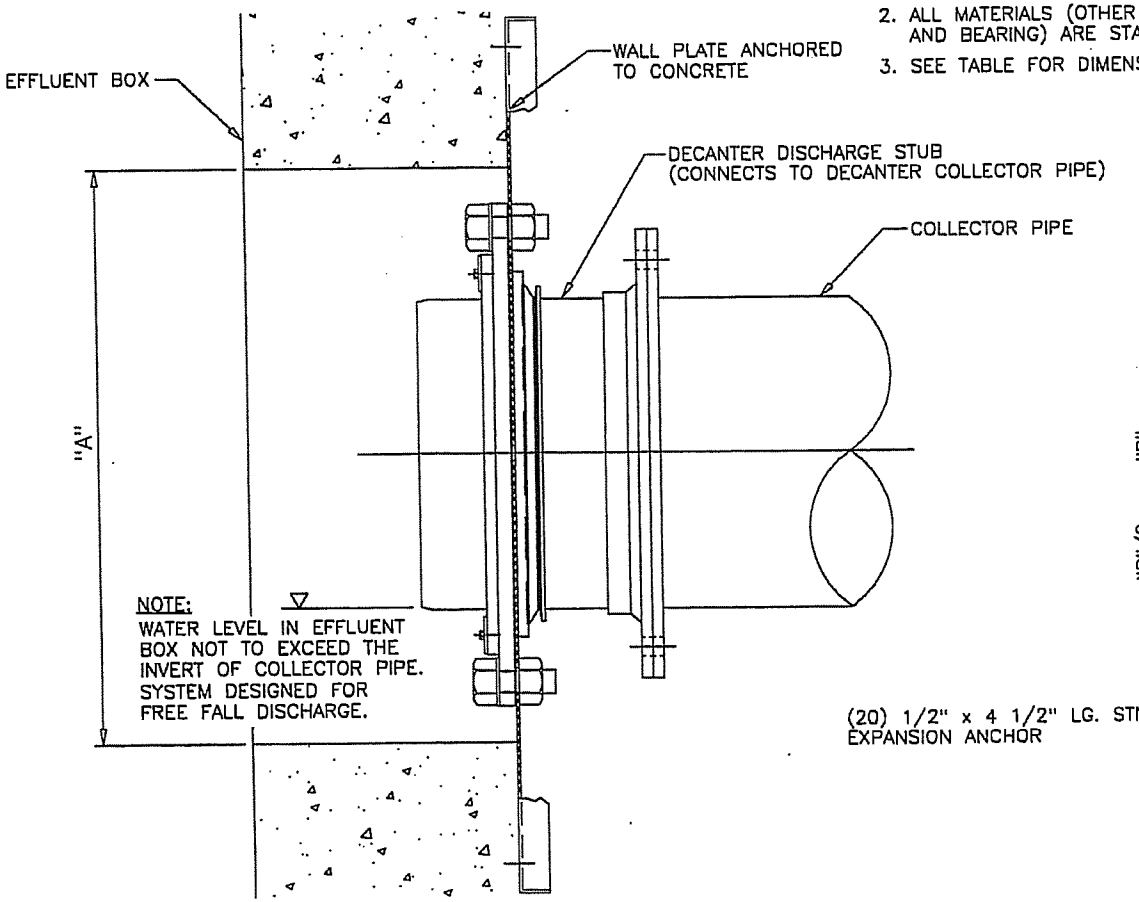
DWG. 99-420

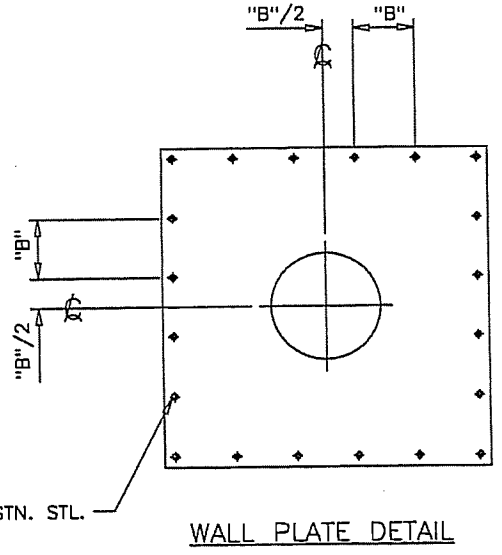
Sanitaire
ABJ® ITT Industries
BROWN DEER, WISCONSIN 53223

NOTES:

1. THIS ASSEMBLY USES A DUAL SEAL SYSTEM.
2. ALL MATERIALS (OTHER THAN SEALS AND BEARING) ARE STAINLESS STEEL.
3. SEE TABLE FOR DIMENSIONS

COLLECTOR PIPE SIZE	"A"	"B"
14"	26"	7 1/4"
18"	30"	8 1/2"
24"	40"	10 3/8"



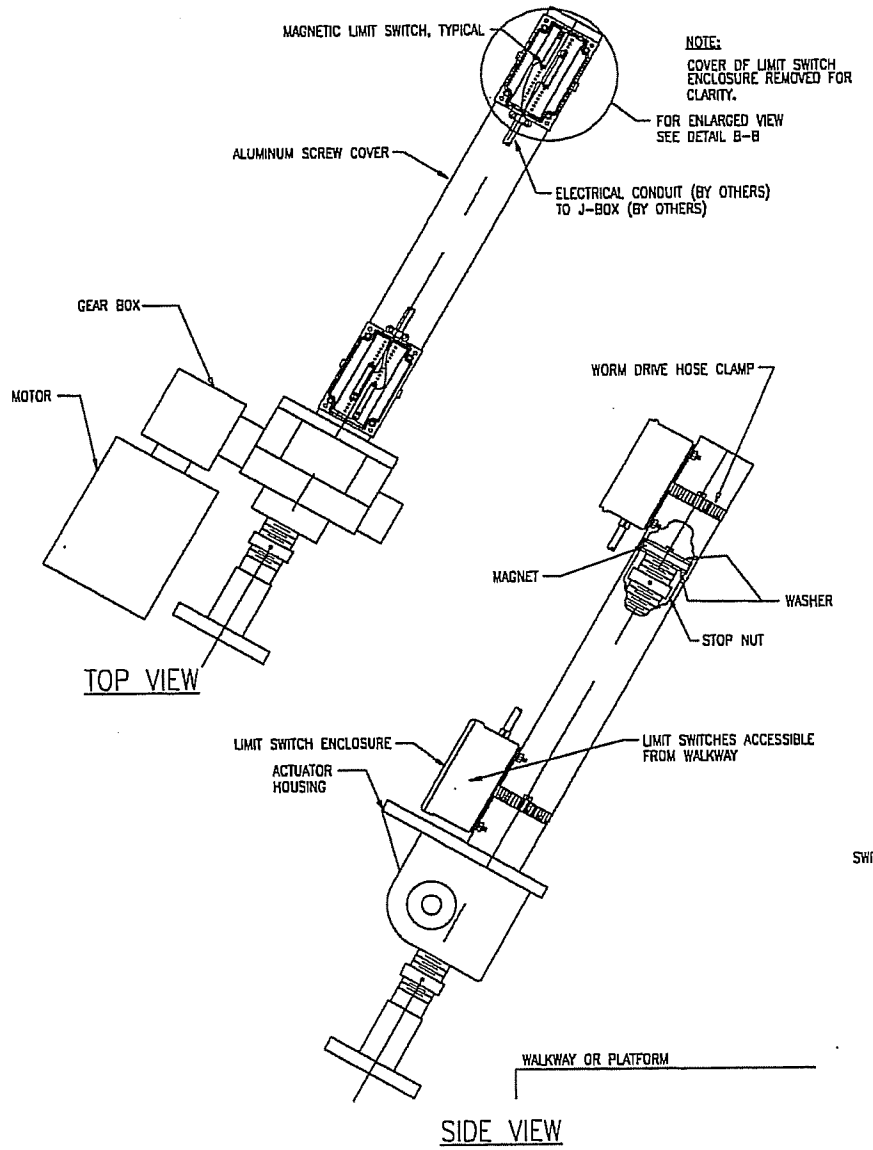


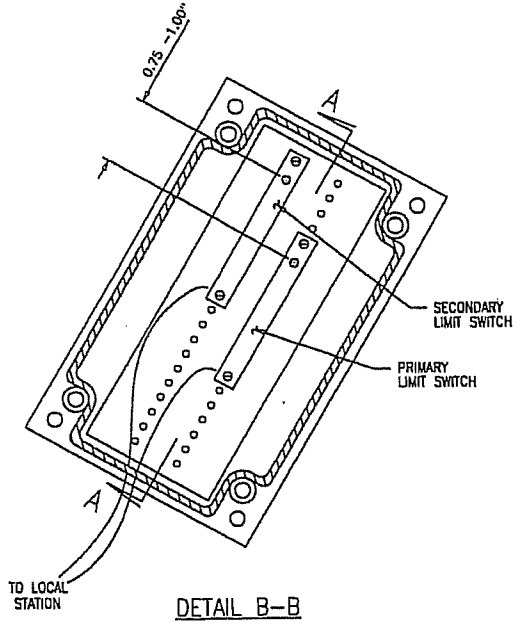
WALL PLATE DETAIL

DECANTER WALL PLATE, SEAL AND BEARING RING ASSEMBLY

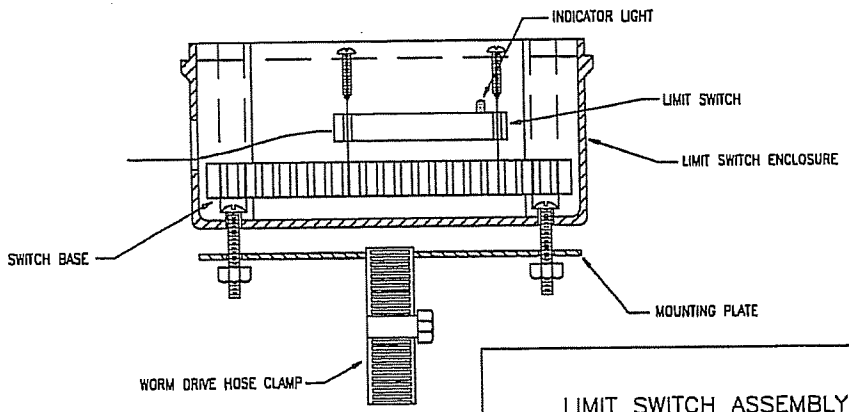
Sanitaire
ABJ® ITT Industries
BROWN DEER, WISCONSIN 53223

DWG. 99-440





DETAIL B-B

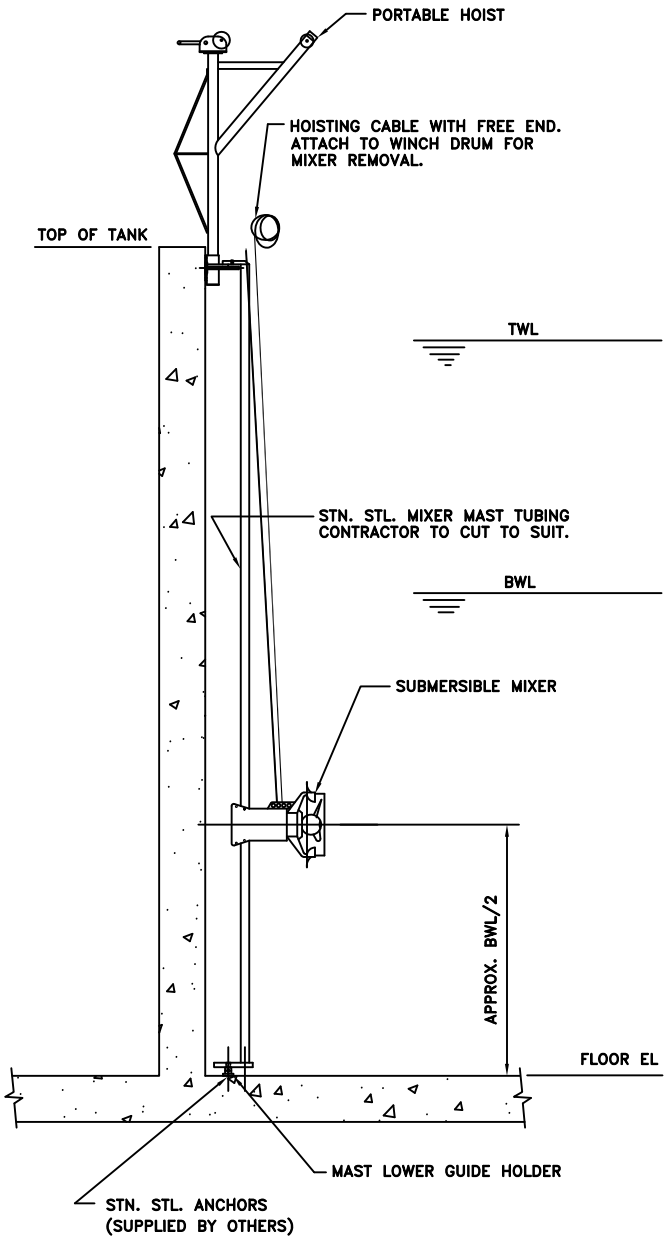


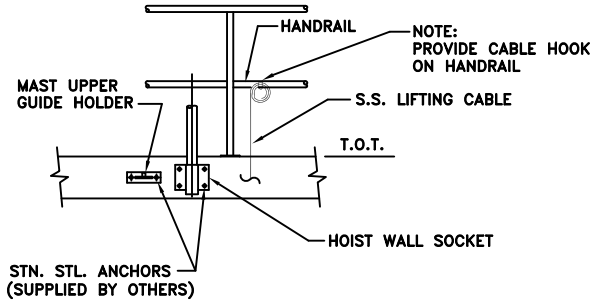
SECTION A-A

LIMIT SWITCH ASSEMBLY AND MOUNTING

Sanitaire
ABJ® ITT Industries
BROWN DEER, WISCONSIN 53223

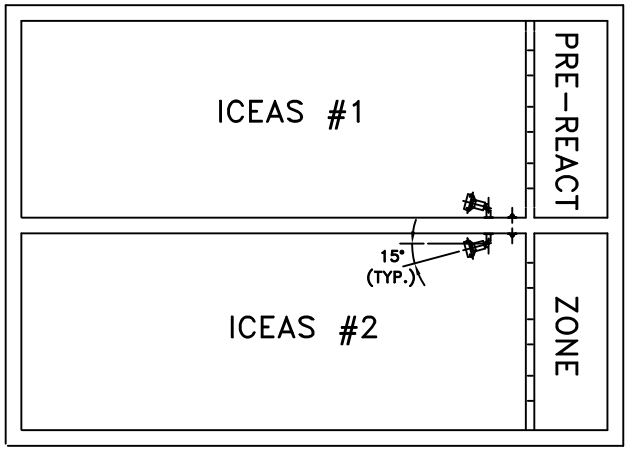
DWG. 99-450





NOTE:

COIL AND ATTACH EXCESS HOISTING CABLE TO CABLE HOOK.



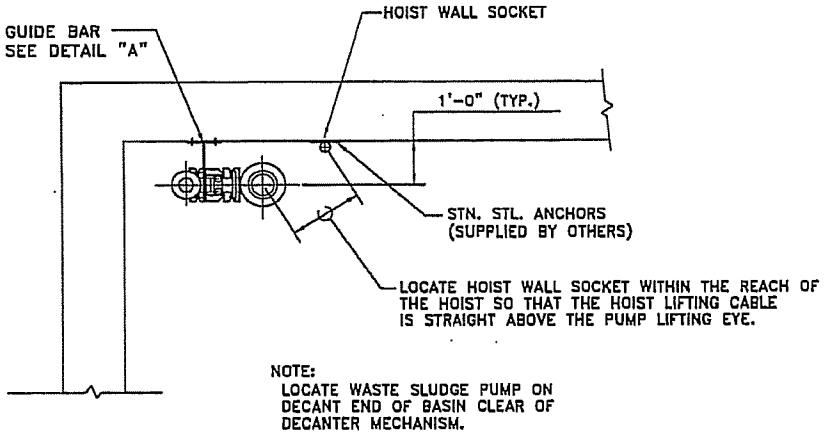
TYPICAL SINGLE MIXER/TANK ARRANGEMENT

NOTE: FACTORY TO DETERMINE QUANTITY AND LOCATION OF MIXERS.

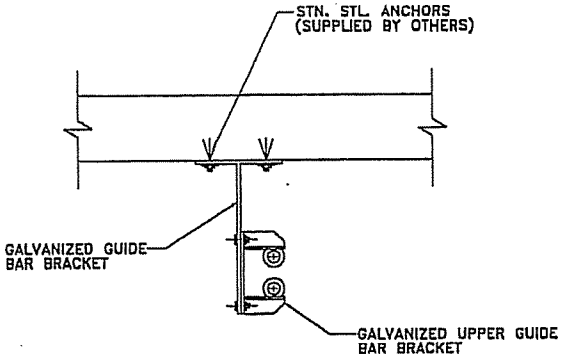
SUBMERSIBLE MIXER ASSEMBLY

Sanitaire
ABJ® ITT Industries
BROWN DEER, WISCONSIN 53223

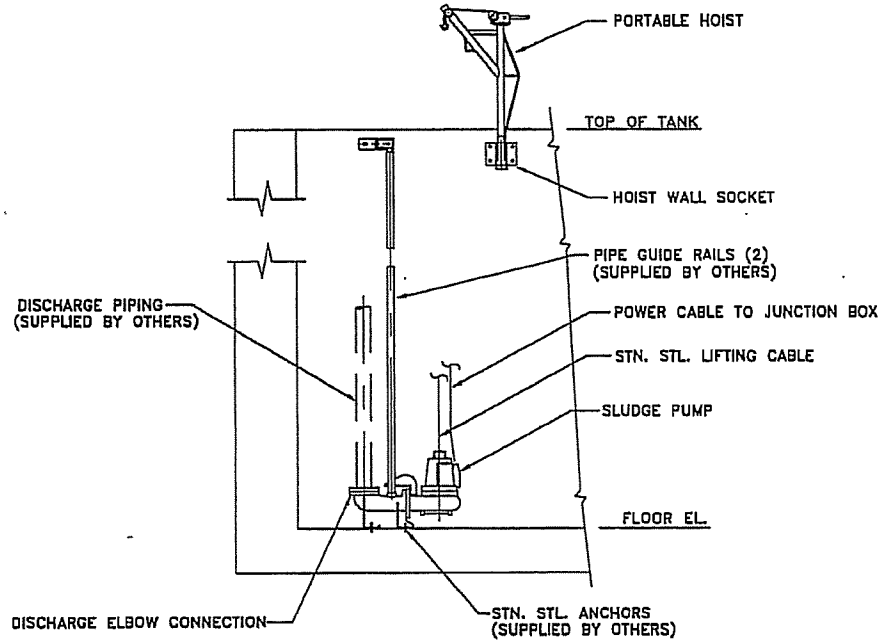
DWG. 99-600

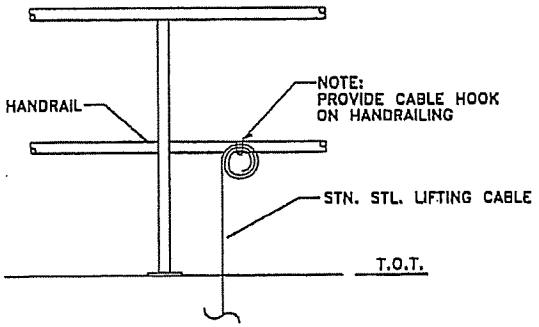


NOTE:
LOCATE WASTE SLUDGE PUMP ON
DECANT END OF BASIN CLEAR OF
DECANTER MECHANISM.



DETAIL (A)



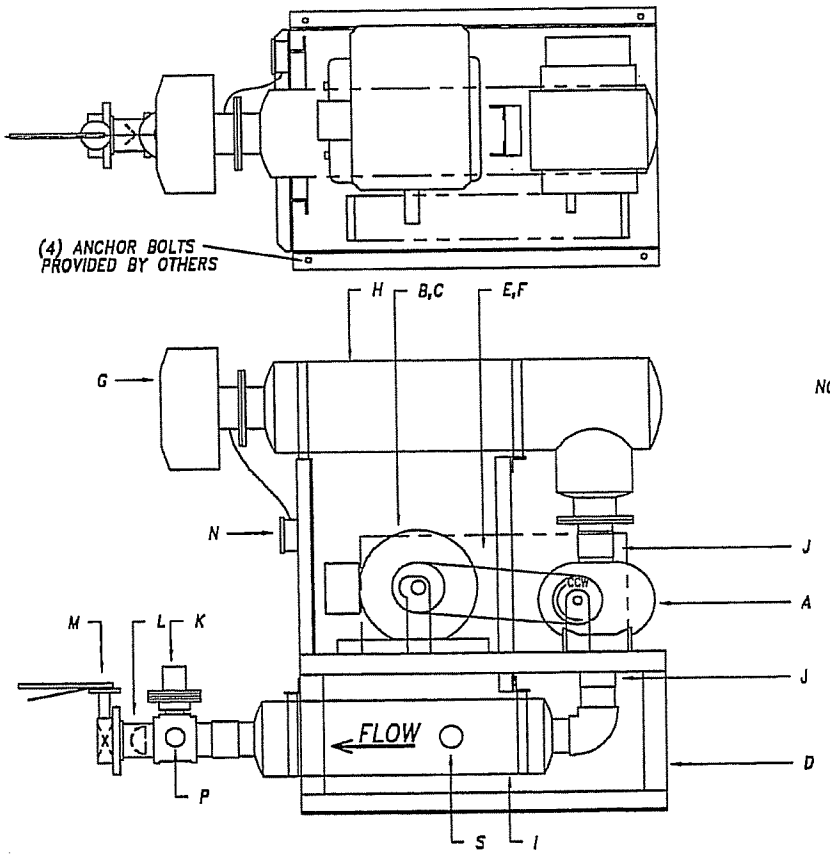


DETAIL (B)

WASTE SLUDGE PUMP TYPICAL ARRANGEMENT

Sanitaire
ABJ® ITT Industries
BROWN DEER, WISCONSIN 53223

DWG. 99-500



A BLOWER
B MOTOR
C MOTOR SLIDE BASE
D ELEVATED STEEL BASE
E V-BELT DRIVE:
F BELT GUARD
G INLET FILTER
H INLET SILENCER
I DISCH SILENCER
J FLEXIBLE PIPE CONNECTOR
K PRESSURE RELIEF VALVE
L CHECK VALVE
M BUTTERFLY VALVE
N DIFFERENTIAL PRESSURE GAUGE
P PRESSURE GAUGE
S THERMOMETER

NOTES:

1) THIS EXAMPLE BLOWER INCLUDES THE MAJORITY OF ACCESSORIES TYPICALLY UTILZED ON AN ABJ PD BLOWER SYSTEM. VARIATIONS DO OCCUR WITH ENGINEER/OWNER DESIGN PREFERENCE.

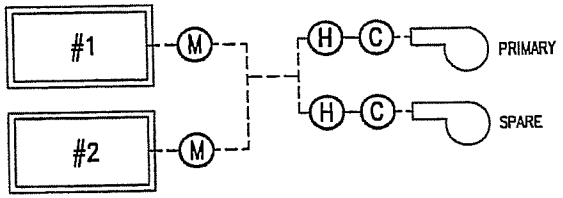
2) FOR MOUNTING PURPOSES, BLOWER PADS SHOULD BE A MINIMUM 8 INCHES LONGER AND WIDER TO ACCOMODATE ANCHOR BOLT CENTERLINE TO EDGE OF CONCRETE REQUIREMENTS.

3) AIR FILTERS ARE COMMONLY FOUND OUTSIDE WITH MULTIPLE BLOWER PACKAGES MANIFOLDED TOGETHER ON ONE COMMON INTAKE LINE.

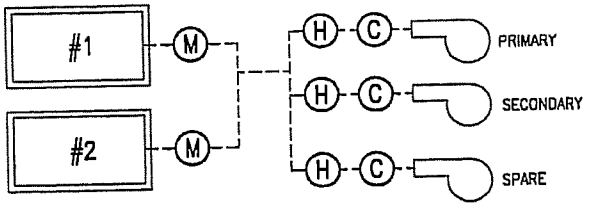
TYPICAL
POSITIVE DISPLACEMENT (PD)
BLOWER

Sanitaire
ABJ® ITT Industries
BROWN DEER, WISCONSIN 53223

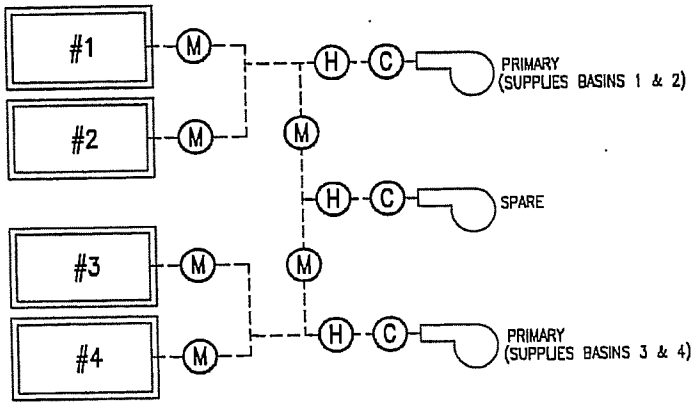
DWG. 99-710



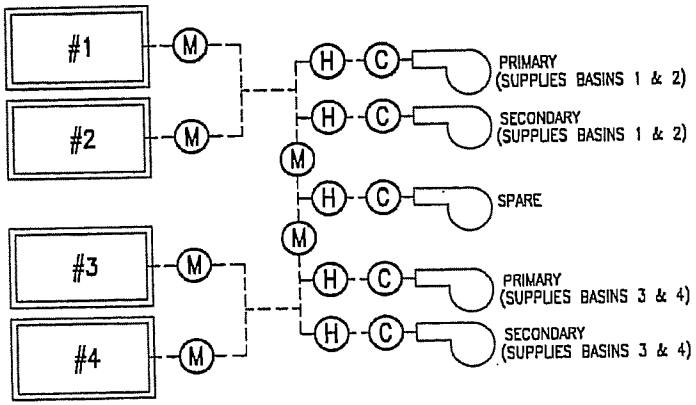
2 BASINS – 2 BLOWERS
(TWO BLOWERS DESIGNED AT 100% CAPACITY EACH)



2 BASINS – 3 BLOWERS
(THREE BLOWERS DESIGNED AT 50% CAPACITY EACH)



4 BASINS – 3 BLOWERS
(THREE BLOWERS DESIGNED AT 100% CAPACITY EACH)



4 BASINS – 5 BLOWERS
(FIVE BLOWERS DESIGNED AT 50% CAPACITY EACH)

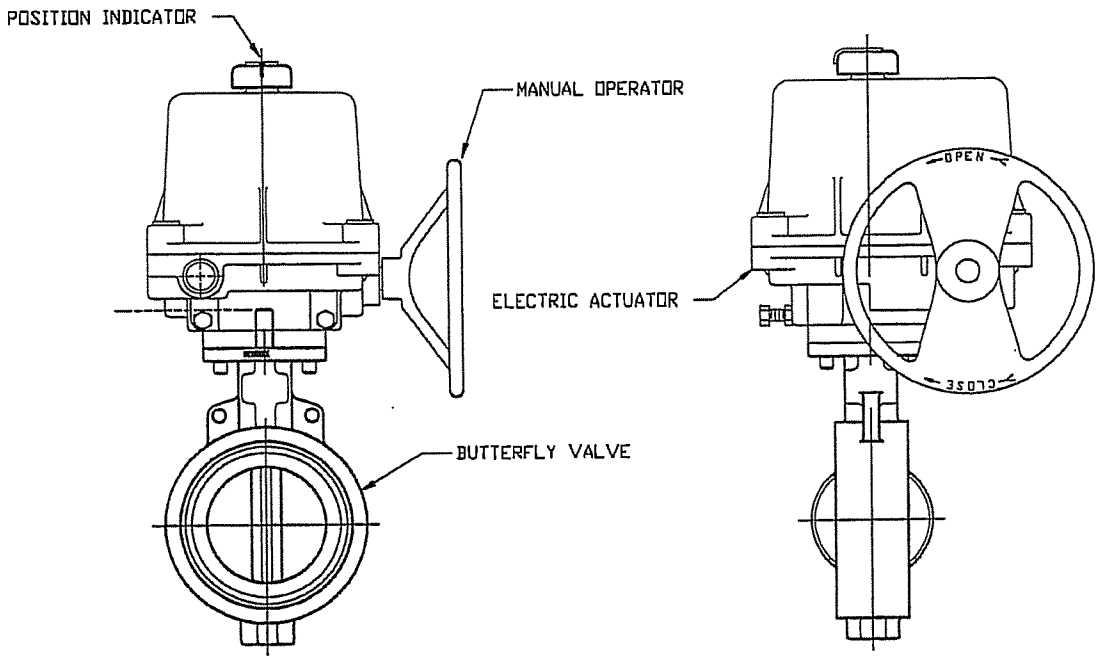
NOTES:
1. BLOWER CAPACITY (50% OR 100%) REFERS TO THE AIR REQUIRED FOR ONE BASIN.
2. THE BASINS OPERATE IN PAIRS WITH THE BLOWERS ALTERNATING BACK AND FORTH.
3. SPARE BLOWERS SHOULD BE REGULARLY ROTATED INTO THE SYSTEM FOR EXERCISE. THIS CAN BE ACCOMPLISHED MANUALLY OR AUTOMATICALLY.

LEGEND
- (M) – MOTORIZED VALVE
- (H) – HAND OPERATED VALVE
- (C) – CHECK VALVE

TWO AND FOUR BASIN BLOWERS/PIPING ARRANGEMENT EXAMPLES

Sanitaire
ABJ® ITT Industries
BROWN DEER, WISCONSIN 53223

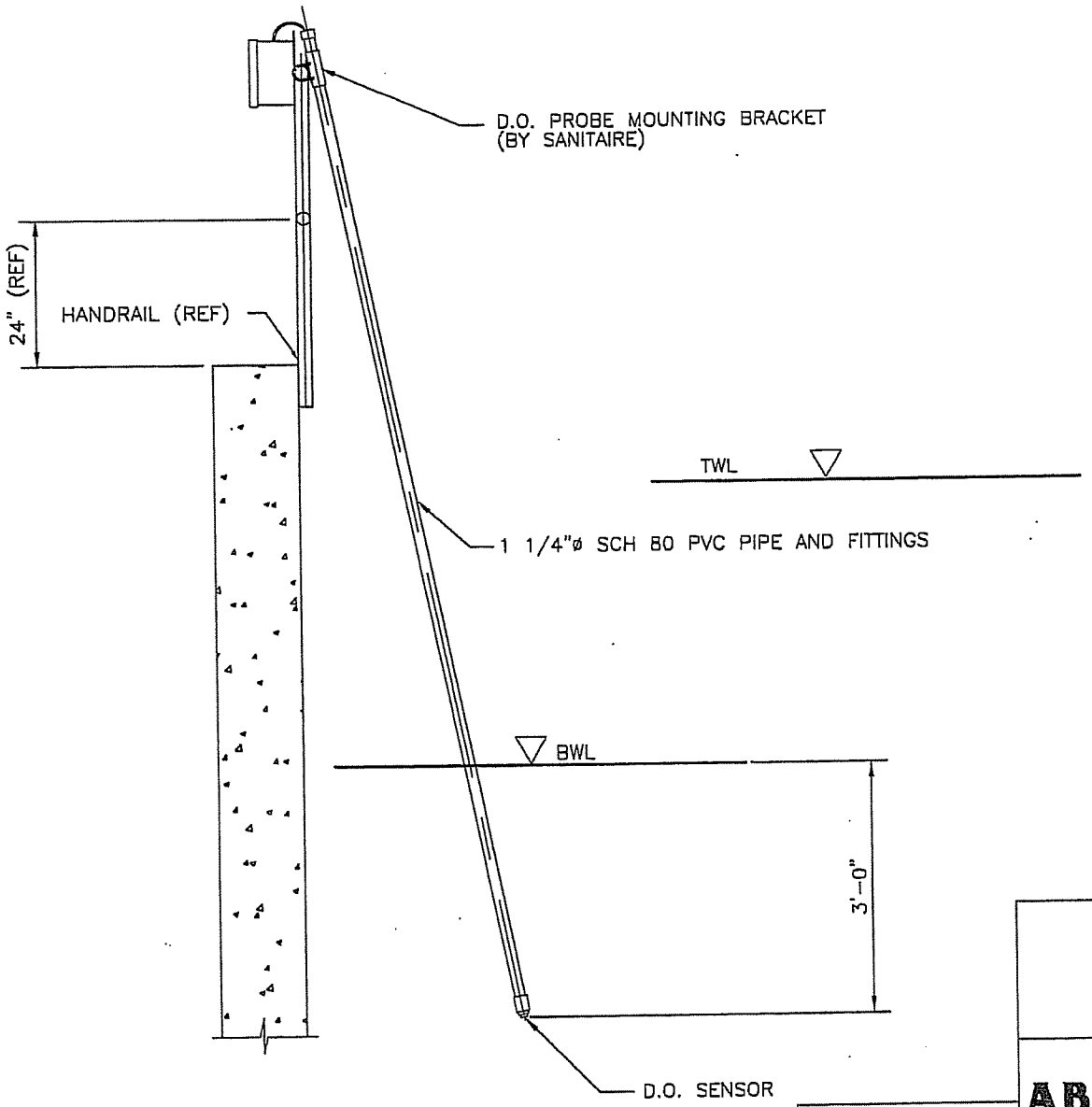
DWG. 99–700



AIR CONTROL VALVE
W/ ELECTRIC ACTUATOR

Sanitaire
ABJ® ITT Industries
BROWN DEER, WISCONSIN 53223

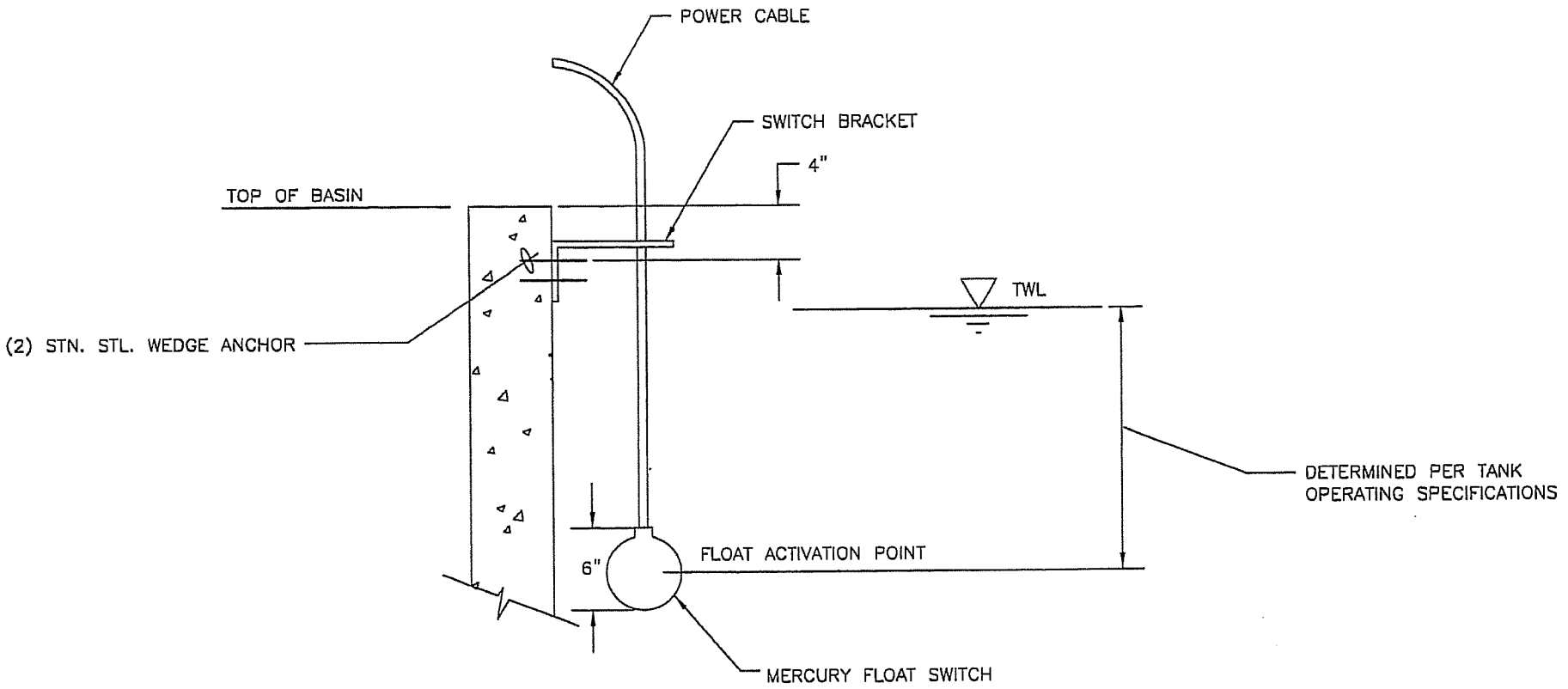
DWG. 99–800



D.O. PROBE
TYPICAL ARRANGEMENT

Sanitaire
ABJ® ITT Industries
BROWN DEER, WISCONSIN 53223

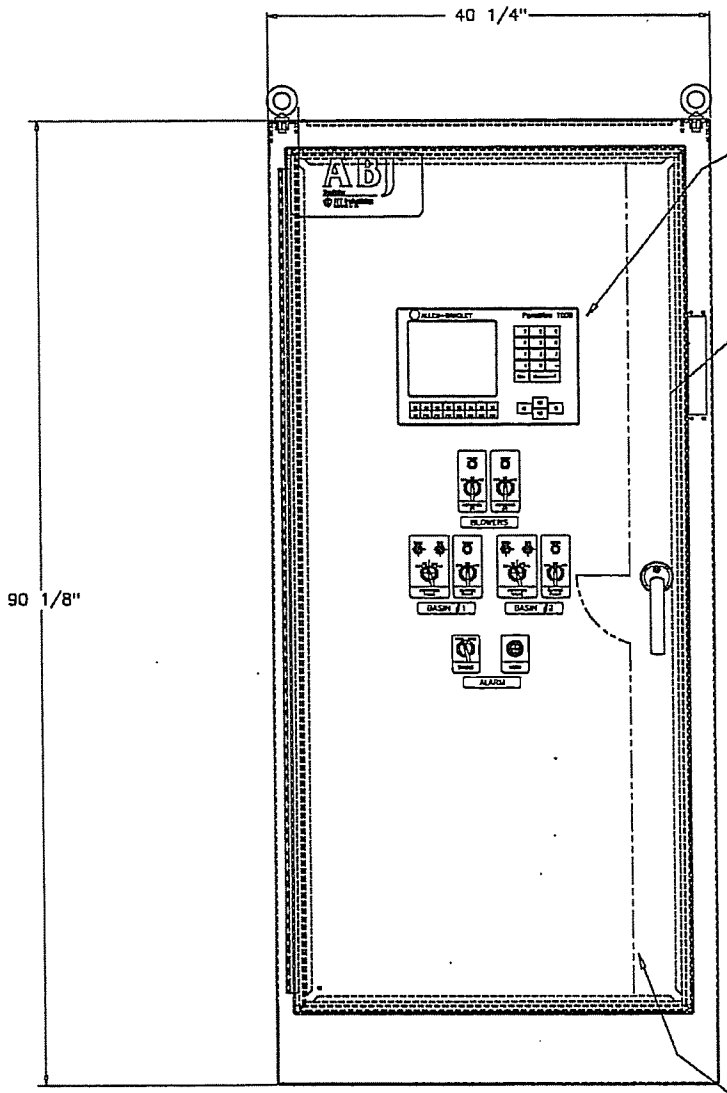
DWG. 99-810

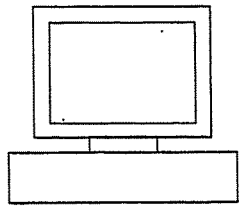


FLOAT SWITCH
TYPICAL ARRANGEMENT

Sanitaire
ABJ® ITT Industries
BROWN DEER, WISCONSIN 53223

DWG. 99–820



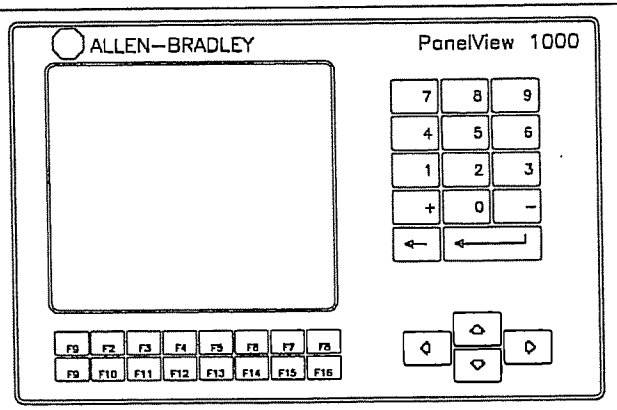


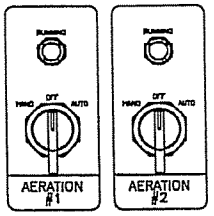
SCADA SYSTEM
(OPTIONAL ADDER)

CONTROL PANEL
2-BASIN (PV1000)

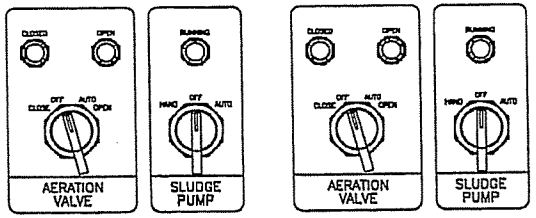
Sanitaire
ABJ® ITT Industries
BROWN DEER, WISCONSIN 53223

DWG. CATA-CP03

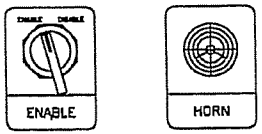




BLOWERS



BASIN #1 BASIN #2

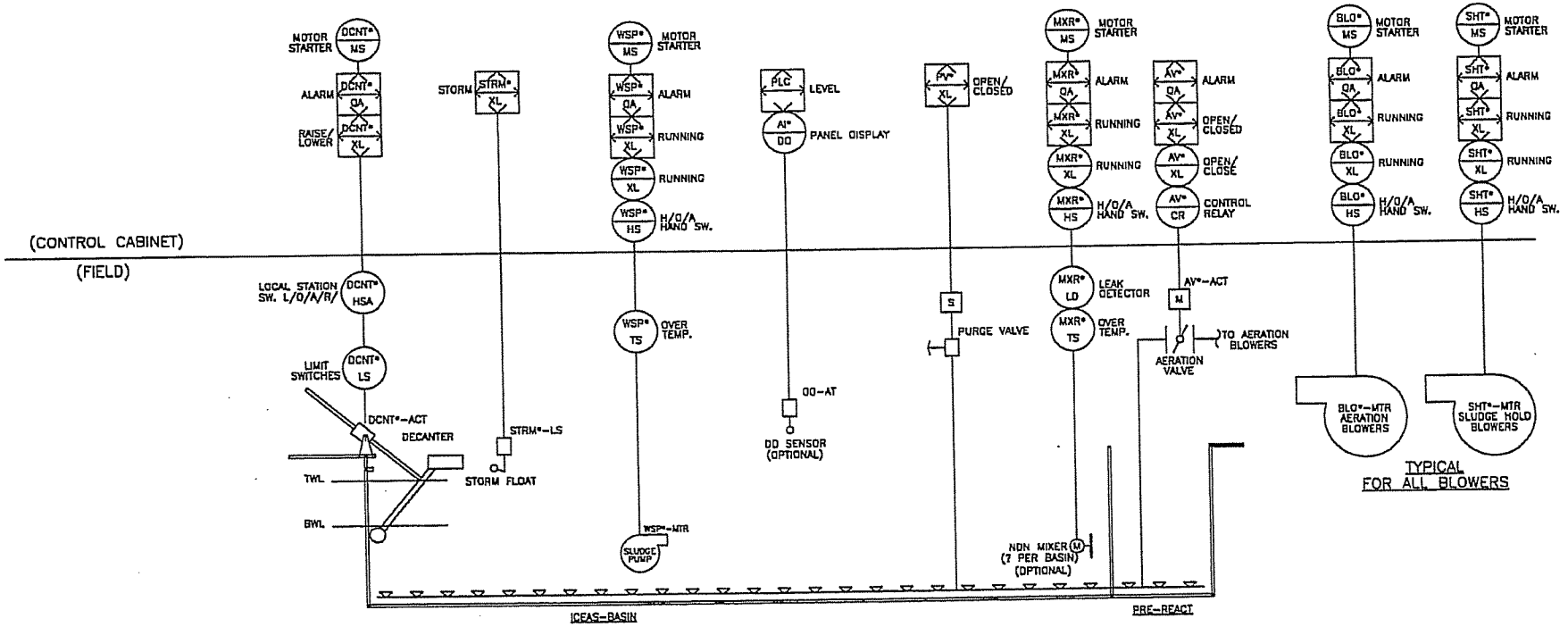


ALARM

CONTROL PANEL
2–BASIN (PV1000)
NAMEPLATE CLARIFCATION

Sanitaire
ABJ® ITT Industries
BROWN DEER, WISCONSIN 53223

DWG. CATA–CP04



TYPICAL FOR ALL BASINS

LEGEND

- MOUNTED AT CONTROL CABINET
- FIELD MOUNTED
- LOGIC/CONTROL

ABBREVIATIONS

AV – AIR VALVE
WS – WASTE SLUDGE
RS – RAW SEWAGE
SCR – SCREENED SEWAGE
TS – TEMPERATURE SWITCH
TDS – TREATED & DISINFECTED SEWAGE
FM – FORCE MAIN
O/F – OVERFLOW
DO – DISSOLVED OXYGEN
SBR – SEQUENCING BATCH REACTOR
H-O – HAND/OFF
O-A – OFF/AUTOMATIC
H-O-A – HAND/OFF/AUTOMATIC
H-O-R – HAND/OFF/REMOTE
C-O-A-O – CLOSED/OFF/AUTOMATIC/OPEN
L-O-A-R – LOWER/OFF/AUTO/RAISE
PLC – PROGRAMMABLE LOGIC CONTROLLER
L/R – LOCAL REMOTE PANEL
LS – LIMIT SWITCH

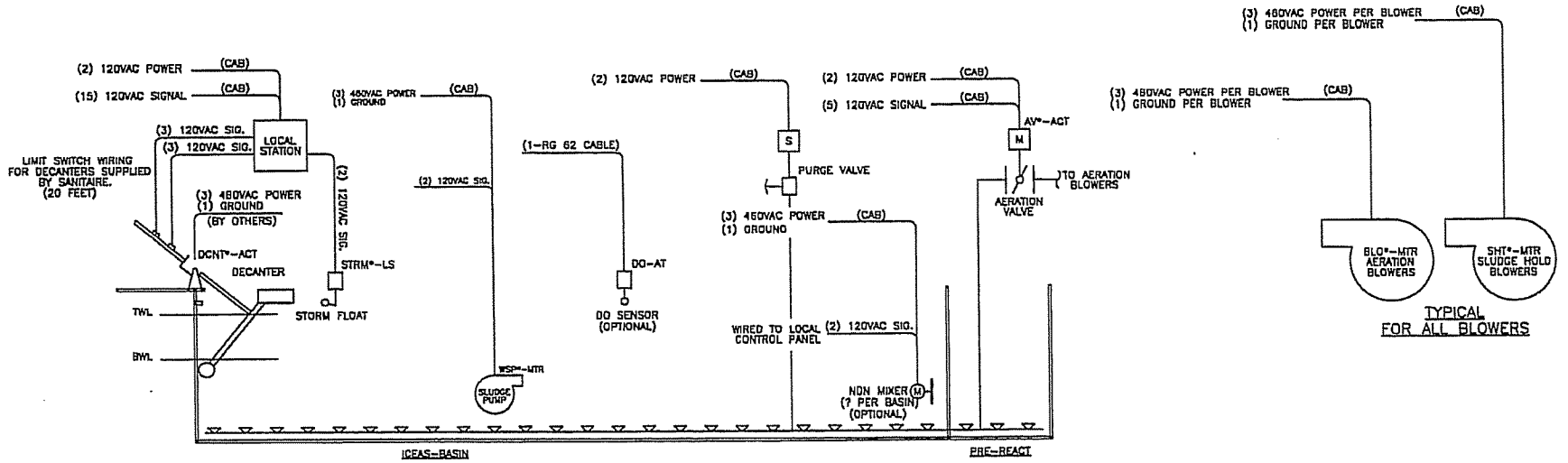
NOTES

1) ALL WIRE SIZES SHOULD BE SIZED ACCORDING TO LOAD, 14 GA. MIN.
2) ELECTRICAL CONTRACTOR IS TO PROVIDE LOCAL DISCONNECTS AS REQUIRED BY LOCAL FEDERAL LAWS.
3) INCLUDE 10% SPARE WIRE PER CONDUIT RUN, 2 WIRES MIN.
4) * INDICATES A BASIN NUMBER.

ICEAS PROCESS
WITH OPTIONAL MIXER AND D.O.
PROCESS & INSTRUMENTATION
DIAGRAM

Sanitaire
ABJ® ITT Industries
BROWN DEER, WISCONSIN 53223

DWG. CATA-PD01



TYPICAL FOR ALL BASINS

LEGEND

MOUNTED AT CONTROL CABINET

FIELD MOUNTED

LOGIC/CONTROL

ABBREVIATIONS

AV – AIR VALVE
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H-O-R – HAND/OFF/REMOTE
C-O-A-D – CLOSED/OFF/AUTOMATIC/OPEN
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NOTES

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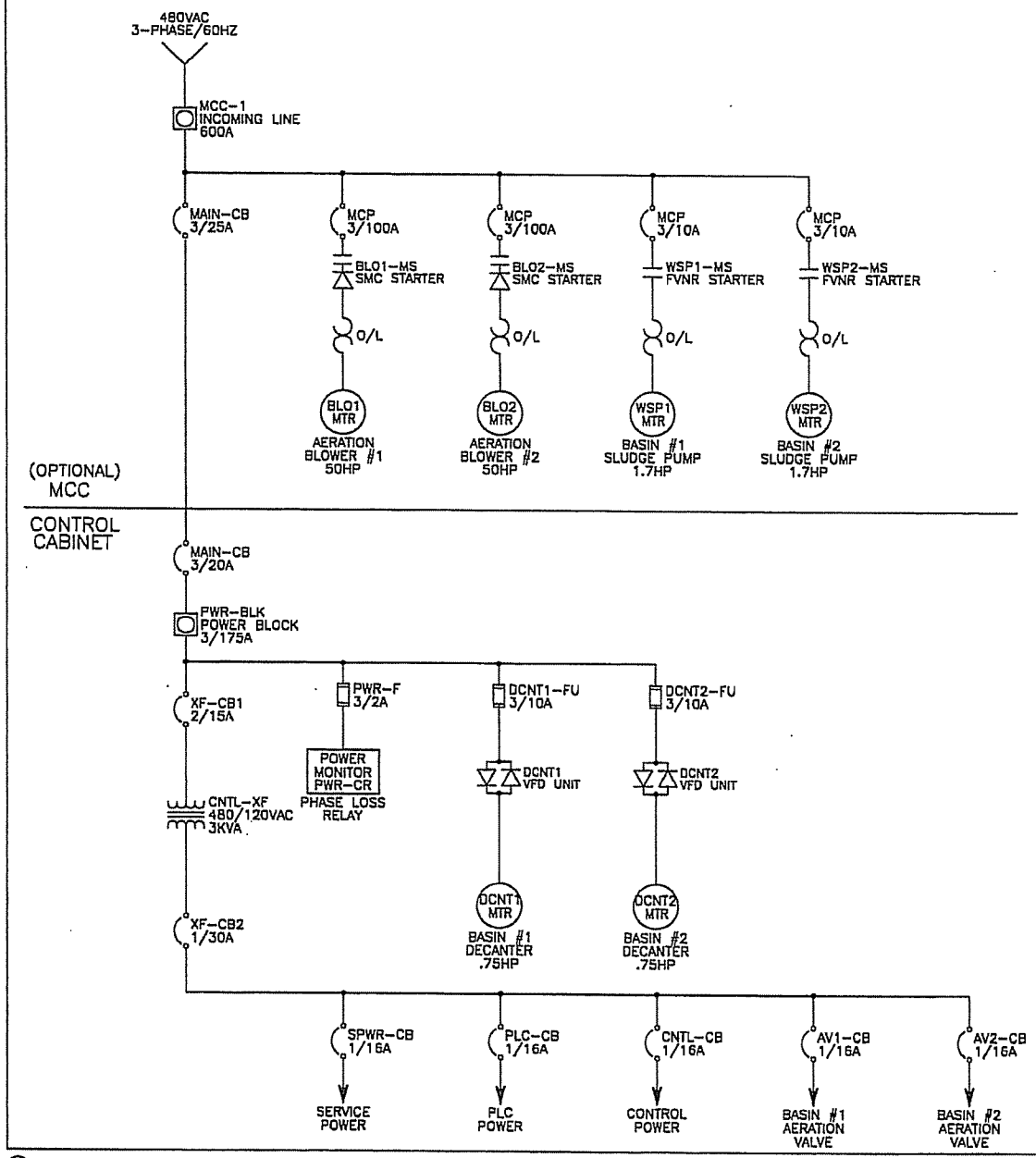
3) INCLUDE 10% SPARE WIRE PER CONDUIT RUN, 2 WIRES MIN.
4) * INDICATES A BASIN NUMBER.

ICEAS PROCESS
WITH OPTIONAL MIXER AND D.O.
BASIN CONDUIT
LAYOUT

Sanitaire
ABJ® ITT Industries
BROWN DEER, WISCONSIN 53223

DWG. CATA-CN01



NOTE:
MOTOR STARTERS LESS THAN 50HP
COULD BE MOUNTED IN ABJ CONTROL PANEL.

CONTROL PANEL
WITH OPTIONAL
SINGLE LINE SCHEMATIC

DWG. CATA-SL01

Sanitaire
ABJ® ITT Industries
BROWN DEER, WISCONSIN 53223

Installation, Operation,
and Maintenance Manual

Sanitaire, Silver Series

SANITAIRE

a xylem brand

Table of Contents

Introduction and Safety

Introduction

Purpose of this manual

The purpose of this manual is to provide necessary information for:

- Installation
- Operation
- Maintenance

CAUTION:

Read this manual carefully before installing and using the product. Improper use of the product can cause personal injury and damage to property, and may void the warranty.

NOTICE:

Save this manual for future reference, and keep it readily available at the location of the unit.

Other manuals

See also the safety requirements and information in the original manufacturer's manuals for any other equipment furnished separately for use in this system.

Safety

DANGER:

- Operating, installing, or maintaining the unit in any way that is not covered in this manual could cause death, serious personal injury, or damage to the equipment. This includes any modification to the equipment or use of parts not provided by Xylem. If there is a question regarding the intended use of the equipment, please contact a Xylem representative before proceeding.
- Do not change the service application without the approval of an authorized Xylem representative.

CAUTION:

- The operator must be aware of safety precautions to prevent physical injury.
- Read this manual carefully before installing and using the product. Improper use of the product can cause personal injury and damage to property, and may void the warranty.

You must observe the instructions contained in this manual. Failure to do so could result in physical injury, damage, or delays.

CAUTION:

Always adhere to site-specific safety protocol.

The safety information presented here is organized into the following areas:

- An explanation of safety symbols and hazard levels, see *Safety terminology and symbols* (page 4)
- Safety precautions to prevent physical injury to personnel, see *User safety* (page 4)
- Precautions for protecting the environment, see *Environmental safety* (page 6)

Safety terminology and symbols

About safety messages

It is extremely important that you read, understand, and follow the safety messages and regulations carefully before handling the product. They are published to help prevent these hazards:

- Personal accidents and health problems
- Damage to the product
- Product malfunction

Hazard levels

Hazard level	Indication
DANGER:	A hazardous situation which, if not avoided, will result in death or serious injury
WARNING:	A hazardous situation which, if not avoided, could result in death or serious injury
CAUTION:	A hazardous situation which, if not avoided, could result in minor or moderate injury
NOTICE:	• A potential situation which, if not avoided, could result in undesirable conditions • A practice not related to personal injury

Hazard categories

Hazard categories can either fall under hazard levels or let specific symbols replace the ordinary hazard level symbols.

Electrical hazards are indicated by the following specific symbol:

Electrical Hazard:

These are examples of other categories that can occur. They fall under the ordinary hazard levels and may use complementing symbols:

- Crush hazard
- Cutting hazard
- Arc flash hazard

User safety

General safety rules

These safety rules apply:

- Machinery in the work area must be de-energized (lockout/tagout) before starting work.
- Pay attention to the risks presented by gases and vapors in the work area.
- Always bear in mind the risk of drowning, electrical dangers, and burn injuries.

Safety equipment

Use personal protective equipment in accordance with applicable laws, regulations, and guidelines. Follow the Health and Safety Plan of the site.

NOTICE:

Never operate a unit unless safety devices are installed. Also see specific information about safety devices in other chapters of this manual.

Electrical connections

Electrical connections must be made by certified electricians in compliance with all applicable codes and regulations. For more information about requirements, see sections dealing specifically with electrical connections.

Confined spaces

DANGER: Inhalation Hazard

The chamber or tank where the equipment is installed should be treated as a confined space. Always follow the applicable safety laws, regulations and guidelines for confined spaces.

Never work alone in a confined space. Before entering the space, check that the following requirements are complied with:

- The atmosphere contains sufficient oxygen
- The atmosphere contains no explosive or toxic gases
- All energy sources are locked out and tagged out
- Adequate ventilation is in place
- There is a clear path of retreat
- Monitoring is in place for hazards which can develop after entering the confined space
- The applicable safety laws, regulations, and guidelines for enclosed spaces are understood and followed.

Drowning

Spaces that are not fully drained or dry can pose a risk of drowning. It takes relatively little standing water or other liquid to create a drowning hazard. For example, insufficient oxygen or the presence of a toxic material can make a worker unconscious, which makes them vulnerable to drowning if they fall face down into a small pool of water. Never work alone where there is a risk of drowning.

WARNING:

Bear in mind the risk of drowning.

Biological hazards

The product is designed for use in liquids that can be hazardous to your health. Observe these rules when you work with the product:

- Make sure that all personnel who may come into contact with biological hazards are vaccinated against diseases to which they may be exposed.
- Observe strict personal cleanliness.

WARNING: Biological Hazard

Infection risk. Rinse the unit thoroughly with clean water before working on it.

Organic dust

WARNING: Biological Hazard

Infection risk. Rinse the unit thoroughly with clean water before working on it.

When performing maintenance on the product inside or close to the tank or pit where the product is used, workers may be exposed to organic dust contaminated with microorganisms.

Employers and workers can minimize the risks of exposure to organic dust by taking the following precautions:

- Be aware of the adverse health effects of breathing organic dust.
- Use engineering controls such as local exhaust ventilation, and wet methods of dust suppression to minimize exposure to organic dust.
- Use appropriate respirators when exposure to organic dust cannot be avoided.
- Follow all health and safety rules and local codes and ordinances.

Working with solvents

WARNING: Explosion/Fire Hazard

Before starting any permit-required hot work such as welding, gas cutting, grinding, or using electrical handtools, do the following: 1. Check the explosion risk. 2. Provide sufficient ventilation.

CAUTION: Chemical Hazard

Contact the supplier for information for proper handling and use.

Be aware of changing conditions when using solvents. Follow all health and safety rules and local codes and ordinances.

Wash the skin and eyes

Follow these procedures for chemicals or hazardous fluids that have come into contact with your eyes or your skin:

Condition	Action
Chemicals or hazardous fluids in eyes	1. Hold your eyelids apart forcibly with your fingers. 2. Rinse the eyes with eyewash or running water for at least 15 minutes. 3. Seek medical attention.
Chemicals or hazardous fluids on skin	1. Remove contaminated clothing. 2. Wash the skin with soap and water for at least 1 minute. 3. Seek medical attention, if necessary.

Environmental safety

The work area

Always keep the station clean to avoid discharge or release of environmentally hazardous substances, and to aid in detecting inadvertent discharges.

Waste and emissions regulations

Observe these safety regulations regarding waste disposal and release of substances:

- Appropriately dispose of all waste.
- Handle and dispose of used or process liquids in compliance with applicable environmental regulations.
- Clean up all spills in accordance with safety and environmental procedures.
- Report all environmental discharges to the appropriate authorities.

CAUTION: Radiation Hazard

Do NOT send the product to Xylem if it has been exposed to nuclear radiation, unless Xylem has been informed and appropriate actions have been agreed upon.

Recycling guidelines

Always follow local laws and regulations regarding recycling.

Product warranty

Coverage

Xylem undertakes to remedy faults in all equipment supplied under these conditions:

- The faults are due to defects in design, materials, or workmanship.
- The faults are reported to a Xylem representative within the warranty period.
- The product is used only under the conditions described in this manual.
- All service and repair work is done according to the instructions in this manual.
- Genuine parts from the original equipment manufacturers are used.

Replacement does not include labor for removal or re-installation of the unit or parts deemed defective.

Limitations

The warranty does not cover faults caused by these situations:

- Deficient maintenance
- Improper installation
- Incorrect storage and handling
- Modifications or changes to the product and installation made without consulting Xylem
- Incorrectly executed repair work
- Normal wear and tear

Xylem assumes no liability for these situations:

- Bodily injuries
- Material damages
- Economic losses

Warranty claim

Xylem products are high-quality products with expected reliable operation and long life. However, should the need arise for a warranty claim, then contact your Xylem representative.

Transportation and Storage

Inspect the delivery

Inspect the package

1. Inspect the package for damaged or missing items upon delivery.
2. Note any damaged or missing items on the receipt and freight bill.
3. File a claim with the shipping company if anything is out of order.

   If the product has been picked up at a distributor, make a claim directly to the distributor.

Inspect the product

1. Inspect the product to determine if any parts have been damaged or are missing.
2. If applicable, unfasten the product by removing any screws, bolts, or straps.

   For your personal safety, be careful when you handle nails and straps.
3. Contact your sales representative if anything is out of order.

Transportation guidelines

Precautions

DANGER: Crush Hazard

Moving parts can entangle or crush. Always disconnect and lock out power before servicing to prevent unexpected startup. Failure to do so could result in death or serious injury.

Lifting

Lifting equipment is always required when handling the shipment. The equipment components can be lifted with either a crane or a forklift.

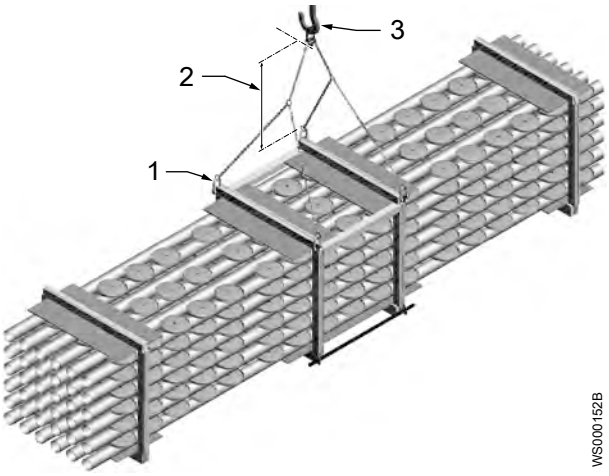
WARNING: Crush Hazard

1) Always lift the unit by its designated lifting points. 2) Use suitable lifting equipment and ensure that the product is properly harnessed. 3) Wear personal protective equipment. 4) Stay clear of cables and suspended loads.

Lifting with crane

Cranes used to lift the equipment components must fulfill the following requirements:

- The lifting equipment must be able to hoist the equipment components straight up and down, preferably without the need for resetting the lifting hook.
- The lifting strap must be fastened to the lifting points on top of the package.

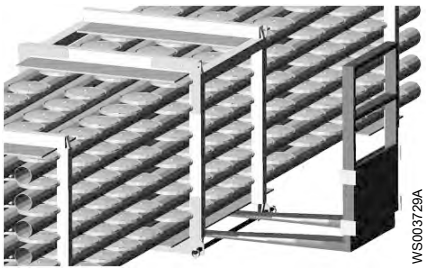


1. Lifting point
2. Minimum 2 m (6 ft 7 in.)
3. Lifting device

Figure 1: Lifting points

1. Check that the site where the equipment components will be placed has a clean and level surface.
2. Fasten a suitable lifting strap or sling to the lifting points on top of the pallet, if used.
3. If the equipment components are secured to the flatbed or other surface, then cut the transportation straps.
4. Lift using proper lifting equipment.
5. Place the equipment components on a clean, rigid, horizontal surface so that they cannot fall over.

Lifting with pallet and forklift



1. Align the forklift prongs with the forklift hole(s), and insert the prongs.
2. If the pallet is secured to the flatbed or other surface, then cut the transportation straps.
3. Lift the pallet and move it to its new position.
4. Place the pallet on a clean, rigid, horizontal surface so that it cannot fall over.

Storage guidelines

Dry storage location

The storage site must be available before equipment arrival. The equipment must be stored in a level and dry location free from heat and dirt. It is recommended that the equipment is stored indoors or in a covered area.

NOTICE:

Do not cover the pipe components with plastic. Excessive heat build-up can damage plastic pipes and void the warranty.

NOTICE:

- Do not stack shipping units.
- Do not place heavy weights on the packed product.
- Protect the product against humidity, heat sources, and mechanical damage.
- Risk of wear. Make sure the equipment is clean before it is placed into service.

Specific storage requirements

Component	Storage
Diffusers	• Original packaging until final installation
PVC piping	• Uncovered • Maximum stack of two bundles
PVC piping with diffusers installed (pre-mounted)	• Uncovered • A sheet of wood placed on top of the piping bundles To keep membrane diffusers shielded from the elements
Wooden crates	• Uncovered • Maximum stack of two crates
Cardboard boxes	• Uncovered • Unstacked • Dry location The cardboard box pallets can loose structure integrity and topple if they get wet

For more information on long-term storage of installed equipment, see *Tank storage* (page 33).

System Description

Diffusers included

Type	Model
Fine bubble	Silver Series II LP, 7 and 9 in.
	Silver Series II, 7 and 9 in.

Diffuser design

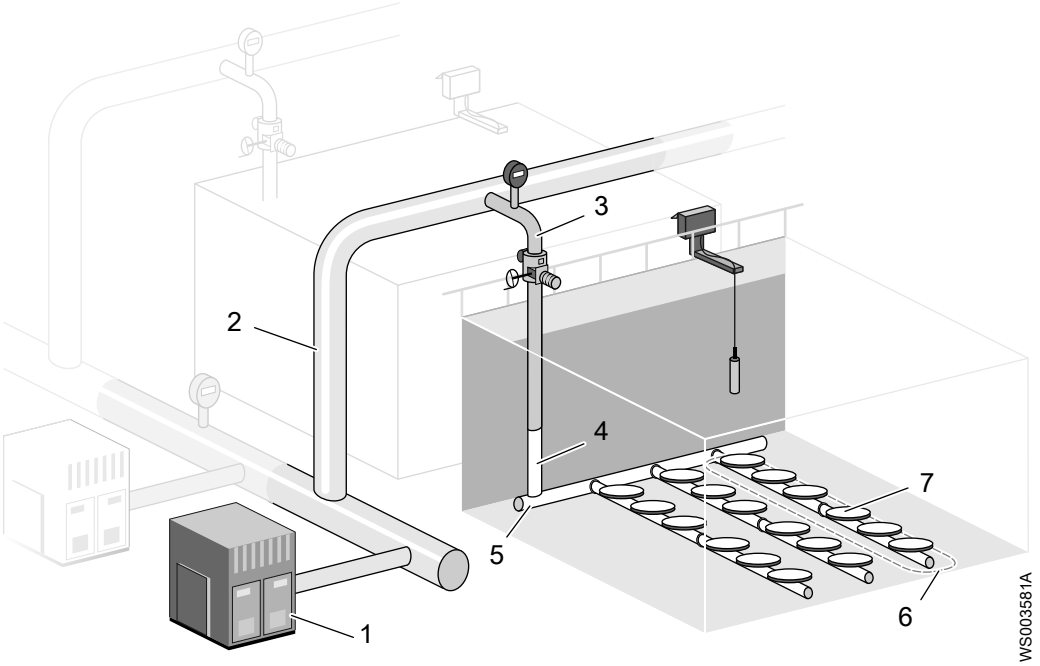
Fine bubble disc diffusers are designed for an efficient and reliable aeration and mixing process of industrial and municipal wastewater. The fine bubble diffuser is completely compatible with other Sanitaire aeration equipment.

Intended use

The product is only for use with municipal and industrial wastewater. If there is a question regarding the intended use of the equipment, then contact a sales representative.

Definition of system components

The main components in an aeration system are shown in the figure below.



Position number	Description	Definition
1	Blower	The device that distributes the air to the air main.
2	Air main	The pipe that connects the blower to the upper dropleg.
3	Upper dropleg	The pipe that connects the air main to the lower dropleg.
4	Lower dropleg	The pipe that connects the upper dropleg to the manifold.
5	Manifold	The pipe that connects the lower dropleg to the air distributor. There are no holders mounted on this pipe.
6	Air distributor	A set of pipes, couplings, and holders with diffusers from the manifold to the end cap.
7	Holder with diffuser	The diffuser is attached to the holder. It forms part of the air distributor, and distributes the air to the liquid.

Installation

Precautions

WARNING:

Always follow safety guidelines when working on the product. See *Introduction and Safety* (page 3).

Requirements

The following requirements apply:

- Never work alone.
- Make sure to have a clear path of retreat.
- Make sure that the work area is properly ventilated.
- Provide a suitable barrier around the work area, for example a guard rail.
- Check the explosion risk before you weld or use electrical hand tools.
- Ensure that welding or construction work does not damage the aeration system equipment.
- Use the installation drawings, containing the required part number designation, in order to ensure proper installation.
- Remove all debris from the air main before installation.

The figures in the instructions can differ from the delivered products.

Leveling guidelines

To ensure an installation where maximum system efficiency is obtained, and where leaks, adjustments, and damage to products are minimized, follow these guidelines:

- Always use the highest point of the tank floor as a reference when leveling. The height of the grid should be as low as possible at this point.
- Use a level system which ensures installation within the given tolerance (6 mm [¼ in.] horizontally).
- Allow for movement of the pipes when securing the clamps.
- Align pipes correctly before couplings are assembled.

Support types

There are three types of supports:

- Single anchor support that is used for 110 mm (4 in) diameter manifolds or air distributors.
- Support with strut that is used for 160 mm (6 in) diameter or greater manifolds where the manifold centerline elevation is less than 559 mm (22 in) from the floor.
- Support with strut that is used for 160 mm (6 in) diameter or greater where the manifold centerline elevation is above 559 mm (22 in) from the floor.

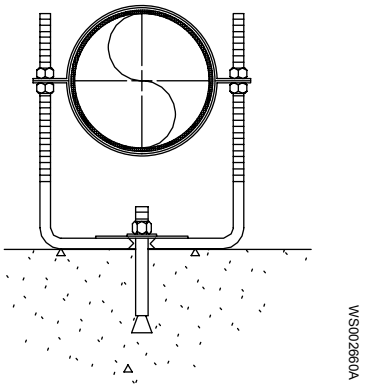


Figure 2: Single anchor support

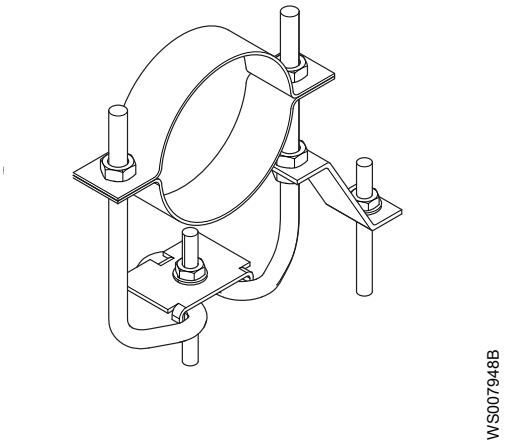


Figure 3: Support with strut, low

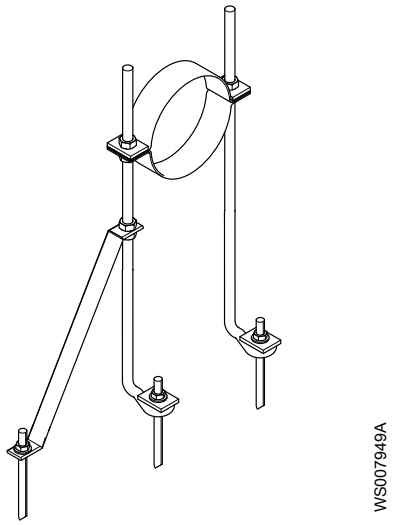


Figure 4: Support with strut, high

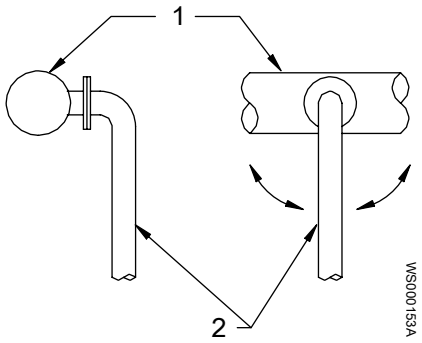
Dropleg and manifold installation

Prerequisites

- Always use the highest point of the tank floor as a reference when leveling.
- Ensure that the air filtration equipment is installed and operating.
- Ensure that all dirt and debris are removed from the air main.

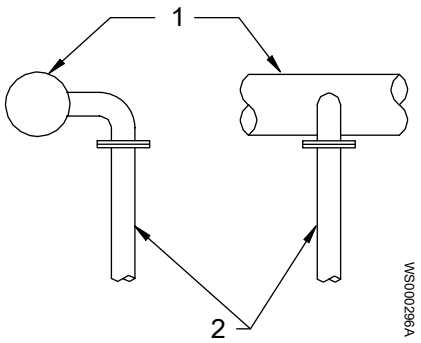
  If air blowers are used, then follow the instructions from the manufacturer. Blowers can require a minimum back pressure when operating.

Upper dropleg connection requirement



1. Air main
2. Upper dropleg

Figure 5: Vertical flange connection



1. Air main
2. Upper dropleg

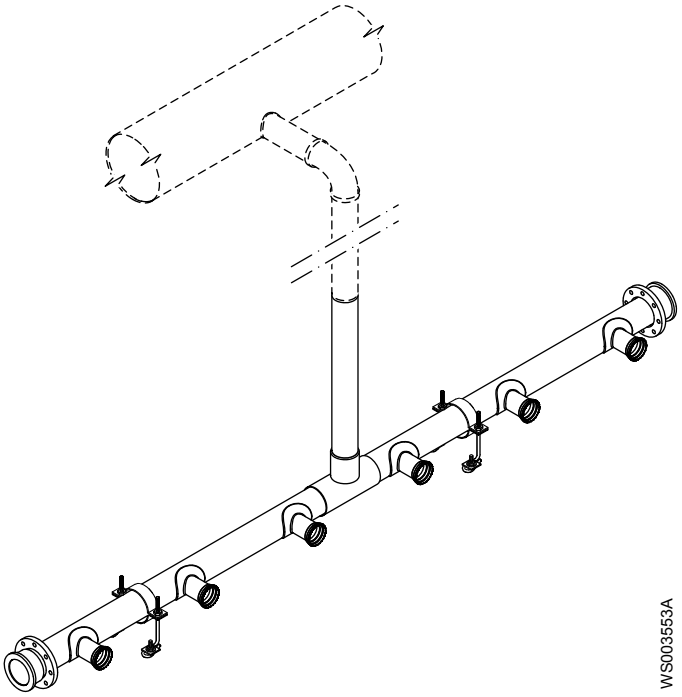
Figure 6: Horizontal flange connection

Ensure that the upper dropleg is attached to the air main, and vertical to its centerline. Refer to the installation drawings. In order to allow easy installation of the lower dropleg, the dropleg must be attached loosely.

- If the dropleg is connected with a vertical flange, then ensure that it can be swung to the side.
- If the dropleg is connected with a horizontal flange, then ensure that it can be easily removed.

Ensure that the end plugs of the upper droplegs are removed.

Installation procedure overview

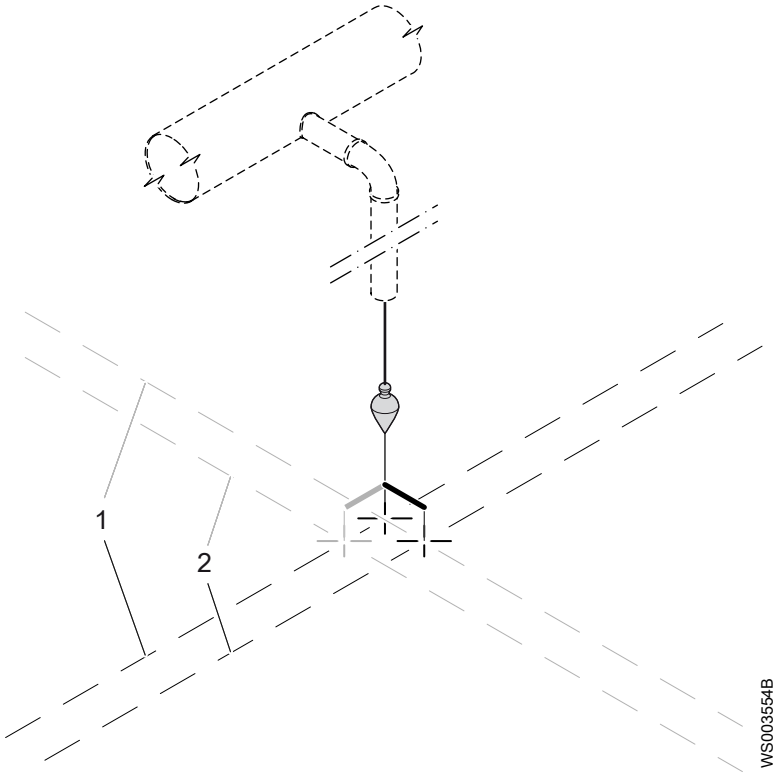


The manifold installation includes the following steps:

- *Lay out the manifold centerline* (page 15)
- *Lay out the manifold support locations* (page 16)
- *Install the manifold anchors and supports* (page 16)
- *Assemble the manifold pipe sections* (page 18)
- *Install the lower dropleg* (page 20)

Lay out the manifold centerline

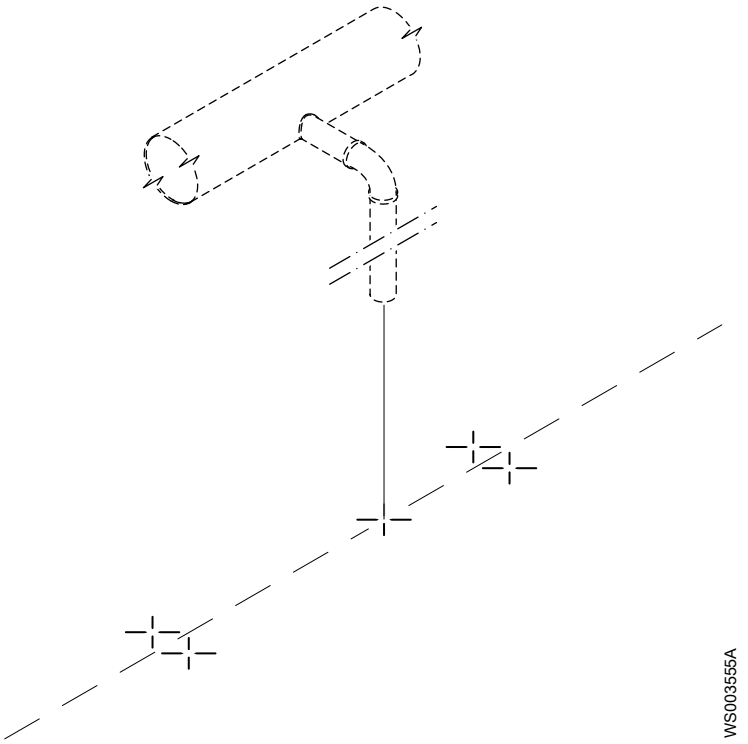
The dropleg connection to the manifold is located directly under the dropleg. In some installations, the dropleg connection is offset.



1. In-line manifold
2. Offset manifold

1. Locate the centerline of the manifold.
   Use the installed upper dropleg and the installation drawings.
2. Mark clearly the position on the floor.

Lay out the manifold support locations



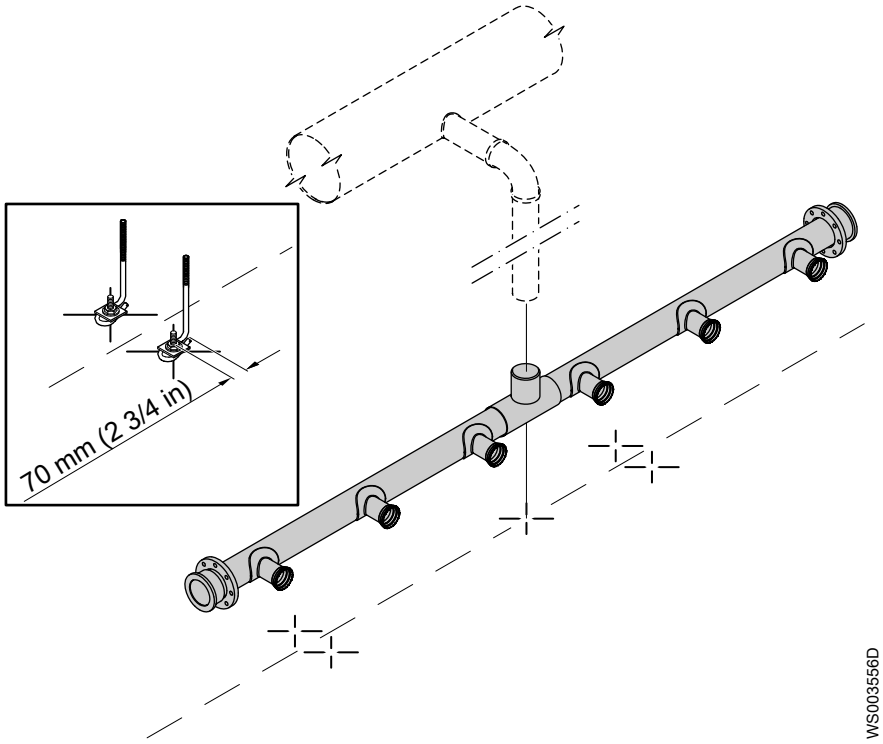
1. Locate and layout all manifold support locations.
   Use the installation drawings and shippings lists.
2. Mark clearly the positions on the floor.

Install the manifold anchors and supports

The manifold sections must be placed according to the manifold and anchor layout before the anchors are installed.

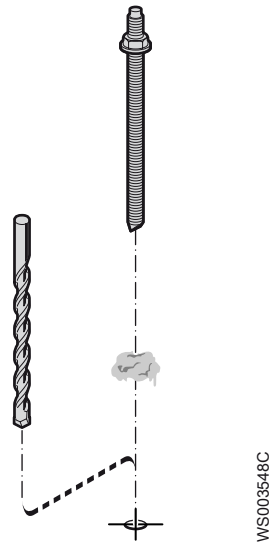
Always use the highest point of the tank floor as a reference when leveling.

1. Lower the manifold sections into the tank.
2. Place the sections according to the layout and double check for possible interference.
   Use the reference numbers from the installation drawings to identify the pipe sections.
3. Check, and if necessary, correct the positions of the support anchors.
   Consider the offset from the anchor position to the center line of the support, and install all supports in the same direction.
   Ensure that the maximum support spacing does not exceed 2400 mm or 8 ft.



4. Install the manifold support anchors according to the instructions from the manufacturer.

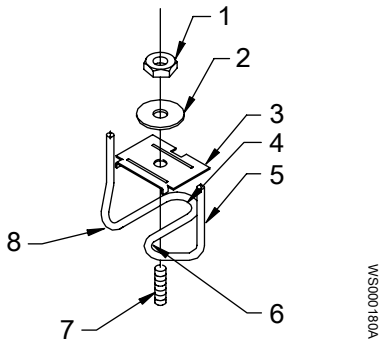
   The threaded projection from the floor level must correspond to the installation drawing anchor table.

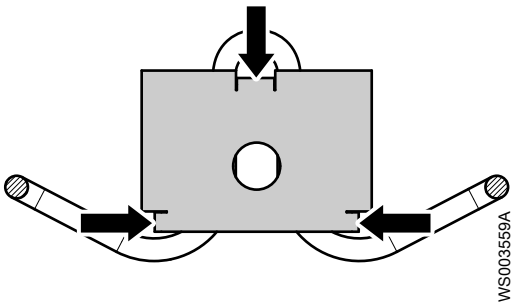


   The tightening torque values are listed in the installation instructions from the anchor bolt manufacturer.

5. On a single anchor support, install the locating plate with the two bent prongs in front, inside the support rod, and the single prong to the back, inside the u-bend.

   Install all supports in the same direction.

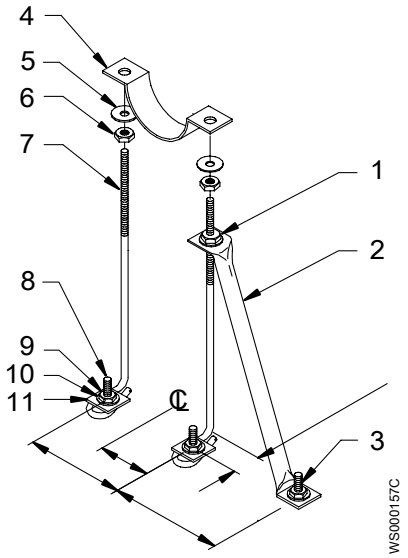




1. Hexagon nut
2. Flat washer
3. Locating plate
4. Back of support
5. Support rod
6. Inside of support rod
7. Anchor bolt
8. Front of support rod

6. Install the struts, if applicable.
7. Install the hexagon nuts and place the lower pipe support clamp on them.

   Project-specific anchor dimensions are found in the erection drawing.



1. Hexagon nut
2. Strut
3. Anchor bolt
4. Clamp
5. Washer
6. Hexagon nut
7. Rod
8. Anchor bolt
9. Hexagon nut
10. Washer, round
11. Washer, square

8. Use the installation drawings and a level system to find the correct clamp flange elevation.

   The correct elevation is equal to the manifold center line, and the tolerance is ± 6 mm (¼ in.).

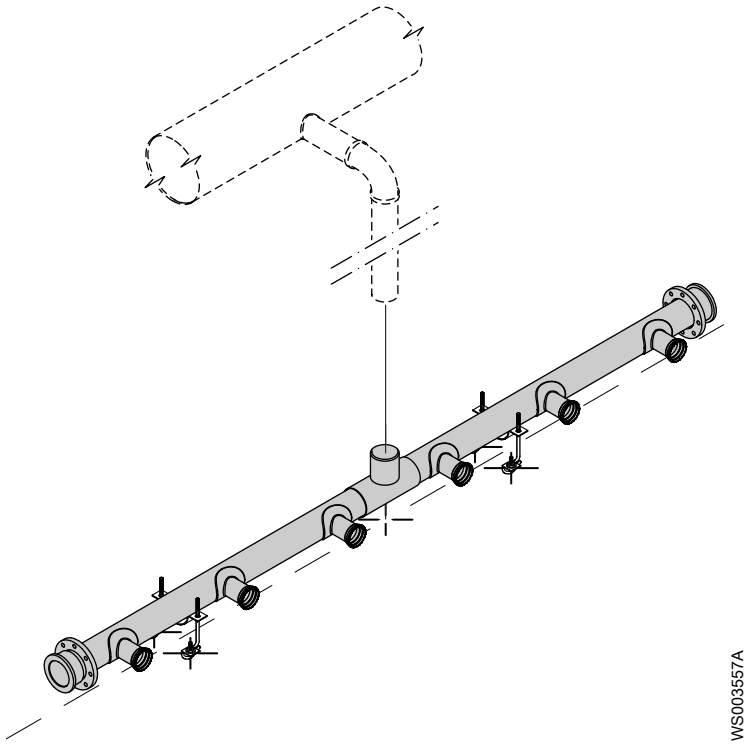
Assemble the manifold pipe sections

CAUTION: Chemical Hazard

Contact the supplier for information for proper handling and use.

1. Examine the manifold sections.

   If the sections are dirty and contain debris from storage, then flush with water before installation.
2. Remove all protective dust covers from the pipe ends and connections.
3. Place the manifold sections in the lower part of the support clamp.



4. Connect the manifolds:
   a) Connect flanges with bolts loosely.
   b) Connect joints with glue.
   c) Connect spline couplings without tightening.
5. Install the upper part of the support clamp with washers and nuts.
   Tighten loosely.
6. Level the manifold sections which attach to the droplegs.
   - For in-line manifolds, ensure that the air distributor connections are horizontal.
   - For raised manifolds, ensure that the air distributor connections are vertical.

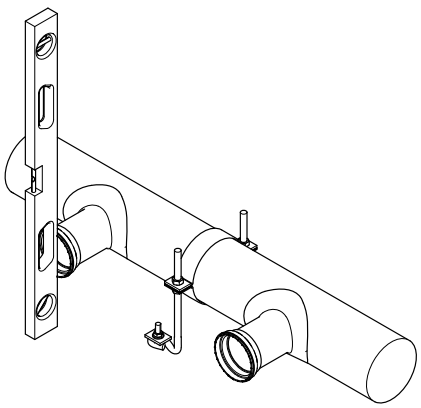


Figure 7: In-line manifold

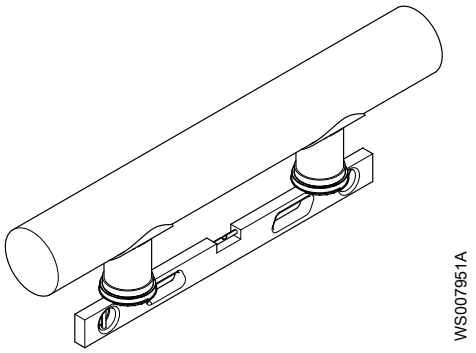


Figure 8: Raised manifold

7. Secure the clamps on the sections which attach to the droplegs by tightening the hexagon nuts.
   Ensure that the manifold is horizontal.
8. Install all manifold sections according to the installation drawings.

Do not secure the clamps on these sections at this point.

9. Install the lower dropleg according to *Install the lower dropleg* (page 20).
10. Complete the manifold installation:
    a) Level the remaining manifold sections and ensure that the air distributor connections are level.
    b) Tighten the flange connections between the manifold sections.
    c) Secure the pipes by tightening the hexagon nuts on the upper part of the clamps.

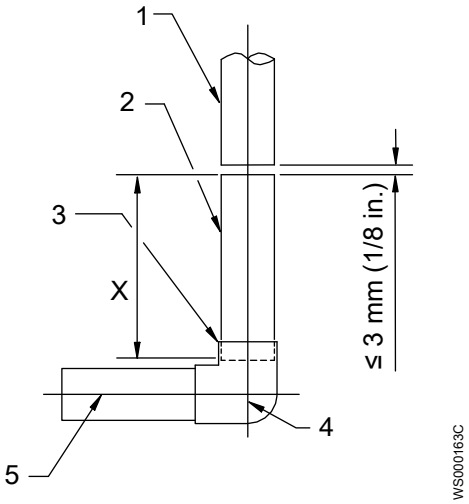
Install the lower dropleg

CAUTION: Chemical Hazard

Contact the supplier for information for proper handling and use.

An in-line manifold (see figure below) does not require a feed pipe. See the installation drawings.

1. Install the feed pipe and support, if applicable. This is only applicable to an offset manifold.
    a) Glue the feed pipe and fittings.
    b) Install the feed pipe and the supports, if applicable.



1. Upper dropleg
2. Lower dropleg, cut to length X
3. Socket fitting
4. Upper dropleg centerline
5. Feed pipe centerline

Figure 9: Parts between dropleg and manifold, offset manifold

2. Measure the distance X from the end of the installed upper dropleg to the insertion depth of the socket fitting.

   If a flange connection is used, then consider the flange, the socket depth, and the gasket thickness.
3. Remove the upper dropleg out of the work area.
4. Cut or trim the lower dropleg to the measured distance.
5. Glue the lower dropleg into the socket fitting.
6. Reinstall the upper dropleg.

   Ensure that the gap between the upper and lower dropleg is maximum 3 mm (1/8 in.).

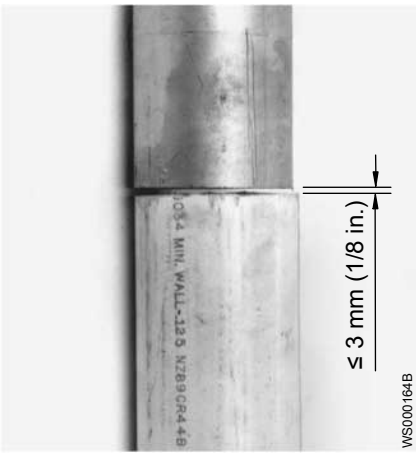


Figure 10: Upper and lower dropleg

7. Install the clamp coupling or tighten the flange connection.
   Tighten the clamp coupling bolts to a torque of 70–75 Nm (50–55 ft-lbs).

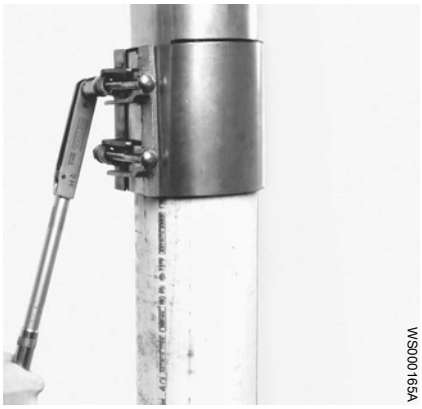


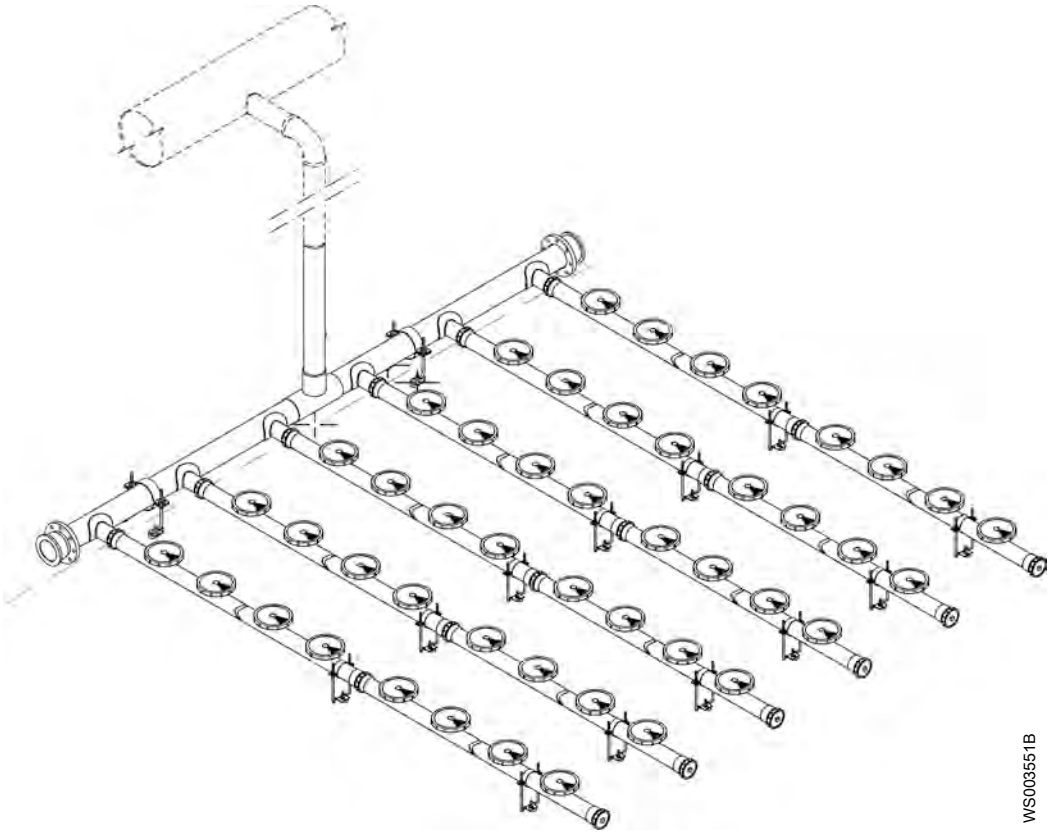
Figure 11: Example of clamp coupling

Figure 12: Example of flange connection

8. Tighten the upper dropleg to the air main.
9. Complete the manifold installation according to the last step in *Assemble the manifold pipe sections* (page 18).

Air distributor installation

Installation procedure overview



The installation includes the following steps:

- *Lay out the air distributor support locations* (page 22)
- *Install the air distributor anchors and supports* (page 23)
- *Assemble an air distributor section* (page 24)
  - *Place the sections* (page 25)
  - *Assemble with spline couplings* (page 25)
  - *Assemble with expansion couplings* (page 26)
  - *Level and tighten the air distributors* (page 28)

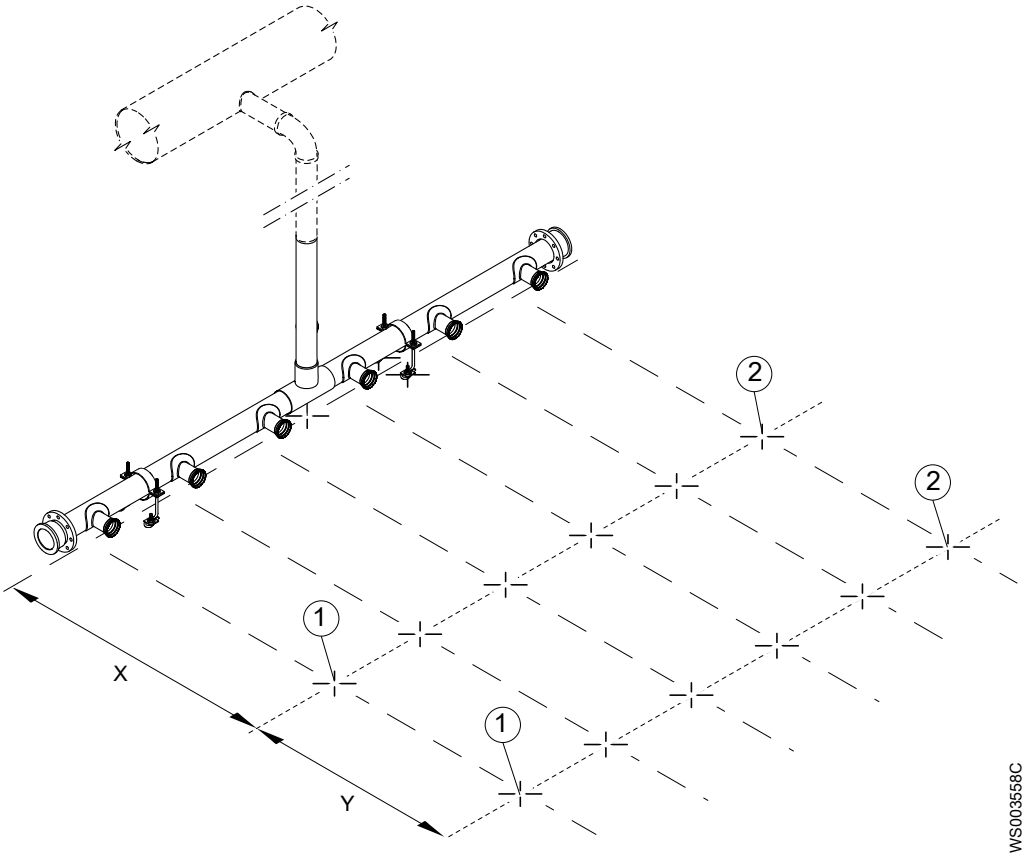
For drainline installation, see *Drainline installation* (page 29).

Lay out the air distributor support locations

1. Lay out the centerline for each air distributor.

   Use the installation drawings and the manifold air distributor connections. Start measuring from the center line of the manifold.
2. Mark the air distributor support locations for the first air distributor from one side. See (1) in the figure below.

   The distance between the manifold center line and first support location is marked X in the figure below. The distance to the second support location is marked Y.



3. Ensure that there is no interference between the holders, couplings, and supports.
4. Make the required adjustments.

   If spacing is extended beyond the installation drawing specification, then consult your Xylem representative.
5. Mark the support locations for the air distributor located at the opposite end of the manifold. See (2) in the figure above.
6. Use a chalk line to mark all support locations between the outside layout lines.

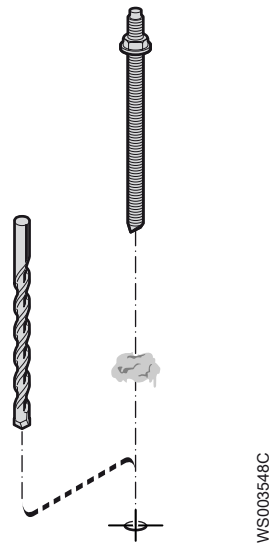
Install the air distributor anchors and supports

Sloped floors can require the use of several different support types or support rod diameters. Refer to the installation drawings for identification of the correct support at each location.

1. Install the anchor bolts according to the instructions from the anchor manufacturer.

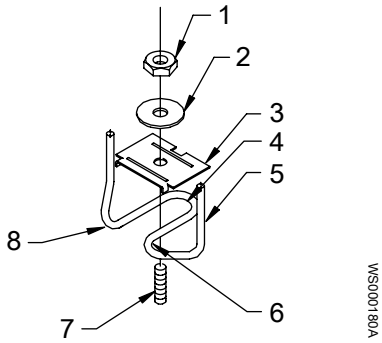
   The threaded projection from the floor level must correspond to the installation drawing anchor table.

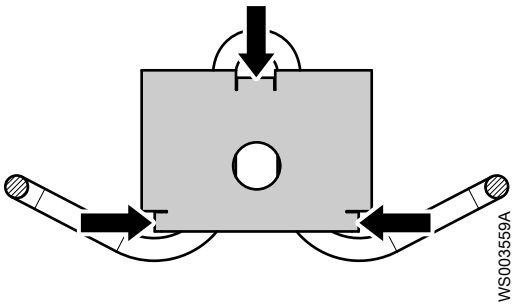
   The tightening torque values are listed in the installation instructions from the anchor bolt manufacturer.



2. Install the locating plate with the two bent prongs in front, inside the support rod, and the single prong to the back, inside the u-bend.

   Install all supports in the same direction.





1. Hexagon nut
2. Flat washer
3. Locating plate
4. Back of support
5. Support rod
6. Inside of support rod
7. Anchor bolt
8. Front of support

3. Tighten the hexagon nut to the recommended torque value as listed by the anchor bolt manufacturer.
4. Using a level system, find the correct elevation to put the hexagon nut on all air distributor supports.

   The correct elevation is the air distributor center line, which is shown on the installation drawings. The difference in height cannot exceed a tolerance of ± 6 mm (¼ in.) from one side to the other throughout the whole grid.
5. Install the lower clamp sections on all air distributor supports.

Assemble an air distributor section

This instruction describes the assembly of a complete air distributor section from the manifold to the end cap.

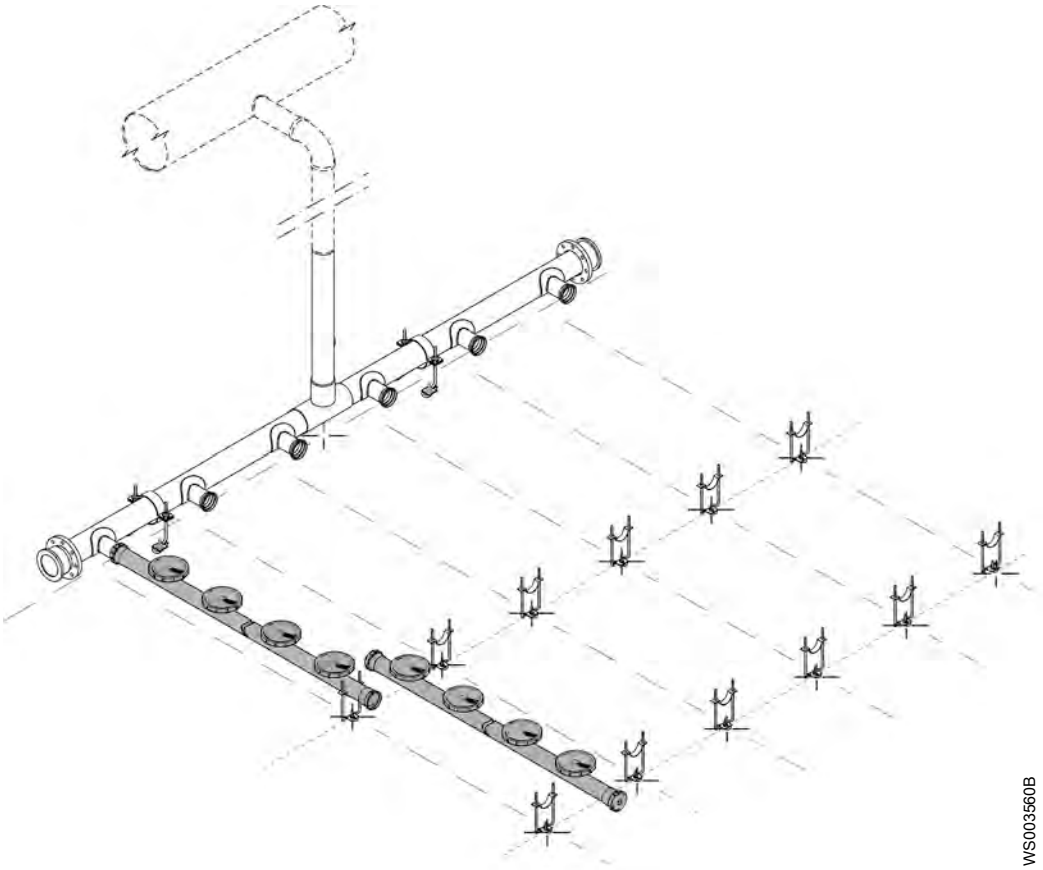
Use the following:

- Air distributor sections, see the installation drawings and the corresponding markings on the sections
- Spline couplings
- Expansion couplings, if applicable
- Drainline sections, if applicable

Piece markings can be printed or hand written on pipe.

Figure 13: Markings on installation drawings and sections

Place the sections



1. Starting from the manifold, check, and flush out any dirt from the first section and place it in the supports.
2. Assemble the first section according to the instructions in *Assemble with spline couplings* (page 25).
3. Check and flush out any dirt from the subsequent section and assemble according to the instructions in *Assemble with spline couplings* (page 25) or*Assemble with expansion couplings* (page 26). Repeat this step until all the sections have been assembled.

   Do not place the flanges closer than 153 mm (6 in) to an anchor support.

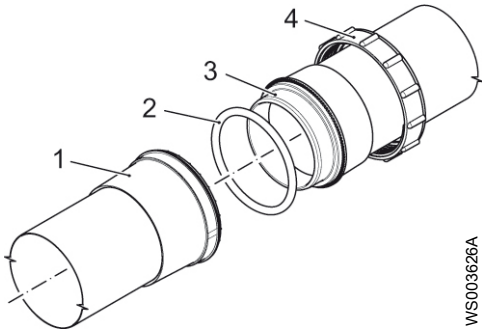
   Tighten loosely.

Assemble with spline couplings

Before starting the assembly, ensure that the air distributor sections are as level as possible.

The spline coupling is a coupling that is used to prevent an air distributor section from rotating.

To adjust the spline coupling after the initial installation, it must be loosened and backed off until the splines are disengaged.



1. Spline socket
2. O-ring
3. Spline spigot
4. Retainer ring

Figure 14: Spline coupling

1. Lubricate the O-ring for ease of installation.

   Use a common dish soap solution. Do not use oil or grease.
2. Fit the O-ring into the spline socket.
3. Push the spline spigot into the spline socket.

   Ensure that the splines are fully engaged.
4. Thread the retainer ring onto the spline socket.
5. Tighten the retainer ring to a hand-tight position.

   Do not use a strap wrench, pipe wrench, spanner wrench or other tool to tighten the retainer ring. The spanner wrench sent together with spares is used for disassembly only.

Assemble with expansion couplings

Expansion couplings are used in some installations and always together with fixed supports.

1. Spline socket
2. O-ring
3. Retainer ring
4. Spline spigot
5. Retainer ring
6. O-ring

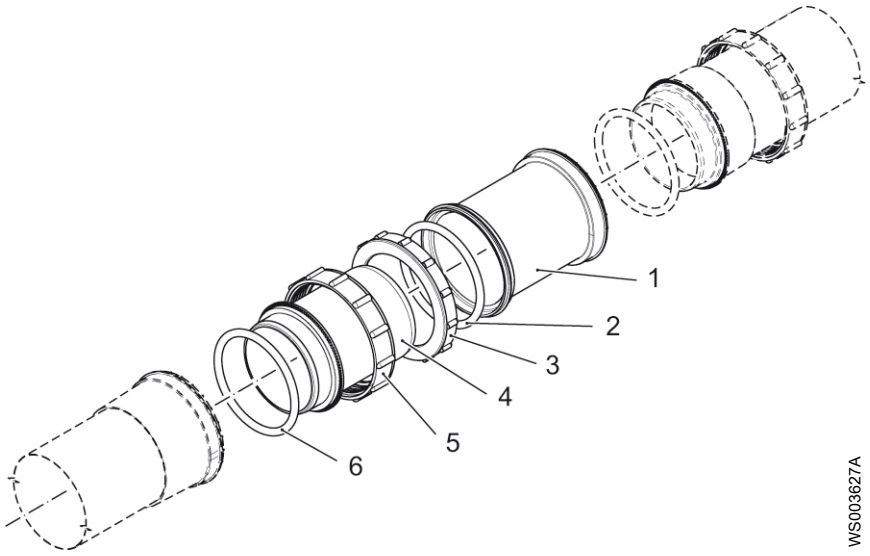
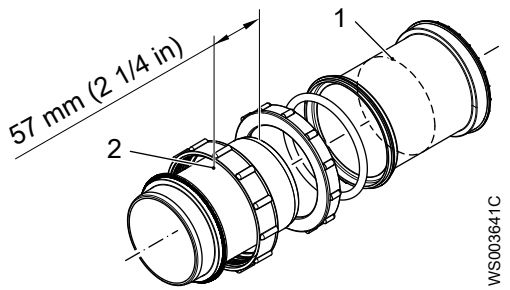


Figure 15: Expansion coupling

1. Assemble the coupling:



1. Spline spigot end placement in an assembled coupling
2. O-ring placement

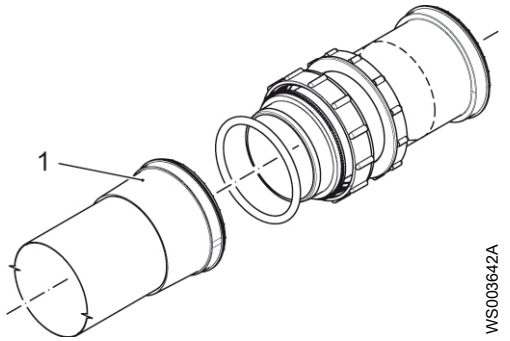
a) Fit both retainer rings on the spline spigot.
b) Lubricate the O-ring for ease of installation.
   Use the supplied silicone grease.

NOTICE:

Risk for damaged O-ring. Always use the supplied grease for the expansion coupling O-ring.

c) Fit the O-ring on the spline spigot.
   Place the O-ring at half the length of the spline spigot, which is 60 mm (2 3/8 in.) from the end.
d) Push the spline socket onto the spline spigot.
   See the exploded view for spline spigot end placement in the spline socket.
e) Thread the retainer ring onto the spline socket, until the O-ring seats.
f) Tighten the retainer ring to a hand-tight position.

2. Install the assembled coupling:

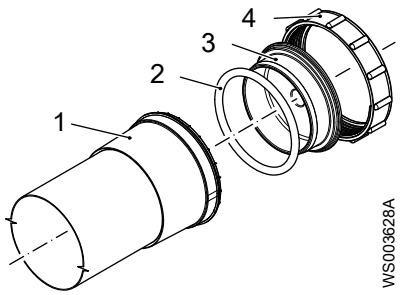


1. Spline socket

a) Lubricate the O-ring for ease of installation.
   Use a common dish soap solution. Do not use oil or grease.
b) Fit the O-ring into the spline socket.
c) Push the assembled coupling into the spline socket.
d) Thread the retainer ring onto the spline socket.
e) Tighten the retainer ring to a hand-tight position.

Install the end cap

The end cap is in some cases factory assembled with the air distributor.

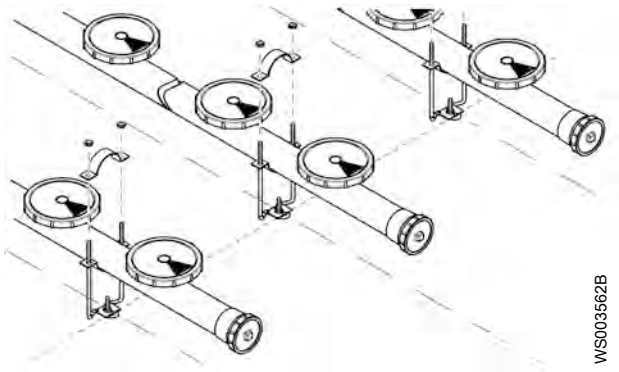


1. Spline socket
2. O-ring
3. End cap
4. Retainer ring

1. Lubricate the O-ring for ease of installation.
   Use a common dish soap solution. Do not use oil or grease.
2. Fit the O-ring into the spline socket.
3. Push the end cap into the spline socket.
4. Thread the retainer ring onto the spline socket.
5. Tighten the retainer ring to a hand-tight position.

Level and tighten the air distributors

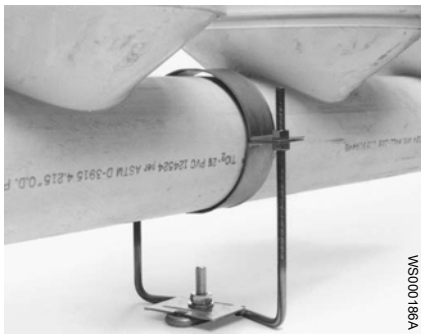
1. Install the top half clamp on each support, and loosely install the top hexagon nuts.



2. Rotate the distributor section until the diffuser is level.
   Use a level system. Make sure to disengage the splines before rotating.
3. Hold the pipe section level and do one or both of the following:
   a) Retighten all corrected spline couplings.
   b) If expansions couplings are used, then tighten all fixed support clamps on those sections.
4. Recheck for level both perpendicular and parallel to the distributor section.
5. Continue this procedure for all distributor sections.
6. Tighten all nuts on the supports.

NOTICE:

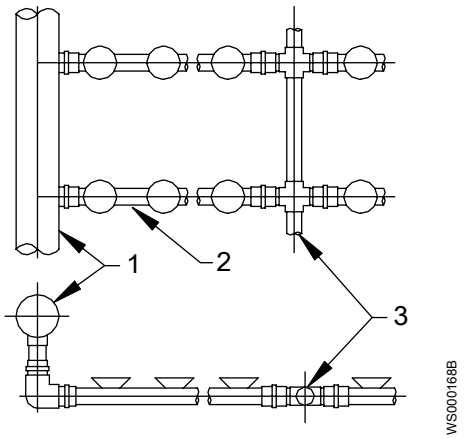
The clamps must be loose around the pipe to allow for movement. Do not wrap anything around the pipe to tighten the clamps against the pipe.



Drainline installation

Separate drainlines are primarily used on fine bubble systems with raised manifolds. On systems with in-line manifolds, the manifold normally serves as drainline.

Ensure that the installation of the drainline is made according to the installation drawings.



1. Raised manifold
2. Air distributor
3. Drainline

Figure 16: Raised manifold with drainline

Purge system installation

There are two types of purge systems:

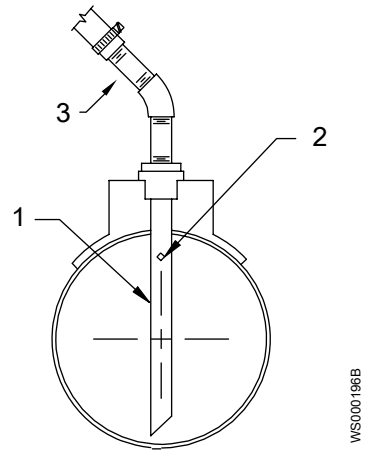
- The manual purge system, with sump and evacuation pipe

  This system uses a sump with an eductor line that extends from the grid to above the water surface and ends with a manual ball valve.
- The continuous purge system, with a diffuser unit that is attached to the bottom of the manifold or the drainline

  The entrapped moisture is continuously purged from the system.

Install a manual purge system

The manual purge system consists of a sump and an evacuation pipe.



1. Suction tube
2. Air orifice hole
3. Evacuation pipe

The sump for systems using in-line manifolds is built into the manifold pipe.

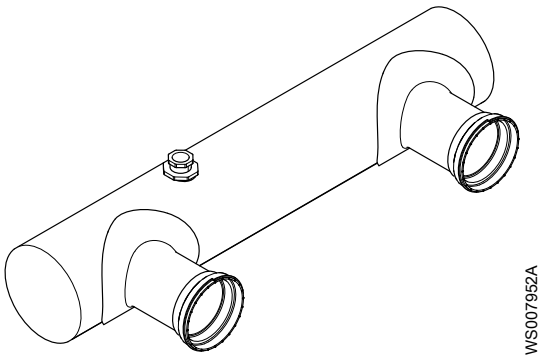


Figure 17: Sump in in-line manifold

The sump for systems using the raised manifold is installed between air distributor or drainline sections.

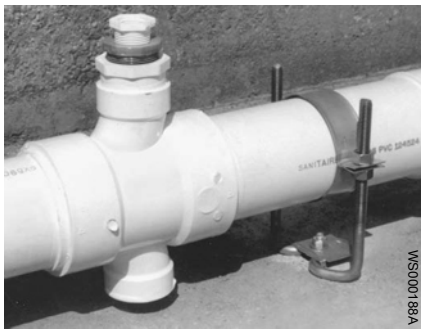


Figure 18: Sump between air distributor sections

1. Identify the parts of the purge system.
2. Install the purge system according to the installation drawings.

Install a continuous purge system

The continuous purge system consists of a tube diffuser unit or a flex-cap diffuser unit that is attached to the bottom of the manifold, air distributor, or drainline.

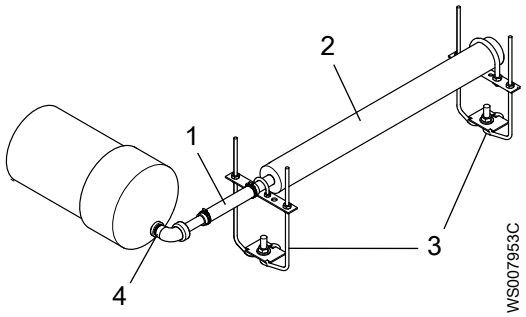


Figure 19: Tube diffuser

1. Hose
2. Tube diffuser
3. Support
4. Cap with drainline tap

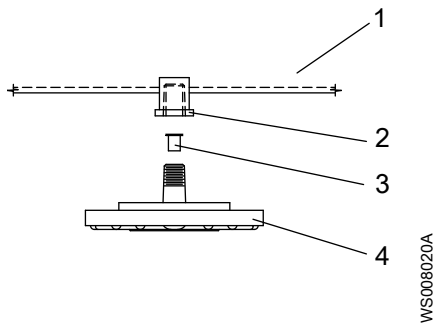


Figure 20: Flex-cap diffuser

1. Manifold
2. Reducer bushing
3. Orifice
4. Flex-cap

The installation is made according to the installation drawings.

1. Mount the diffuser.

Condition	Action
Tube diffuser	1. Assemble the continuous purge. 2. Install the supports on the tank floor according to the installation drawings and the instructions from the anchor bolt manufacturer. Ensure that the tube diffuser is placed horizontally, aligned with the orifice and at an elevation lower than the section to which it is attached. 3. Cut the hose to the correct length 4. Attach the hose to the cap with drainline tap.
Flex-cap diffuser	Thread the flex-cap diffuser into the solvent welded bushing of the manifold. Hand-tight only.

2. Make sure that the manifold, air distributor, or drainline is tapped at a low point.

Diffuser installation

Prerequisites

The diffusers should be installed just before the scheduled start-up of the aeration system.

If the diffusers are pre-mounted, then ensure that all retainer rings are in a hand-tight position. If not, tighten according to the applicable steps in *Install the diffusers* (page 31).

If the diffusers are not delivered pre-mounted, they must be assembled. Before the assembly, ensure that:

- The holders are clean.
- The orifices are not obstructed.
- Blank holders are plugged according to the instructions in *Plug blank holders* (page 32). See the installation drawings for the location of blank holders.

The orifices must be drilled with the correct tool if they are obstructed. Contact your local sales representative.

Install the diffusers

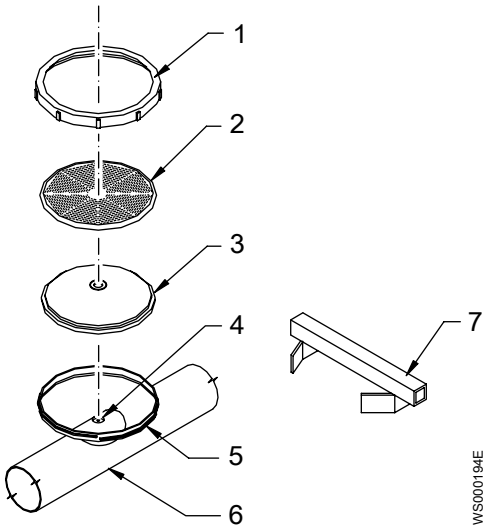


Figure 21: Assembly

1. Retainer ring
2. Diffuser
3. Base plate
4. Orifice
5. Holder
6. Air distributor pipe
7. Spanner wrench

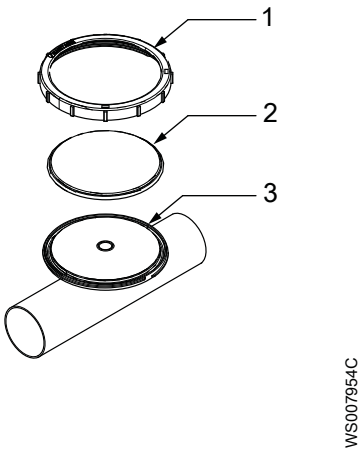


Figure 22: Assembly

1. Retainer ring
2. Diffuser
3. Premounted holder and base plate

1. Set the base plate, if applicable, in the holder with the flat side up.

In some equipment the holder and base plate are incorporated as one piece.

2. Mount the diffuser.

   The diffuser O-ring edge must fit down into the void at the edge of the holder to ensure good sealing.

1. Retainer ring
2. Diffuser
3. Base plate
4. Holder

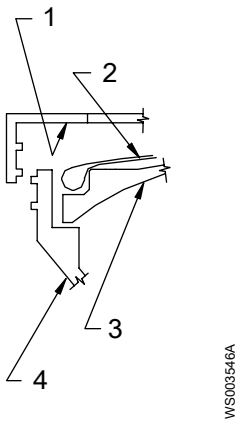


Figure 23: Diffuser placement

3. Lubricate the retainer ring with the silicone grease provided.

   Use a small amount, approximately the size of a finger tip. Do not use excessive silicone grease and only lubricate the underside of the retainer ring, in three or four places. Avoid getting lubricant on the threads.

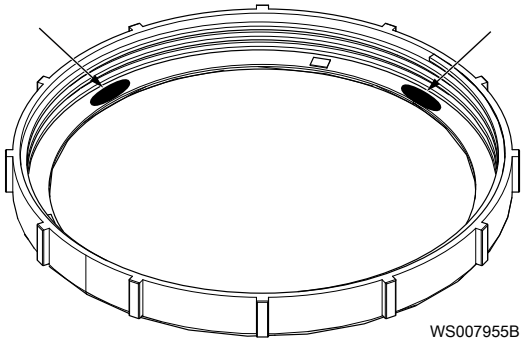


Figure 24: Lubrication of retainer ring

4. Turn the retainer ring to a hand-tight position.
5. Turn the retainer ring an additional 45–90°, using the spanner wrench.

   Do not over tighten.

Plug blank holders

A holder that is not put into operation must be plugged. This is known as a blank holder. If the aeration process requirements change, then the holder can be put into operation later.

1. Locate blank holder positions. See the installation drawings.
2. To ensure proper embedment, add the provided silicone grease in the plugging tool before inserting the plug.
3. Plug the orifice.

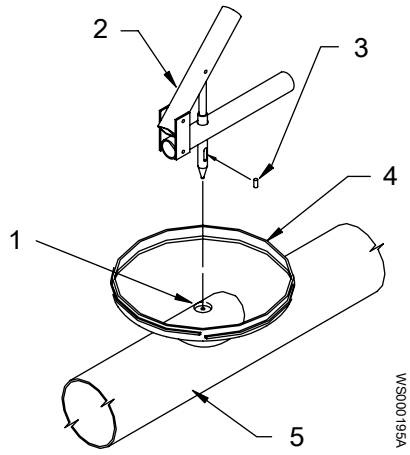


Figure 25: Example of plugging tool

1. Orifice
2. Tool
3. Plug
4. Holder
5. Air distributor

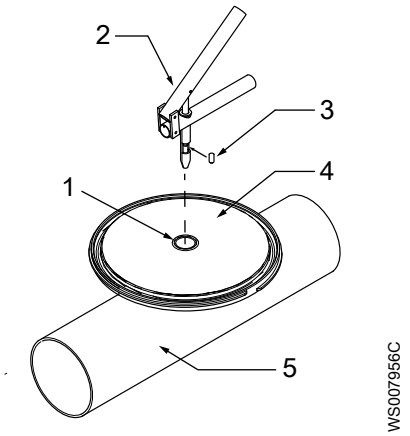


Figure 26: Example of plugging tool

1. Orifice
2. Tool
3. Plug
4. Premounted holder and base plate
5. Air distributor

Tank storage

The different options have been developed to protect the pipes and diffusers from environmental damage, and are listed in order of preference.

Xylem assumes no responsibility for damage and cleaning requirements as a result of long-term storage.

- Equipment flooded by overflows, misdirected sewage flows, and excessive airborne dirt build-up requires cleaning before being placed in service.
- Standing water which is allowed to freeze around the pipe can break the pipe or cause diffusers to crack.
- UV light degradation and heat build-up in the tank bottom can cause warping and loss of some structural properties.

NOTICE:

Risk of wear. Make sure the equipment is clean before it is placed into service.

Store in tank when air and water is available

This procedure describes storage of an installed system, before placing it into operation.

1. Add protection around the dropleg and the carrier columns in the tank when there is a risk of ice build-up.

   Use for example Styrofoam blocks.
2. Fill the tank with clean water to a minimum level of 1 m (3.1 ft) above the lower droplog. This action gives the pipe and the diffusers protection from UV light and heat build-up.
3. Run a small amount of air through the system to secure that the pipes remain free from water and to minimize the growth of algae on the diffusers.
4. Take appropriate measures against excessive algae growth.
5. Before bringing the system into operation:

a) Drain and check all hardware.
b) Check the diffusers and clean if fouling is evident.

The operator may have to adjust the air flow rate to a higher level to prevent ice formation during severely cold temperatures.

Store in tank without air, removed diffusers

This procedure describes storage of an installed system in a flooded tank, before placing it into operation.

1. If there is a risk of ice build-up, then start by installing styrofoam blocks around the dropleg and carrier columns installed in the tank.

   If ice builds up around the pipes, these blocks prevent crushing.
2. Remove all diffusers, O-rings, retainer rings, base plates, and so on.
3. Clean as required, and store in a clean, dry environment.
4. Fill the tank with clean water to a minimum level of 1 m (3.1 ft) above the lower dropleg.
5. Take appropriate measures against excessive algae growth.
6. Before bringing the system into operation:
   a) Ensure that there is no ice in the tank.
   b) Drain and check all hardware.
   c) Check all holders.
   d) Spot check pipe internals for algae growth and fouling.
   e) Clean as required before installing the diffusers.

NOTICE:

Falling ice can crush the system. If water freezes, do not drain the water below the ice layer.

Store in tank without air, with diffusers

This procedure applies to storing in a flooded tank with diffusers installed.

1. If there is a risk of ice build up, then start by installing styrofoam blocks around the dropleg and carrier columns installed in the tank.

   If ice builds up around the pipes, these blocks prevent crushing.
2. Fill the tank with clean water to a minumum level of 1 m (3.1 ft) above the lower dropleg.
3. Take appropriate measures against excessive algae growth.
4. Before bringing the system into operation:
   a) Ensure that there is no ice in the tank.
   b) Drain and check all hardware.
   c) Spot check pipe internals for algae growth and fouling.
   d) Remove the diffusers and spot check the underside to determine the extent of fouling, and if cleaning is required before use.
   e) Clean as required before use and then remount the diffusers.

NOTICE:

Falling ice can crush the system. If water freezes, do not drain the water below the ice layer.

Store in tank with neither air nor water

This procedure applies to storing in tanks when flooding is undesirable.

1. Drain tanks dry.
2. Clean out solids and debris.
3. Make sure that floor drains remain open to prevent water from standing in the pipe system and tank.
4. Before bringing the system into operation:
   a) Check gaskets and O-rings for deterioration or leakage.
   b) Replace as required.

- Equipment flooded by overflows, misdirected sewage flows, and excessive airborne dirt build-up requires cleaning before being placed in service.
- Standing water which is allowed to freeze around the pipe can break the pipe or cause diffusers to crack.

NOTICE:

Risk of wear. Make sure the equipment is clean before it is placed into service.

Operation

Precautions

WARNING:

Always follow safety guidelines when working on the product. See *Introduction and Safety* (page 3).

- Never work alone.
- Make sure that you have a clear path of retreat.
- Never operate the system without safety devices installed.
- Make sure that all safety guards are in place and secure.

Preconditions

Perform a final tank inspection:

- Tighten any loose nuts, couplings, or end caps
- Replace any missing or improperly placed hardware.

Before starting the system, ensure that all repair work is completed. Before doing any work, see *Introduction and Safety* (page 3).

Start the system

Complete the start-up procedure before the site visit by authorized service personnel.

CAUTION: Fall Hazard

Slips and falls can cause severe injuries. Watch your step.

WARNING:

- Bear in mind the risk of drowning.

NOTICE:

To avoid damage to the piping, introduce water to the tank at a low flow rate and avoid vertical water flow falling directly on the piping.

1. Start filling the aeration tank with clean water.
2. If a manual purge system is installed, then disconnect the purge hoses from the sumps.
3. When the water level reaches a point just above the top of the air distributor pipes, then turn on the air at a low air flow rate of approximately 0.85 Nm^3/h/diffuser (0.5 SCFM/diffuser) or 1.7 Nm^3/h/diffuser (1.0 SCFM/diffuser) for LP.
4. Check all submerged couplings for air bubbles which indicate leaks.

   Leaking at spline or expansion couplings is normally due to:

   - The O-ring is pinched or out of place.
   - The coupling retainer ring is cross threaded in the spigot.
   - The coupling is not tight.

   Repair as required, see chapter *Maintenance* (page 39).
5. With the air on, check each purge.

Any water in the pipe should be discharging from the purge.

Condition	Action
There is water in the pipe	The water should be discharging from the purge exit
There is no water in the pipe	Air should be discharging
Neither air nor water is discharging	Check, and if necessary, clean or redrill the purge air orifice to 5 mm (0.2 in.)

6. Turn the water supply off when it has reached a level of 25 mm (1 in.) below the top of the diffusers.

   This is half way up the retainer ring.

   a) Visually check the level of the aeration system using the water line.

      The distance from the top of the perimeter of the diffusers to the static water level should be ±6 mm (1/4 in.).

   b) Adjust the air distributor sections as required in order to level the aeration system.
7. Check for small leaks in the holders.
8. Increase the air rate to about 1.7–2.6 Nm^3/h/diffuser (1–1.5 SCFM/diffuser) and turn the water supply back on.
9. Fill the aeration tank to a maximum water level of 50–75 mm (2–3 in.) above the diffusers, and then turn off the water.
10. Check all diffuser units for uniform air distribution or excessive air discharge.

    Air should be discharging uniformly across the diffuser surface. Large coarse bubbles around the perimeter or halo of the diffuser indicate a loose retainer ring or an improperly seated O-ring.

Figure 27: Uniform air discharge

Figure 28: Excessive air discharge

    a) Remove the retainer ring.

       Use the spanner wrench.

    b) Reseat the diffuser.

       Ensure that the diffuser is correctly seated.

    c) Retighten the retainer ring to a hand-tight position.
    d) Turn the retainer ring an additional 45–90°, using the spanner wrench.

       Do not over tighten.
11. If no air is discharging from the diffuser surface, then the air control orifice can be plugged with debris.

    a) Remove the retainer ring, the diffuser, and the base plate, if applicable.
    b) Clean or drill the orifice.

Use an appropriate tool. Contact your local sales representative.

c) Reinstall the retainer ring, the diffuser, and the base plate, if applicable.

12. Reattach the purge hoses to the purge sumps when the system is leak free and is purged of any entrapped water.
13. Leave the tank before filling with more water.
14. Continue filling the tank to a point 1 m (3.1 ft) over the diffusers.

    If the system has a raised manifold, then check for manifold connection leaks. Repair as required.
15. Continue to fill with water and check for leaks at the connection between the upper and lower dropleg. Use soapy water or a spray bottle of cleaning solution and inspect for bubbles. Bubbles will indicate a leaking connection.

    Adjust as required.
16. Allow the system to operate 3–4 hours in this mode before introducing the process media (liquid).

Maintenance

Precautions

WARNING:

Always follow safety guidelines when working on the product. See *Introduction and Safety* (page 3).

Requirements

The following requirements apply:

- Never work alone.
- Make sure to have a clear path of retreat.
- Make sure that the work area is properly ventilated.
- Provide a suitable barrier around the work area, for example a guard rail.
- Check the explosion risk before you weld or use electrical hand tools.
- Make sure that the product and its components have been thoroughly cleaned.

The figures in the instructions can differ from the delivered products.

Preventive maintenance

The operator should keep a regular log of pressure and dissolved oxygen readings.

Diffuser fouling is indicated by a continuous increase in:

- Operating pressure
- Air demand without a change in the aeration tank loading
- Air demand with a decrease of dissolved oxygen levels

This chapter includes instructions for:

- Empty the moisture purging system
- Air bumping
- Power failure and loss of air supply
- Visual inspection

Moisture purging

Moisture enters the pipe system in the following ways:

- Condensate build-up inside the pipe system due to high blower discharge temperatures, or moist or humid air
- Minor leaks in the pipe system

The effects of entrapped moisture are:

- Increased air velocity and headloss
- Poor air distribution

1. Lower the air flow to the grid for maximum purge results.
   The air velocity is reduced and more of the liquid is forced to the sump.
2. Open the ball valve on the eductor line.
   The trapped liquid is purged from the system.

CAUTION:

Contents under pressure. Wear safety goggles.

3. Close the ball valve when the water flow stops and mist appears.

Air bumping

Air bumping is a technique that operators can employ to remove settled debris temporarily on a system in operation, between diffuser cleaning. It means increasing the air flow rate for 5–10 minutes once a week. Use an air rate per diffuser as stated in *Operational limits* (page 52).

Power failure and loss of air supply

The result of a power failure and loss of air supply on membrane diffusers is that solids settle on the diffuser surface. The short-term affect is none.

The long-term effect is that the potential of surface fouling is possible and the diffusers can require a cleaning. This is generally the case for long-term intermittently used membrane diffuser aeration systems (for example Anoxic Zones or Batch Reactors).

Due to the described long-term effect, the operator can be required to shut off adjacent grids or turn on additional blowers to increase the air flow rate and force the membrane off the base plate surface.

Visual inspection

Visual inspection is an ongoing preventative maintenance step and can be done while taking routine samples.

- Visually inspect the aeration tank surface pattern.

  The flow should be, for the most part, a nice quiescent pattern. Some coarse bubbling at the tank inlet may occur due to surfactants in the wastewater and is generally dispersed shortly downstream.
- Look for excessive coarse bubbling throughout the tank.

  Coarse bubbling indicates that the diffusers can be fouled.
- Look for large boiling in an isolated area.

  Large boiling indicates a failure in the submerged pipe system or a broken diffuser.

Recurrent maintenance

Maintenance schedule

The following service schedule is recommended to be observed at least once per year.

1. Drain each tank.
2. Remove excess settled solids that have accumulated.
3. Clean diffusers. See *Diffuser cleaning* (page 40).
4. Inspect support hardware to ensure that all components are intact and tight.
5. Inspect diffuser retainer rings to make sure all rings are in place and tight.
6. Inspect spline and expansion coupling retainer rings to make sure that they are tight.

For hardware inspection, see also the corresponding section in the installation chapter, or in other appropriate documentation.

Diffuser cleaning

Clean the diffusers

1. Drain the aeration tank.

   The air supply must remain on when the tank is drained and the water is above the diffusers. The valve on the dropleg has to be adjusted as the tank is being drained. Excessive air flow to the tank being drained must be prevented, and enough air must be supplied to adjacent operating grid systems supplied from the same source.

NOTICE:

Excessive heat build-up can damage plastic pipes.

2. Clean each diffuser.

   Use a hose with clean water at a nozzle pressure of 410 kPa (60 psig).

3. Scrub each diffuser with a rag or soft bristle brush in order to remove stubborn slime growth, chemical precipitates, or oils.

NOTICE:

Do not use acids or aggressive cleaners on the membranes.

4. Inspect the aeration system visually. Ensure that no hardware was loosened or broken during the cleaning.

Manifold repair

Replace a saddle

This section shows how to replace a damaged air distribution connection, a saddle tee, on the manifold. A cracked saddle tee, or a damaged socket end, is hard to detect until the air is turned on. Always replace the entire saddle tee, even if only the socket is damaged.

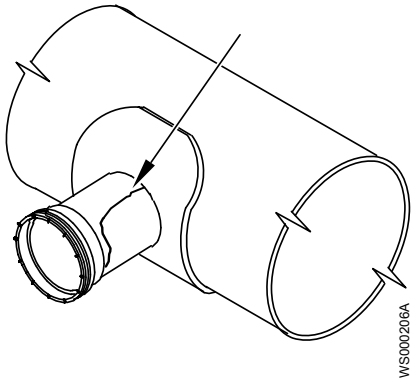


Figure 29: Cracked saddle tee

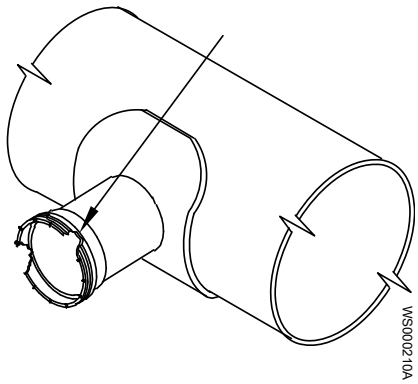
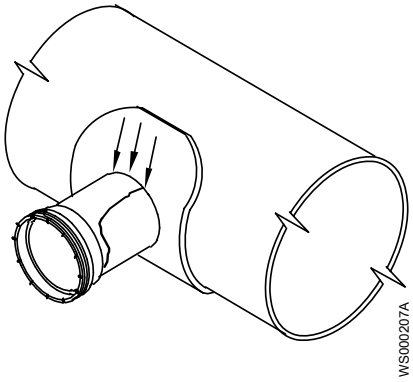


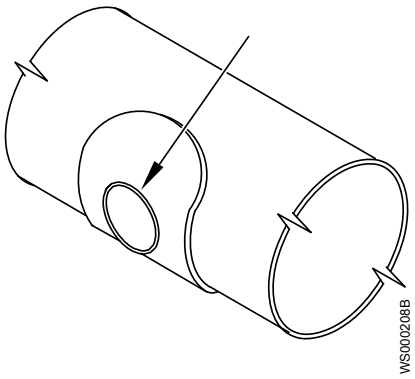
Figure 30: Damaged socket

1. Cut the pipe section off flush with the saddle.

   Use a reciprocating type saw (Sawzall).

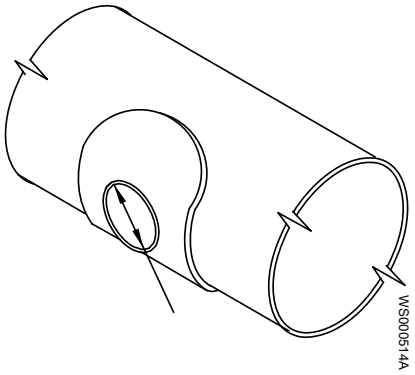


2. Chamfer the inside edge of the saddle opening to remove any saw cut projections.



3. File the saddle opening using a half round file.
4. File off the saddle projection on each side of the opening.

   The clear opening diameter must be 108 mm (4 1/4 in.) for a proper fit of the new saddle piece.



5. Clean and prime the surfaces.
6. Glue the new saddle assembly directly over the existing saddle.

WARNING:

These chemicals can cause physical injury. Contact the supplier for information and advice for proper handling precautions and procedures.

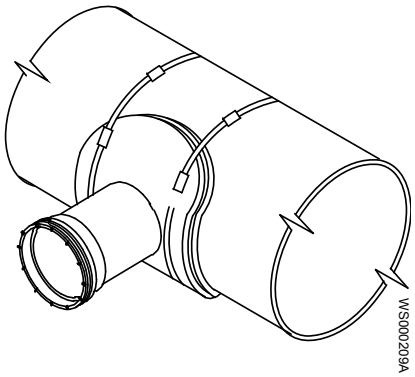


Figure 31: 1-piece saddle tee

7. Secure the saddle assembly to manifold using strap clamps.
8. Allow appropriate time to cure.

Repair a minor leak

This instruction shows how to repair a minor leak around the edge of a saddle tee. Air release at startup indicates a leak.

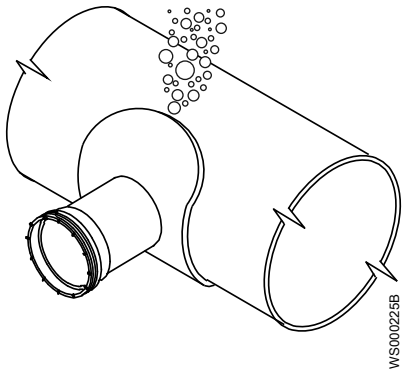


Figure 32: Air release

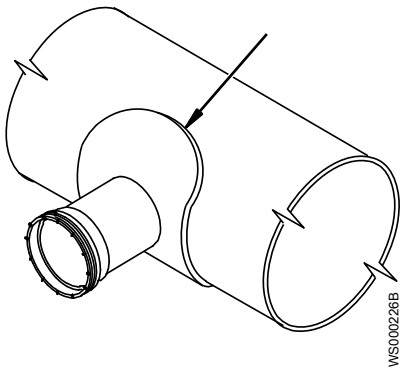


Figure 33: Glue

1. Apply a bead of glue around the edge of the pipe saddle.

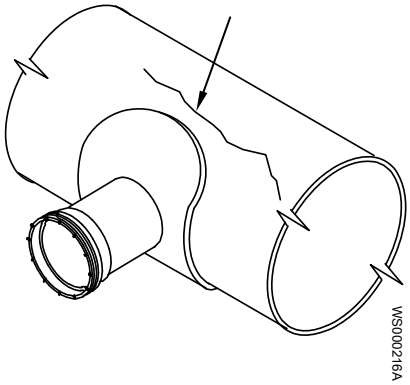
CAUTION: Chemical Hazard

Contact the supplier for information for proper handling and use.

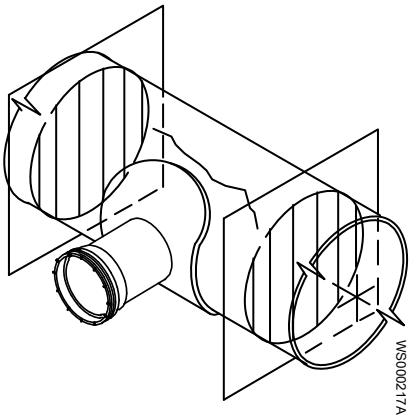
2. Allow adequate time to cure (>24 hours).

Replace a cracked manifold pipe section

This instruction shows how to replace a cracked manifold pipe section. The crack can extend further down the pipe.

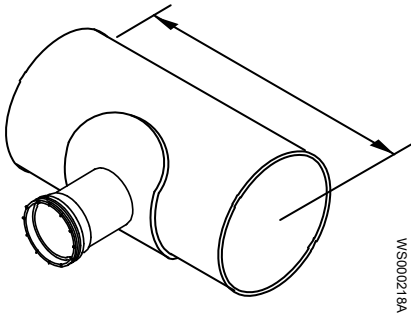


1. Cut the broken pipe section between the saddles.



2. Remove saw cut burrs by filing or sanding the outside edge of the pipe.
3. Cut a length of pipe of the correct diameter and the correct number of tee connections.

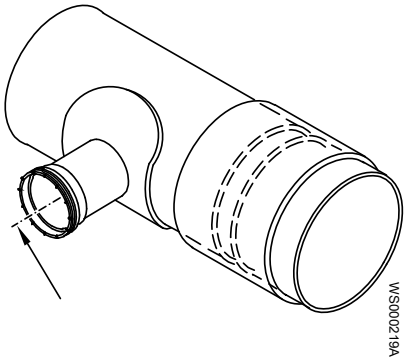
   The ends must be cut perpendicular to the pipe.



4. Remove the burrs from the cut pipe ends.
5. Glue the repair section to the new couplings.
   Ensure that the couplings are the correct size and type.

CAUTION: Chemical Hazard

Contact the supplier for information for proper handling and use.

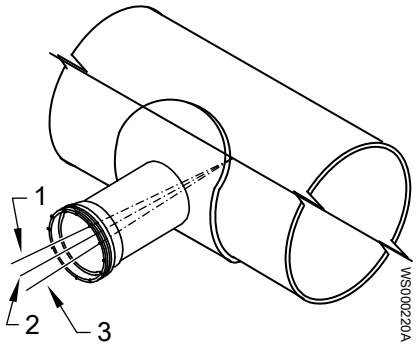


6. Glue the repair section to the original manifold sections.
   Ensure that the manifold air distributor connections are level.

Align an air distributor connection

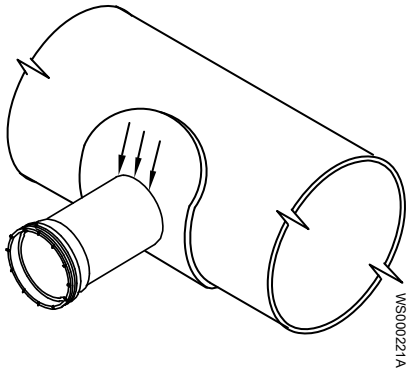
This instruction shows how to align an air distributor connection. Alignment is needed in the following situations:

- The in-line manifold air distributor connection is out of horizontal level, causing the air distributor to be out of level.
- The raised manifold air distributor connection is out of vertical plumb, causing the air distributor to be out of level.



1. Out of level
2. Level
3. Out of level

1. Use a reciprocating type saw (sawzall) and cut the spigot section off flush with the saddle.

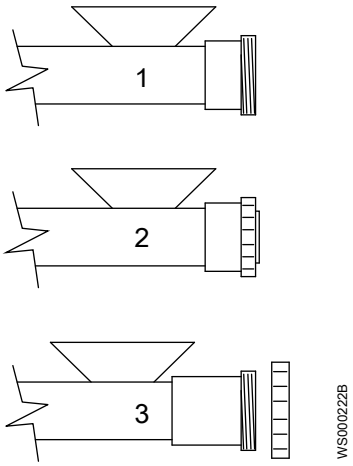


2. Follow the instructions in *Replace a saddle* (page 41).

Air distributor repair

Replace an air distributor end

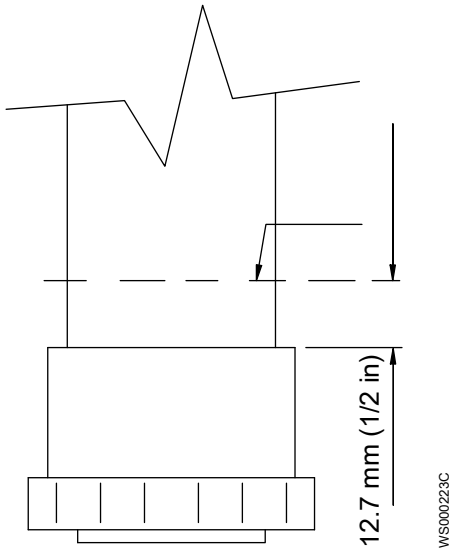
This instruction shows how to repair an air distributor spline coupling, expansion coupling, and socket. Ensure that the required spare parts are available.



1. Spline socket
2. Spline spigot with retainer ring
3. Expansion coupling with retainer ring

1. Remove damaged coupling end by cutting the attached pipe section at a distance of 12.7 mm (1/2 in.) from the end of the fitting.

   Care should be taken to make cut as perpendicular as possible.

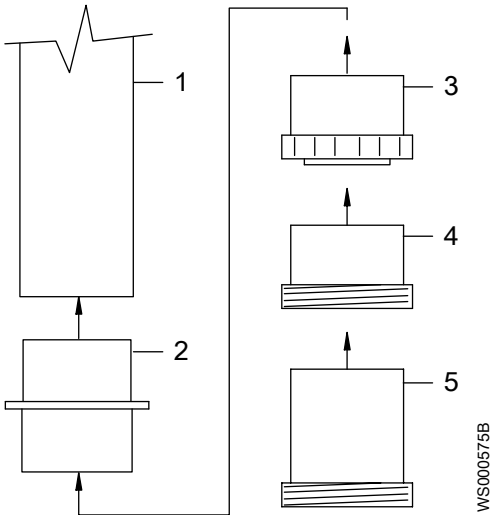


2. Remove the burrs from the cut pipe end.
3. Clean and prime the inside of cut pipe end.

CAUTION: Chemical Hazard

Contact the supplier for information for proper handling and use.

4. Clean and prime the outside of the small end of the adaptor.
5. Glue the pipe adaptor to the pipe end.
6. Clean and prime the opposite outside end of the adaptor.
7. Clean and prime the inside face of the coupling end.
8. Glue the coupling end onto the adaptor.



1. Pipe end
2. Adaptor
3. Spline spigot with retainer ring
4. Spline socket
5. Expansion coupling

Replace a spline coupling retainer ring

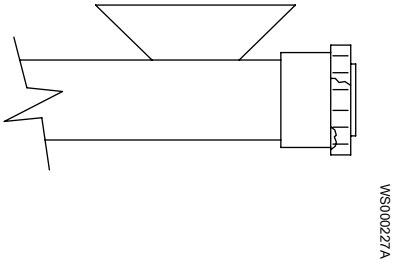


Figure 34: Damaged or broken retainer ring

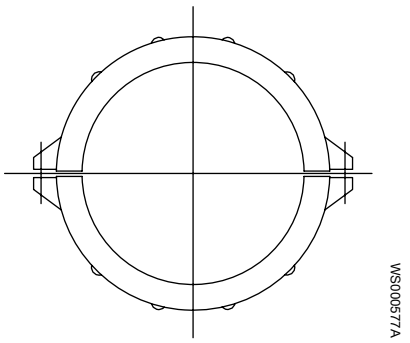


Figure 35: Retainer ring for replacement

1. Cut off the damaged retainer ring.

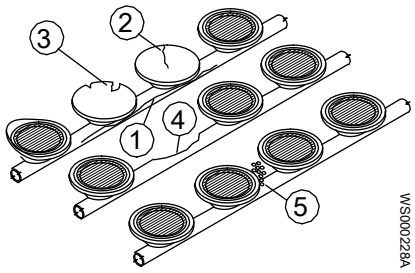
   Use a hand held hacksaw or pipe saw and be careful not to damage other parts.
2. Install a replacement retainer ring.

Replace a holder

This instruction shows how to repair a holder due to one or more of the following problems:

CAUTION: Chemical Hazard

Contact the supplier for information for proper handling and use.



1. Cracked pipe
2. Cracked holder
3. Chipped diffuser holder
4. Broken off holder
5. Holder unable to seal

The repair of the listed problems involves cutting out and replacing a pipe section. The number of diffusers that require removal depend on the extent of the damage.

Ensure that repair components are available before starting the repair work. The components are supplied locally.

1. Remove the diffusers from the holders on the damaged pipe section.
2. Cut out the damaged pipe section.

   The minimum distance the pipe should be cut from any adjacent holder is 150–200 mm (6–8 in.), depending on which holder type is installed. Ensure that the coupling does not interfere with the holder after the installation.

   If the cut point falls on a support location, then do one of the following:

   - If the space allows, then move off the support location towards the next diffuser.
   - If the diffusers are tightly spaced, then move down to the space after the next diffuser.

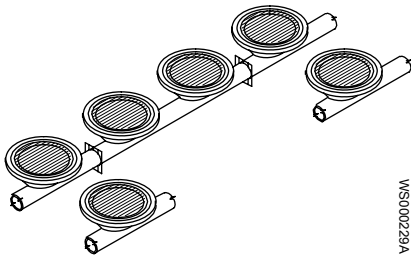


Figure 36: Damaged pipe section cut

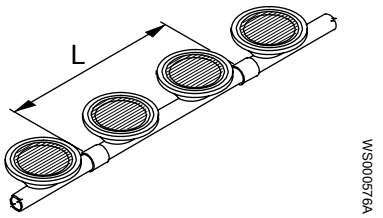


Figure 37: Spare distributor section cut

3. Cut a section to the required length L with the appropriate number of diffusers at the correct diffuser spacing.
4. Remove the burrs, clean and prime all cut ends.
5. Glue the repair pipe section into place.

   Use two repair couplings.
6. Clean, prime and glue according to separate instructions.

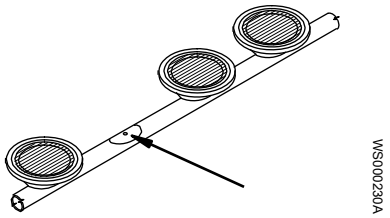
   The retainer ring must be free to rotate. Ensure that no excess glue comes in contact with the retainer ring.

Refit a holder

This instruction shows how to replace a missing holder when there is no pipe damage.

CAUTION: Chemical Hazard

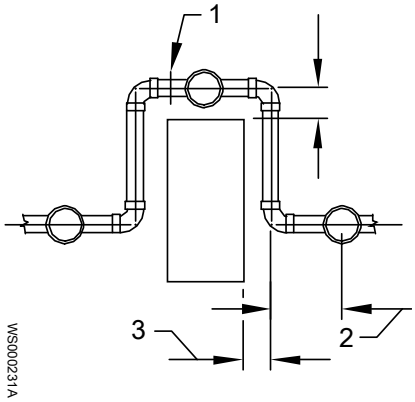
Contact the supplier for information for proper handling and use.



1. Clean the holder area of any old glue residue.
2. Prime the holder area and the bottom of the holder.
3. Attach the holder on the pipe. Ensure that the holder is level.
4. Drill a new hole in the holder and the pipe, if applicable.
5. Allow appropriate time to cure (>24 hours).

Reroute an air distributor section

This instruction shows how to route an air distributor around an obstacle.



1. Support placement
2. Minimum distance 230 mm (9 in.)
3. Minimum distance 150 mm (6 in.)

Use 90° sewer size socket elbows and 110 mm diameter (4.215 in. O.D.) sewer pipe to make necessary modifications.

Ensure that the offset air distributor run is adequately supported.

Troubleshooting

Operational troubleshooting

For instructions, see chapter *Maintenance* (page 39). For instructions on how to handle other equipment such as air blowers, see the instructions from the manufacturer.

Symptom	Cause	Remedy
Poor air distribution Non-uniform air distribution	Diffusers not level	Level system
	Grid flooded	Operate grid purge system
	Insufficient air	Provide more air
	Solids settling	Provide more air to the grid, perform air bumping procedure, or clean the diffusers
	Plugged orifice	Clean orifice
Visible mounding of air in one location	Broken pipe	Repair pipe, see *Manifold repair* (page 41) or *Air distributor repair* (page 45)
Coarse bubbling (large bubbles)	Diffuser fouling, loose coupling, degraded gasket, broken pipe or diffuser	Clean diffusers, see *Diffuser cleaning* (page 40), or inspect and repair accordingly
Low dissolved oxygen (D O) concentration	Too little air	Increase air flow
Increased operating pressure	Diffuser fouling	Clean diffusers, see *Diffuser cleaning* (page 40)
	Line blockage or valve closed	Check air lines and valves
Increased air requirement without load change	Diffuser fouling	Clean diffusers, see *Diffuser cleaning* (page 40)
	Leak in air system	Inspect and repair accordingly

Diffuser fouling

Fine bubble diffusers can foul or become clogged during operation. The rate of fouling, type of foulant, and strength of foulant depend primarily on the constituents in the wastewater.

The results of diffuser fouling include:

- Loss of oxygen transfer efficiency due to bubble coalescence and coarse bubbling
- Increased pressure requirements
- Increased air demand
- Increased operating costs

Several ways to determine if the diffusers are fouled are discussed in *Preventive maintenance* (page 39).

The corrective action for fouled diffusers is to clean them. See *Diffuser cleaning* (page 40).

Diffuser fouling causes

Diffuser fouling is divided into two categories:

- Water side fouling (most common)
- Air side fouling (less common)

Causes of water side fouling include:

- Fibrous material that adheres to the edges of the diffuser units
- Oil or grease in the wastewater

- Precipitated deposits of iron and carbonates
- Biological growths of slime

Causes of air side fouling include:

- Dust and dirt from unfiltered or inadequately filtered air
- Rust and scale from air main corrosion
- Oxidation and subsequent flaking of bituminous air main coatings
- Construction debris
- Mixed liquor solids that enter through system leaks or cracks.

Technical Reference

Operational limits

Use ADA for proper dimensioning and related performance.

Silver Series II

Table 1: Air flow per diffuser

Size (in)	Minimum	Maximum
7	0.60 Nm^3/h (0.35 SCFM)	• Long term 5.10 Nm^3/h (3.00 SCFM) • Short term 8.20 Nm^3/h (4.80 SCFM)
9	0.85 Nm^3/h (0.50 SCFM)	• Long term 6.80 Nm^3/h (4.00 SCFM) • Short term 11.90 Nm^3/h (7.00 SCFM)

Silver Series II LP

Table 2: Air flow per diffuser

Size (in)	Minimum	Maximum
7	1.20 Nm^3/h (0.70 SCFM)	• Long term 14.50 Nm^3/h (8.50 SCFM) • Short term 29.80 Nm^3/h (17.50 SCFM)
9	1.70 Nm^3/h (1.00 SCFM)	• Long term 20.40 Nm^3/h (12.00 SCFM) • Short term 42.50 Nm^3/h (25.00 SCFM)

Xylem |'zīləm|

1) The tissue in plants that brings water upward from the roots
2) A leading global water technology company

We're a global team unified in a common purpose: creating innovative solutions to meet our world's water needs. Developing new technologies that will improve the way water is used, conserved, and re-used in the future is central to our work. We move, treat, analyze, and return water to the environment, and we help people use water efficiently, in their homes, buildings, factories and farms. In more than 150 countries, we have strong, long-standing relationships with customers who know us for our powerful combination of leading product brands and applications expertise, backed by a legacy of innovation.

For more information on how Xylem can help you, go to xyleminc.com

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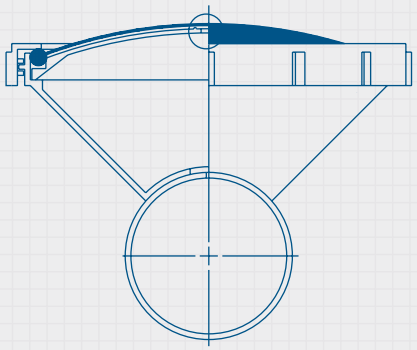
Visit our Web site for the latest version of this document and more information

The original instruction is in English. All non-English instructions are translations of the original instruction.

Membrane Disc

Fine Bubble Aeration Systems



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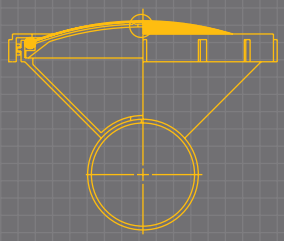
Membrane Disc
Fine Bubble Aeration Systems



SANITAIRE®

Technology You Can Count On

SANITAIRE® is the trade name recognized throughout the wastewater treatment industry for quality products and advanced technology. SANITAIRE Silver Series membrane fine bubble disc diffusers are recognized worldwide for their high oxygen transfer efficiency and durability in wastewater treatment plant aeration processes.

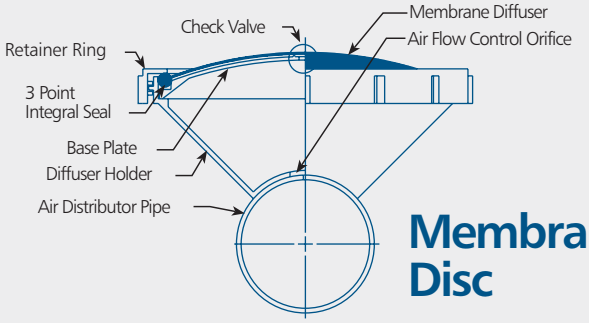
Owners and engineers prefer SANITAIRE fine bubble diffusers because:

- Power costs can be reduced by 50% or more.
- High oxygen transfer efficiency and low system headloss lead to low energy costs.
- Minimal maintenance is required.
- Gentle positive mixing action using full floor coverage aeration grids promotes excellent floc formation.

Sanitaire's leadership and experience in aeration technology has resulted in high quality SANITAIRE fine bubble disc aeration systems being specified more than any other. The SANITAIRE Membrane Disc fine bubble aeration system offers advantages in performance, ease of maintenance, construction integrity and quality. Ongoing research and developement shows Sanitaire's commitment to the most technologically advanced diffused aeration system.

Diffuser and Holder Features

- Diffuser holders are factory solvent welded to the air distribution piping providing superior mechanical strength and eliminating the necessity for field installation and leveling of individual assemblies.
- Membrane diffusers include an integral check valve. The non-perforated center portion of the membrane collapses onto the air release port of the base plate when the air is turned off. The diffuser slits also act as check valves and close onto the base plate when the air is turned off.
- Integral seal and threaded retainer ring design prevents air leakage and resulting contamination from mixed liquor solids leakage into the aeration system.



Membrane Disc

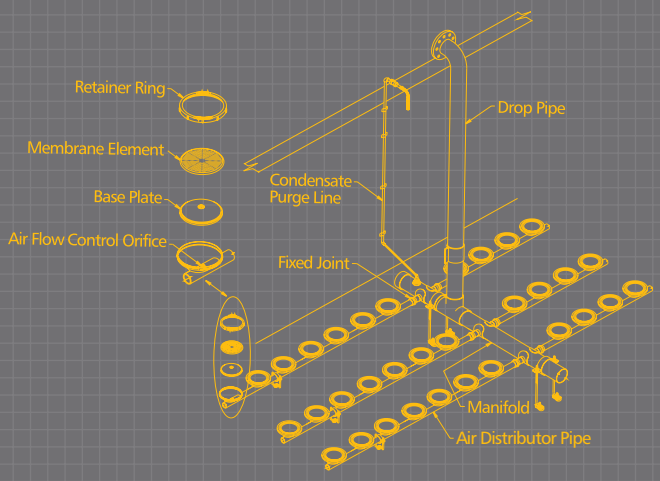
Top centerline diffuser mounting prevents cantilever or torque forces from being transmitted to piping system.

- Diffuser and holder are designed to provide full surface uniform air distribution and bubble release.
- The membrane is completely supported by the base plate, preventing reverse flexing.
- Available in 9-inch (229-mm) and 7-inch (178-mm) diameters.

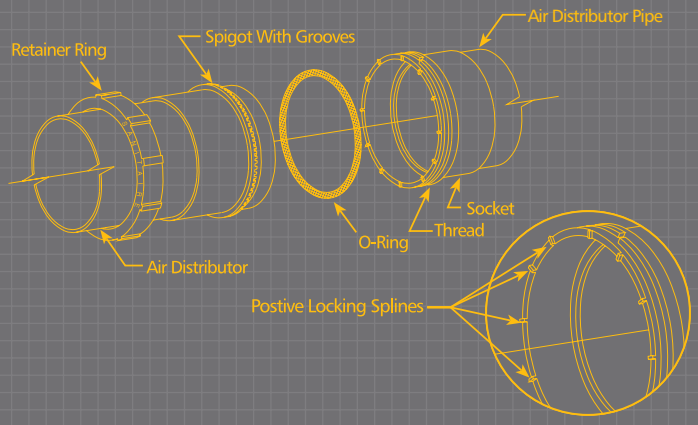
Proven System Components

- The SANITAIRE air distribution system incorporates patented locking pipe joints combined with guide type supports that do not positively grip the pipe to accommodate thermal expansion and contraction. The unique system design allows the individual distributor pipes to move freely through the pipe supports.
- The patented SANITAIRE fixed joint features an airtight O-ring seal, anti-rotational splines and a positive locking threaded retainer ring to prevent air leakage, pipe blow apart and distributor rollover.
- PVC air distribution piping system provides long-term mechanical integrity.
- Submerged components of corrosion resistant materials.
- Unique all stainless steel anchorage system with threaded supports for infinite adjustments on sloped or irregular floors.
- Joint components are factory solvent welded to the pipe ends, allowing for quick and easy field assembly of air distributor sections.
- Condensate removal with sumps and purge system.
- Over 10 million fine bubble diffusers installed worldwide.

Typical Membrane Disc Grid Layout



Sanitaire Positive Locking Fixed Joint



Membrane Disc Diffuser Advantages

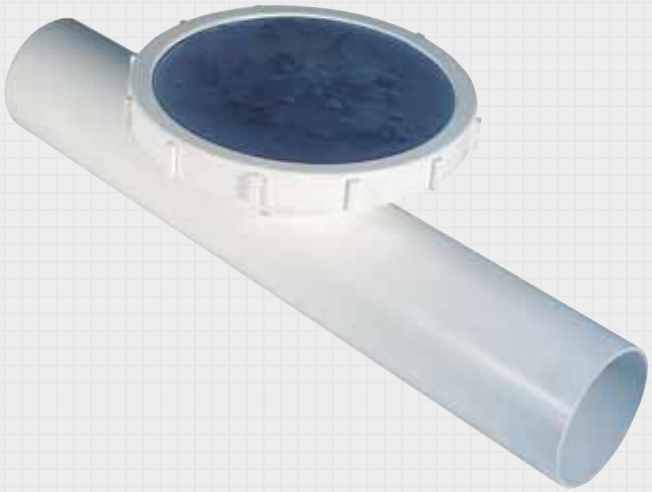
- Provides full surface, uniform air distribution and bubble release.
- Operating air pressure creates peripheral seal to eliminate air leakage.
- Precision die-formed slits are punched perpendicular to membrane grain direction for greater resistance to elongation and tearing.
- Proprietary technologically advanced membrane material blended from special synthetic rubber compound has been specifically engineered for domestic and industrial waste applications providing:
  - Extended service life.
  - Resistance to material property changes.
  - High modulus of elasticity.
  - Proper material thickness - lower unit stress.
  - Resistance to oils and ultraviolet light.
  - High oxygen transfer efficiency.
- Alternative materials and configurations available for specific applications.
- The unique design eliminates the use of hold-down bolts, lift limiters and metallic mechanical fasteners.
- Existing aeration tanks can be easily upgraded with membrane disc aeration, upgrading existing plant's organic treatment capacity without adding tankage.
- Convenient shipping - diffusers and piping are delivered in a compact palletized arrangement.
- Ease of installation - up to 12 units installed per man-hour. Step-by-step O&M manuals, educational videos and field service startup training provided with every system.
- Factory installed diffuser holders and pipe end fittings to reduce installation time.
- Pressure monitoring system available.

Applications

- Aeration Tanks
- Sludge Holding Tanks
- Aerobic Digesters
- Sequencing Batch Reactors
- Channel Aeration
- Air On/Air Off Processes
- Membrane Bioreactors

Those Who Choose Membrane Disc Aeration...
get the best of all worlds when they choose proven SANITAIRE systems for their wastewater treatment needs.

Sanitaire provides time-tested aeration technology and products for municipal and industrial markets worldwide.



Call Sanitaire - the aeration leader for more information
9333 N. 49th Street
Brown Deer, WI 53223 USA
Tel 414 365 2200
Fax 414 365 2210
www.sanitaire.com

SANITAIRE
a xylem brand

11/04 US Patent # 5,714,062

Sanitaire
ITT Industries

MEMBRANE DISC SYSTEM
(PVC Pipe & Fittings, 304 SS Droplegs & Hardware)

Material and Manufacturing Specifications

Item	Material Specification	Manufacturing Specification	Notes
Dropleg	304L Stainless Steel ASTM A240	Fittings: ASTM A774 Tubular Products: ASTM A778 Dimensions: ASTM A554	150# Class Drilling For Termination Flange Connection. 12 gauge pipe (0.109") wall thickness on dropleg. *See Below
Supports	304 Stainless Steel Sheets & Plates Per ASTM A240 Threaded Rod Per ASTM A276	--	"L" Grade Required For Welded Parts
Nuts, Bolts & Washers	18/8 Stainless Steel	--	--
Fixed Joint "O" Ring	Natural Rubber/SBR	--	45± 5 Durometer Shore A Compression Set 5% Max
Expansion Joint "O" Ring	Natural Rubber/SBR	--	40 ± 5 Durometer Shore A 0.45 Coefficient of Friction Max.
Lower Dropleg & Manifold	PVC, ASTM D1784 Compound 12454-B	Pipe: ASTM D1785 Fittings: ASTM D2466	---
Air Distributors	PVC, ASTM D3915 Compound 124524	Pipe & Fittings: ASTM D3034	Minimum 2% Titanium Dioxide added for UV protection
Diffuser Holder	PVC, ASTM D3915 Compound 12424	--	Minimum 2% Titanium Dioxide added for UV protection
Diffuser Element	EPDM	---	---
PVC Solvent Welding	ASTM D2564	ASTM D2855	---

*** Stainless Steel Dropleg Fabrication**

Factory weld only with MIG, TIG or plasma-arc welding inert gas processes, full penetration butt welds, ER 316L filler wire. After fabrication finish clean all welded stainless steel assemblies by full immersion cleaning techniques in accordance to 6.2.11 of ASTM A380-88. Use acid as defined by Table A.2.1 of Annex A2 of ASTM A380. Final rinse and dry in accordance to Section 8.3 of ASTM A380. All welded surfaces to conform to AISI No. 2D finish.

SANITAIRE®
9333 N. 49th Street Brown Deer, WI 53223 USA
Tel 414 365 2200 Fax 414 365 2210
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Gardner Denver

POSITIVE DISPLACEMENT BLOWERS & VACUUM PUMPS

HeliFlow®
Industrial Series

It's all about...

the HeliFlow

The HeliFlow Series integrates proven experience with blower design and manufacturing techniques to create an innovative helical tri-lobe blower. Gardner Denver has created a low noise solution for positive displacement blower and vacuum pump applications.

BACKED BY A

2 YEAR

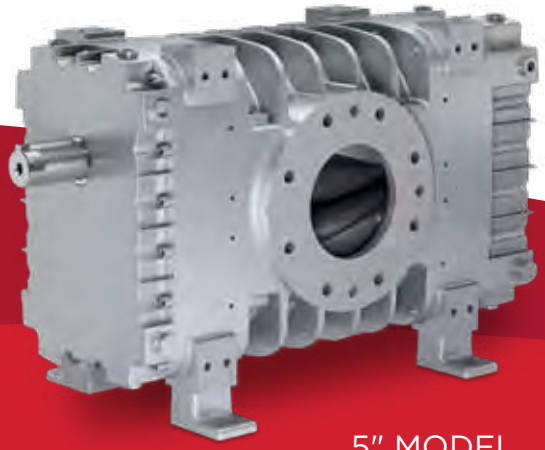
WARRANTY

From date of initial use or
30 months from date of shipment

HELIFLOW DELIVERS

- Pressure to 18 psig
- Vacuum to 17 inHg
- Airflow to 4,500 cfm

4" MODELS
406, 408, 412



5" MODEL
514

Results

Durability

Innovation

Trust

QUIET

Tradition

Strength

Quality

Efficiency

Performance

6″ MODELS
616, 624

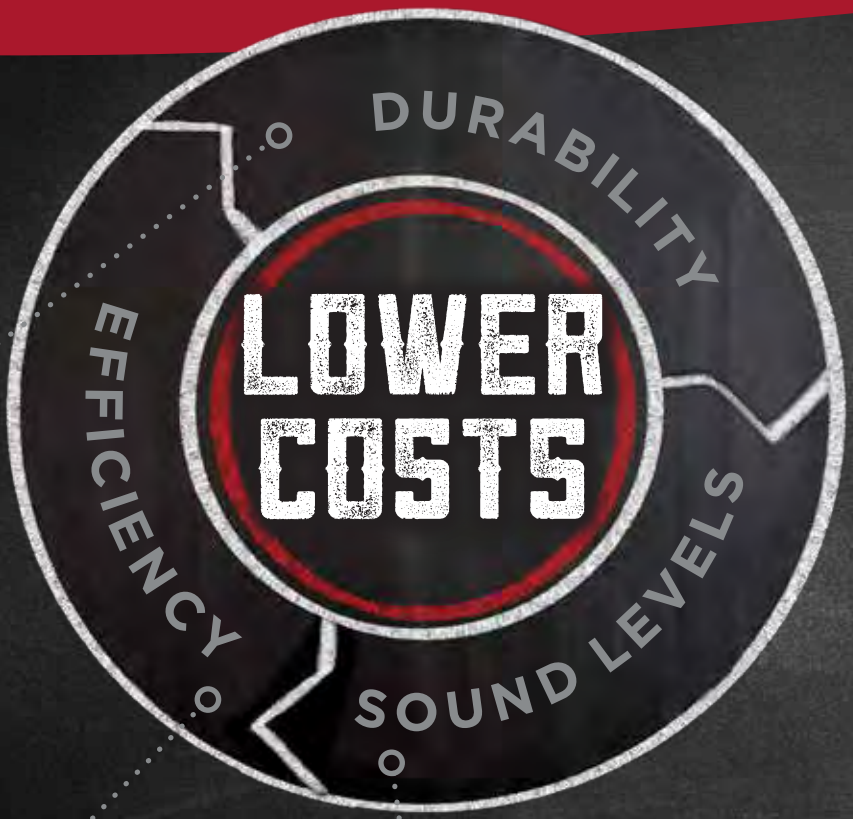
8″ MODEL
825, 817

It's all about...

the Savings

RUGGED CONSTRUCTION

Reduces maintenance and downtime



GREATER EFFICIENCY

Lowers operating costs

QUIETER OPERATION

Reduces enclosure and hearing protection requirements

Lower Cost + Higher Revenue

SAVES MONEY

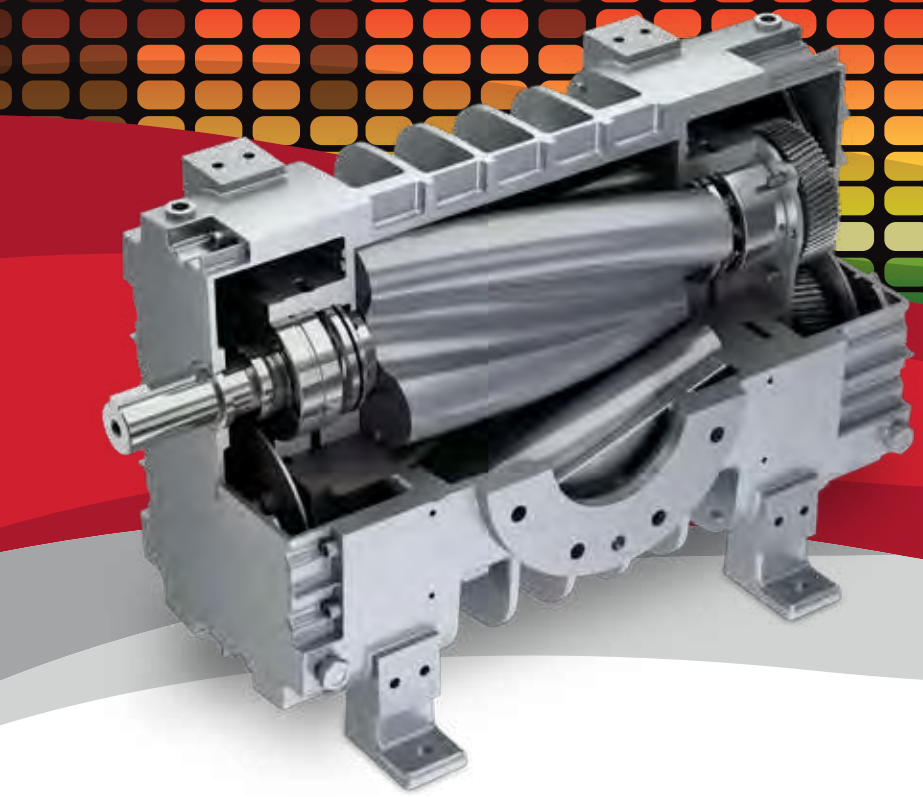
HIGHER REVENUE

PERFORMANCE

Higher pressure, vacuum and temperature limits

It's all about...

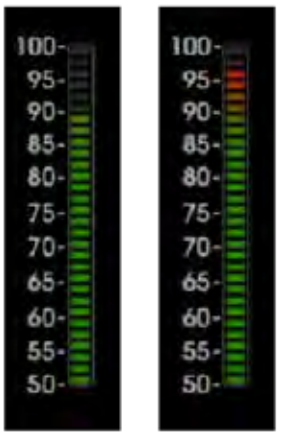
the PULSE



REDUCES NOISE LEVELS

Up to 4–7 dBA

Noise Levels dBA



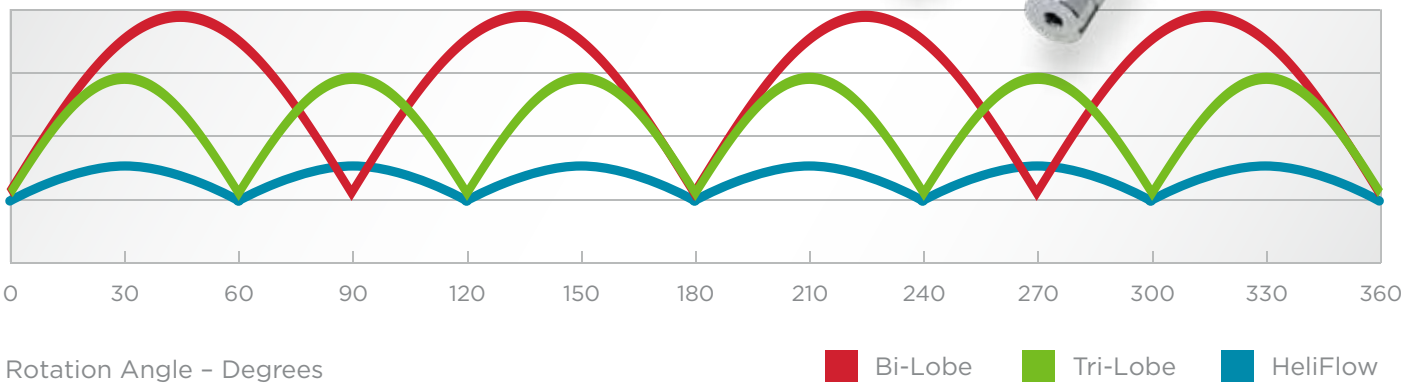
HeliFlow

Typical Lobe Blower

Protect your ears,

Protect your WORKFORCE

CHANGE IN PRESSURE PULSE



The HeliFlow Series

REDUCED PULSE = LOWER NOISE = QUIETER OPERATION

Lower Noise

Discharge pulsation is the chief contributor to high noise levels. HeliFlow provides the lowest pressure pulse in the lobe blower market. This reduces noise levels by 4–7 dBA over similar sized, straight-lobe blowers.

Reduced Pulsations

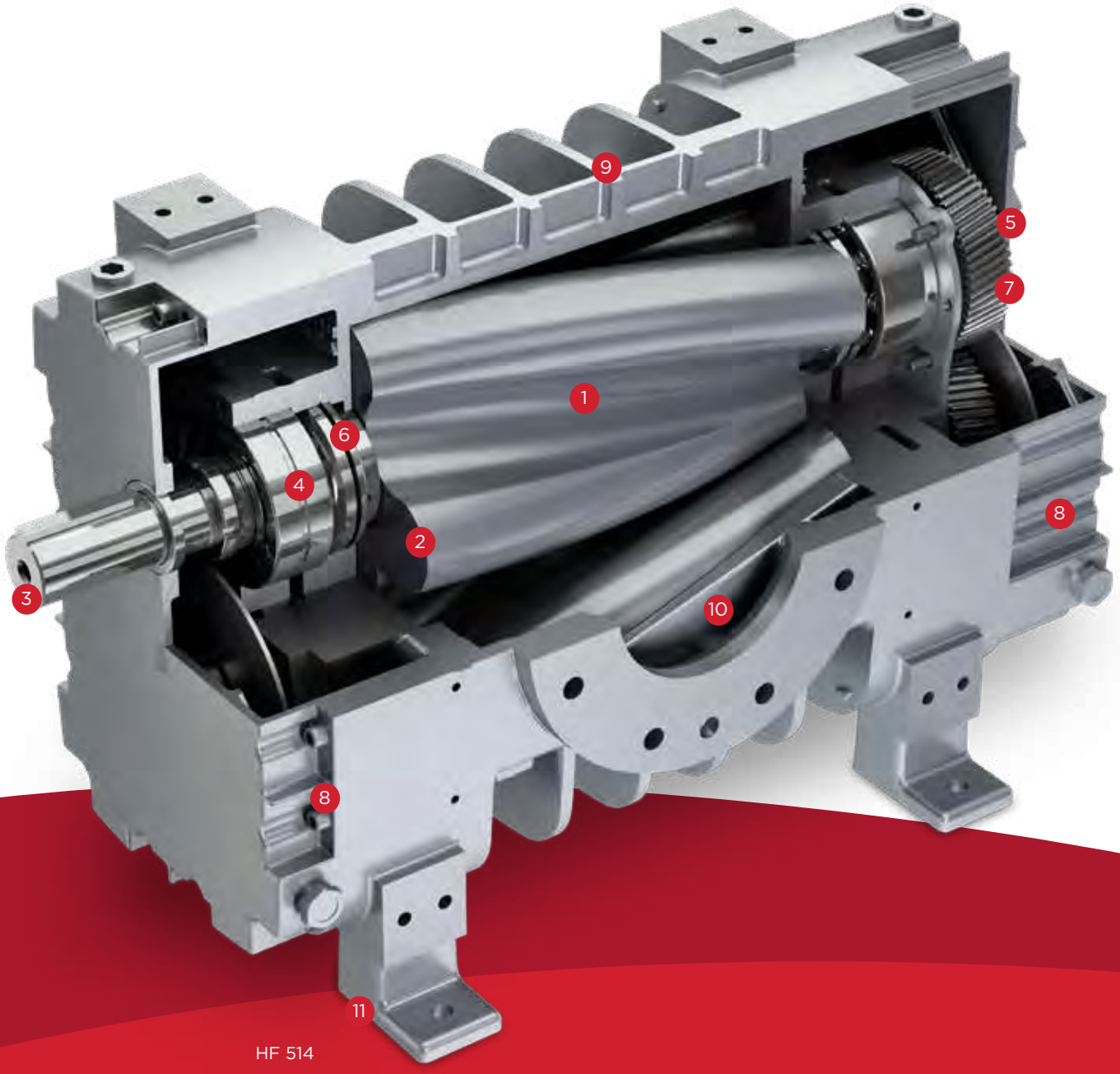
HeliFlow provides more consistent flow variation, reducing the potential for damage to downstream valves and instrumentation.

Higher Reliability

Discharge pressure pulsation causes axial thrust and higher variations in torque resulting in reduced bearing life. The HeliFlow smooth pulse operation extends the life of the blower.

It's all about...

an Innovative Design



HF 514

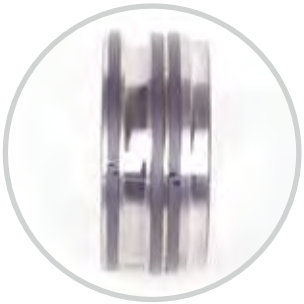
HeliFlow Design Advantages

1. Innovative, proprietary, smooth-running, helical rotor profile significantly reduces pulsations and discharge noise levels for quieter operation

2. Solid rotor design eliminates the potential for vibration caused when hollow rotors become unbalanced due to build-up of ingested material inside the rotor cavities
   - Rotors and shafts are machined from high-strength ductile iron and are dynamically balanced to ISO Grade 6.3 as standard
3. Large diameter shafts provide superior overhung load capacity compared to competitive models
4. Oversized spherical roller bearings for superior reliability
   - Precision fit bearings mounted on large diameter shafts provide longer blower service life

5. Refined timing and gear locking device
   - Grip rings expand against the bore of the gear and compress on the shaft for a secure, mechanical shrink fit
   - 4″ & 8″ models use tapered press fit gears

6. Advanced piston ring oil and air seals provide leak-free operation
   - 1 air and 2 oil seals
   - 2 air and 2 oil seals (8″ model)



7. Helical alloy steel timing gears, featured on 5″ & 6″ models provide quiet and smooth mechanical operation at all speeds

8. Dual splash lubrication for reduced maintenance intervals and superior durability
9. The single piece cylinder incorporates large external fins for heat dissipation and structural integrity
10. The unique triangular tuned ports and extra cylinder mass provides greater strength and noise attenuation
11. Flexible design allows mounting feet to be attached inward or outward based on installation requirements (not available on 8″ model)
    - Offers the ability to connect units in a variety of configurations

Raising the Bar with Cutting Edge Technology

It's all about...

the Advantages

PRODUCT DESIGN	HELIFLOW 514/616/624/624/825	COMPETITOR A	COMPETITOR B	HELIFLOW ADVANTAGES
CYLINDER & RIB DESIGN	One piece with integral ribs	One piece without ribs	One piece without ribs	■ Noise & pulsation dampening ■ Improves heat dissipation ■ Reduces stress on cylinder ■ Ensures better tip clearance accuracy
DRIVE & GEAR END BEARINGS	Spherical roller	Cylindrical roller (drive) Double row ball (gear)	Cylindrical roller	■ Increases bearing life ■ Better equipped to handle radial & axial loads commonly caused by misaligned V-belt drives
GEAR TYPE	Helical	Helical	Spur	■ Quiet & smooth mechanical operation ■ Reduces backlash ■ Allows tighter clearances
GEAR ATTACHMENTS	Grip rings Press fit gears (825)	Keyed interference fit	Taper gear fit	■ Improves reliability & eliminates timing loss ■ Easier to rebuild ■ Easily adjustable & release-able mechanical shrink fit
ROTOR PROFILE	Solid, Helical Tri-Lobe	Hollow, Dual-Lobe	Hollow, Dual-Lobe	■ Reduces noise & pulsations ■ Improves blower life ■ Eliminates the potential for unbalanced rotors due to product contamination
OIL SEALS	Two piston ring seals with slinger & groove	Lip seal	Lip seal	■ Superior oil sealing ■ Dependable supply of oil-free air ■ Extends maintenance intervals

PRODUCT DESIGN	HELIFLOW 514/616/624/624/825	COMPETITOR A	COMPETITOR B	HELIFLOW ADVANTAGES
MAX. OVERHUNG LIMIT (IN-LBS)	514 = 8100 616/624 = 13500 825 = 19,500	3200 <7999 18,000	1600 <7999 NA	■ More resistant to overhung loads ■ Will not require a jack shaft at higher HP
PRESSURE CAPABILITY (PSIG)	514 = 15 624 = 12 825 = 15	10 10 15	13 10 NA	■ Increased pressure capability
TEMPERATURE RISE LIMITS (°F)	624 = 250 825 = 265	230 230	230 NA	■ Improved ability to withstand extreme operating conditions
APPROXIMATE WEIGHT (LBS)	514 = 667 616 = 865 624 = 1145 825 = 1,820	410 650 775 1,330	615 650 775 NA	■ Extra cylinder mass for reduced noise & pulsations ■ More robust design

It's all about...

the Applications

THE HELIFLOW PROVIDES REVOLUTIONARY

Sound Levels | Durability | Performance

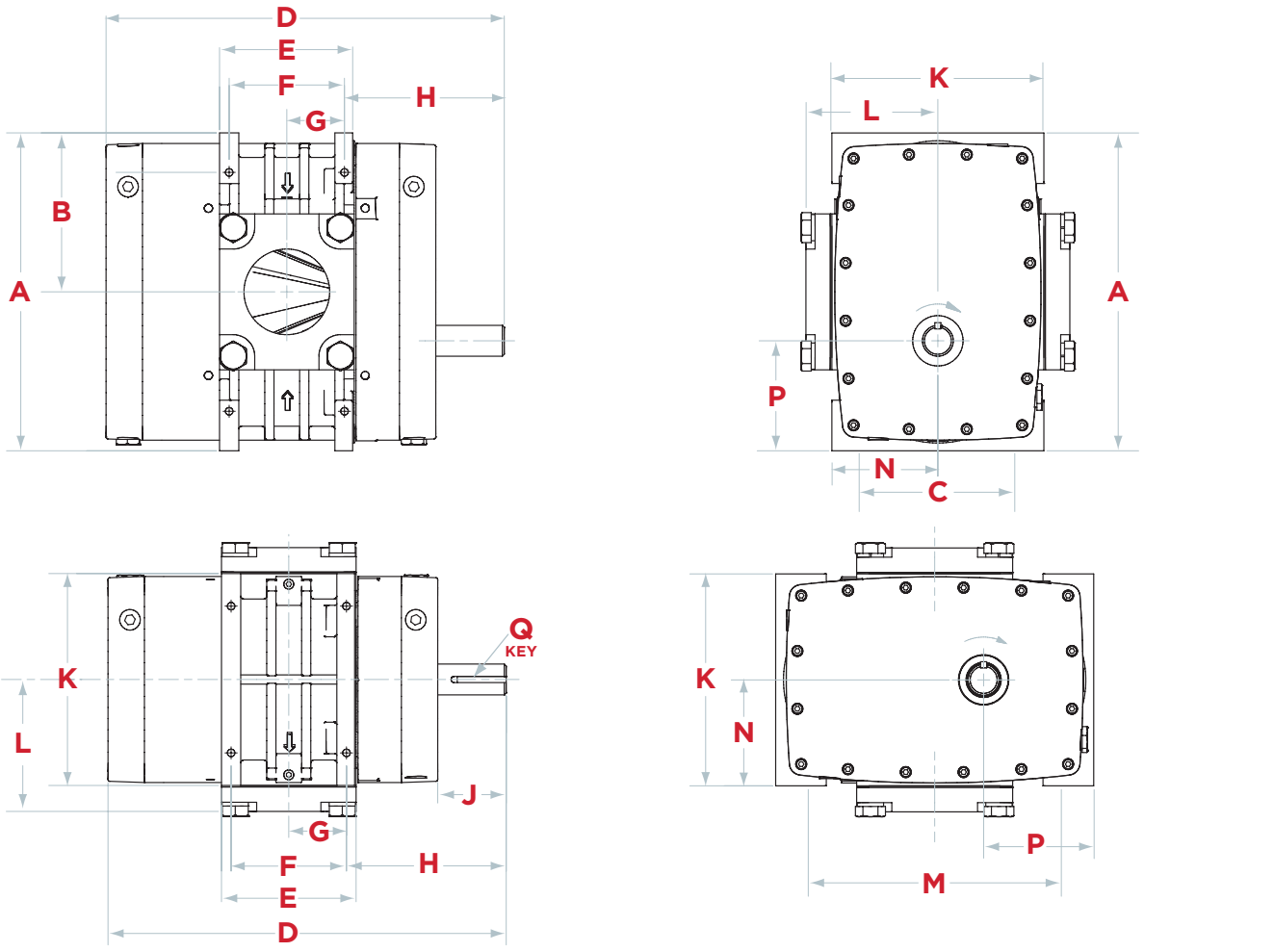
Ideal Applications:

- Wastewater
- Carpet Cleaning
- Pneumatic Conveying
- Milling
- Plastics ...and MANY more!

406 & 408 Dimensional Data

MODEL	WEIGHT	SHAFT DIAM.	A	B	C	D	E	F	G	H	J	K	L	M	N	P	Q
HF 406	173	1.25	13.0	6.5	6.0	16.27	5.5	4.71	2.36	6.53	2.8	8.66	5.39	9.76	4.33	4.5	0.25 × 0.25 × 2.0
HF 408	201	1.25	13.0	6.5	6.0	18.77	7.94	7.21	3.61	6.53	2.8	8.66	6.36	9.76	4.33	4.5	0.25 × 0.25 × 2.0

Dimensions shown in inches. Weights are in pounds and approximate (packaging materials included).
Dimensions for installation purposes provided upon request.
406 = 3" NPT Flange, 408 = 4" NPT Flange; Mounting holes 3/8–16 UNC



406 & 408 Performance Data

PRESSURE

MODEL	RPM	5 PSI		7 PSI		10 PSI		12 PSI		15 PSI	
		CFM	BHP	CFM	BHP	CFM	BHP	CFM	BHP	CFM	BHP
HF 406	1760	147	4.7	136	6.4	120	9.0	111	10.8		
	2190	198	6.0	187	8.2	171	11.5	161	13.8		
	2620	248	7.6	236	10.3	220	14.3	211	17.0	198	21.0
	3600	357	12.0	345	15.7	328	21.3	318	25.1	305	30.7
	4000	399	14.2	387	18.3	370	24.5	360	28.7	346	35.0
HF 408	1760	223	7.1	211	9.7	193	13.4	182	15.7	170	20.1
	2190	297	9.2	284	12.5	265	17.2	253	20.2	240	25.6
	2620	369	11.5	356	15.4	336	21.1	324	24.8	307	31.4
	3600	529	16.8	515	22.3	493	30.3	479	35.5	458	45.1
	4000	592	19.2	577	25.3	555	34.2	541	40.0	516	50.5

VACUUM

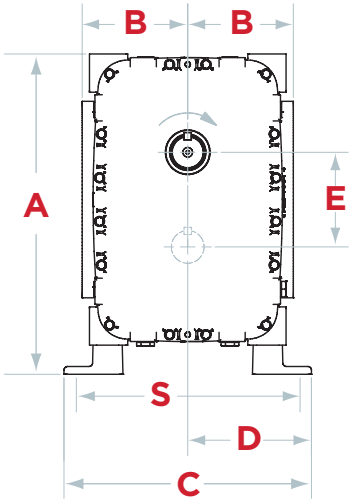
MODEL	RPM	10 inHG		12 inHG		14 inHG		16 inHG	
		CFM	BHP	CFM	BHP	CFM	BHP	CFM	BHP
HF 406	1760	135	4.2	125	5.0	113	5.8		
	2190	187	5.5	176	6.5	164	7.5	152	8.5
	2620	236	7.0	226	8.2	214	9.4	201	10.6
	3600	345	11.0	333	12.7	321	14.4	308	16.1
	4000	387	13.0	375	14.8	362	16.7	349	18.6
HF 408	1760	217	6.3	204	7.6	189	8.9		
	2190	292	8.1	278	9.6	264	11.1	247	12.8
	2620	364	10.1	351	11.8	337	13.6	321	15.4
	3600	523	15.3	511	17.5	497	19.8	482	22.1
	4000	584	17.7	573	20.1	560	22.6	545	25.1

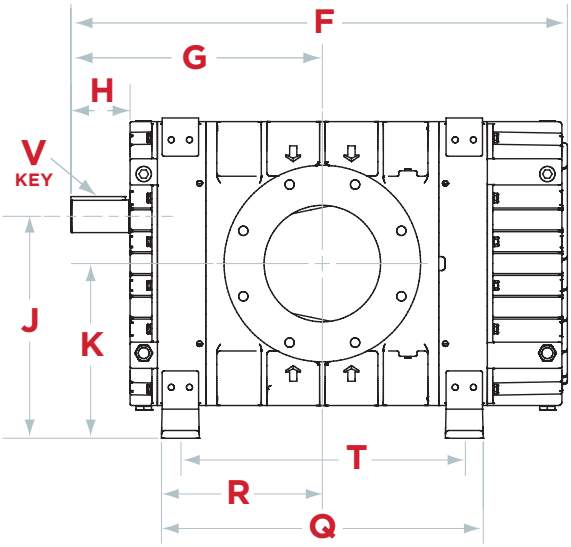
Performance based on inlet air at standard temperature of 68° F, an ambient pressure of 14.7 psia and 36% relative humidity.
For performance at non-standard conditions, contact your authorized Gardner Denver representative.

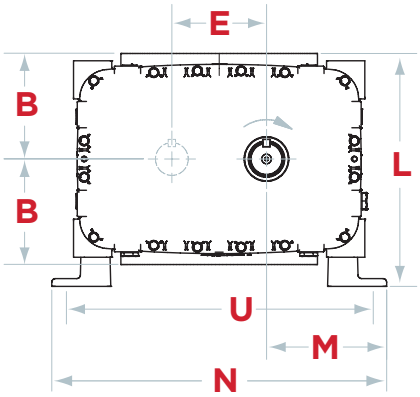
412, 514, 616 & 624 Dimensional Data

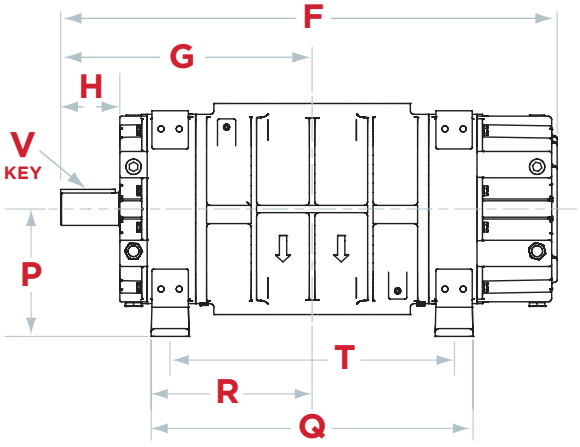
MODEL	WEIGHT	SHAFT DIAM.	A	B	C	D	E	F	G	H	J	K	L	M	N	P	Q	R	S	T	U	V
HF 412	291	1.5	13.32	4.81	9.62	4.81	4	23.98	13.29	3.89	8.66	6.66	9.62	4.66	13.32	4.81	13.32	6	7	10.75	11	.375 × .375 × 3.50
HF 514	667	1.875	19.1	6.37	15.0	7.5	5.5	31.6	16.29	3.53	12.0	10.56	14.18	7.5	20.5	7.81	19.92	9.96	13.0	17.31	18.5	0.5 × 0.5 × 3.25
HF 616	866	2.25	22.0	7.25	17.0	8.5	6.5	34.1	17.27	4.07	15.25	12.0	16.0	8.25	23.0	8.75	22.11	11.05	15.0	19.5	21.0	0.5 × 0.5 × 3.75
HF 624	1144	2.25	22.0	7.25	17.0	8.5	6.5	42.1	21.27	4.07	15.25	12.0	16.0	8.25	23.0	8.75	30.11	15.05	15.0	27.5	21.0	0.5 × 0.5 × 3.75

Dimensions shown in inches. Weights are in pounds and approximate. Dimensions for installation purposes provided upon request.
412 = 6" flange, 514 = 6" flange, 616 = 8" flange (150# flange connections 8x ¾ -10 UNC); 624 = 10" flange (150# flange connections 12x 7/8 -9 UNC);
Hold down bolt hole diameter = .59"









412, 514, 616, 624 Performance Data

PRESSURE

MODEL	RPM	5 PSI		7 PSI		10 PSI		12 PSI		15 PSI	
		CFM	BHP	CFM	BHP	CFM	BHP	CFM	BHP	CFM	BHP
HF 412	1760	349	10.8	331	14.4	305	20.3	288	24.4		
	2190	460	14.0	442	18.7	415	26.0	398	31.1	374	39.1
	2620	570	17.5	551	23.1	523	31.9	506	38.1	481	47.6
	3600	815	25.8	795	33.8	766	46.0	747	54.4	721	67.3
	4000	913	29.5	892	38.4	863	52.0	844	61.3	817	75.6
	4500	1034	34.2	1013	44.3	982	59.6	963	70.1	935	86.1
HF 514	1000	252	9.5	224	13.0	187	18.5	165	22.2		
	1600	519	15.2	492	21.1	457	29.9	435	35.9	407	45.0
	2200	783	21.5	757	29.6	723	41.9	702	50.1	676	62.6
	2800	1043	28.4	1019	38.8	986	54.4	966	65.0	941	80.9
	3300	1258	34.6	1234	46.8	1202	65.3	1184	77.7	1160	96.5
	4000	1554	43.8	1532	58.7	1502	81.2	1485	96.3	1463	119.0
HF 616	1000	444	16.3	405	21.7	353	30.1	322	35.8		
	1600	879	25.4	840	34.7	787	48.7	757	58.3	717	72.8
	2200	1305	36.3	1265	49.3	1212	69.1	1180	82.4	1140	102.7
	2800	1720	48.9	1679	65.7	1625	91.2	1594	108.3	1553	134.3
	3300	2058	60.7	2017	80.7	1962	110.9	1930	131.2	1889	161.9
HF 624	1000	672	23.2	619	31.5	546	44.5	502	53.6		
	1600	1310	37.7	1258	51.8	1187	73.5	1144	88.3		
	2200	1946	54.3	1896	74.1	1826	104.5	1784	125.0		
	2800	2581	72.7	2531	98.3	2464	137.3	2423	163.7		
	3300	3108	89.6	3060	120.0	2994	166.2	2954	197.4		

VACUUM

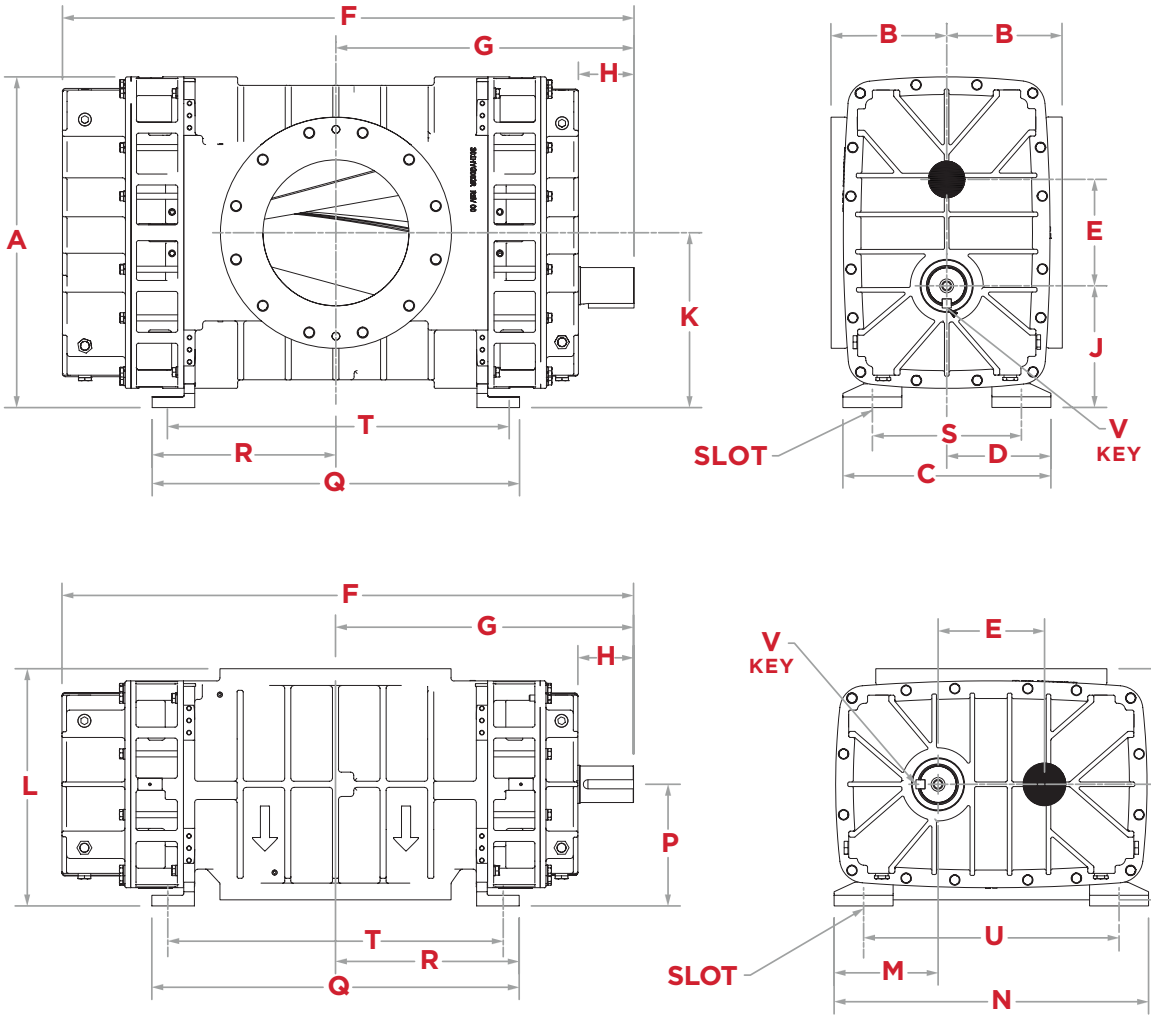
MODEL	RPM	10 inHG		12 inHG		14 inHG		16 inHG	
		CFM	BHP	CFM	BHP	CFM	BHP	CFM	BHP
HF 412	1760	328	10.5	306	12.4	282	14.3		
	2190	439	13.4	418	15.7	394	17.9	369	20.0
	2620	549	16.6	528	19.2	504	21.7	479	24.2
	3600	791	24.9	771	28.2	748	31.5	723	34.8
	4000	887	28.7	867	32.3	844	36.0	820	39.6
	4500	1005	33.7	985	37.8	962	41.8	938	45.9
HF 514	1000	237	9.3	211	11.2	185	13.1		
	1600	503	14.9	478	17.8	453	20.7	427	23.7
	2200	766	20.9	743	24.8	719	28.8	694	32.8
	2800	1028	27.3	1006	32.3	983	37.3	960	42.4
	3300	1244	33.1	1223	38.9	1201	44.8	1179	50.7
	4000	1544	41.7	1525	48.7	1504	55.8	1484	63.0
HF 616	1000	468	15.8	419	18.5	357	21.2	284	23.9
	1600	904	25.8	863	30.1	810	34.4	745	38.8
	2200	1334	36.7	1302	42.7	1258	48.7	1201	54.8
	2800	1760	48.8	1736	56.4	1700	64.1	1653	71.8
	3300	2111	59.6	2094	68.7	2065	77.7	2025	86.8
HF 624	1000	657	23.8	608	27.7	562	31.2	520	34.5
	1600	1341	38.4	1299	45.0	1261	51.4	1226	57.5
	2200	2013	53.8	1979	63.3	1949	72.4	1921	81.3
	2800	2675	70.0	2648	82.4	2625	94.4	2605	106.0
	3300	3218	84.3	3197	98.9	3180	113.3	3167	127.3

Performance based on inlet air at standard temperature of 68° F, an ambient pressure of 14.7 psia and 36% relative humidity.
For performance at non-standard conditions, contact your authorized Gardner Denver representative.

817, 825 Dimensional Data

MODEL	WEIGHT	SHAFT DIAM.	A	B	C	D	E	F	G	H	J	K	L	M	N	P	Q	R	S	T	U	V	SLOT
HF 817	1400	3	27.18	9.50	17.10	8.55	8.75	38.99	20.51	4.58	10	14.38	19.50	8.55	25.85	10	22.20	11.10	15	20	23	.75×.75×4.13	1.00×1.38
HF 825	1820	3	27.18	9.50	17.10	8.55	8.75	46.99	24.51	4.58	10	14.38	19.50	8.55	25.85	10	30.20	15.10	15	28	23	.75×.75×4.13	1.00×1.38

Dimensions shown in inches. Weight is in pounds and approximate.
HF817: 10" Flange for Inlet/discharge connections (150 # flange connections). Hold down slot diameter 1.00"
HF825: 12" Flange for Inlet/discharge connections (150 # flange connections). Hold down slot diameter 1.00"



817, 825 Performance Data

PRESSURE

MODEL	RPM	5 PSI		7 PSI		10 PSI		12 PSI		15 PSI		18 PSI	
		CFM	BHP	CFM	BHP	CFM	BHP	CFM	BHP	CFM	BHP	CFM	BHP
HF 817	1000	1006	30.7	965	42.5	910	60.2	879	72	838	89.6	806	107.2
	1200	1281	36.5	1241	50.8	1187	72.3	1155	86.5	1116	108	1085	129.3
	1500	1690	46.3	1650	64.4	1597	91.5	1567	109.5	1528	136.5	1499	163.6
	1800	2093	57.3	2054	79.2	2003	112	1973	133.8	1936	166.5	1907	199.1
	2200	2622	74	2585	100.9	2535	141.2	2507	168	2471	208.2	2444	248.5
	2650	3207	95.3	3171	128	3124	176.7	3096	209.1	3062	257.9	3037	306.6
HF 825	1000	1470	44.4	1400	61.5	1310	87.7	1255	105.3	1180	132.1		
	1200	1870	53.9	1805	74.7	1715	106.1	1665	127.5	1590	159.4		
	1500	2460	69.0	2400	95.1	2315	134.6	2265	161.1	2200	201.4		
	1800	3045	85.1	2985	116.5	2905	164.0	2860	196.1	2800	244.5		
	2200	3805	107.9	3750	146.5	3675	204.7	3630	243.7	3575	302.8		
	2500	4365	126.1	4310	169.9	4240	236.2	4200	280.7	4150	348.0		

VACUUM

MODEL	RPM	10 inHG		12 inHG		14 inHG		16 inHG		17 inHG	
		CFM	BHP	CFM	BHP	CFM	BHP	CFM	BHP	CFM	BHP
HF 817	1000	981	31.5	935	38.6	885	44.9	835	48.6		
	1200	1252	37.1	1205	45.2	1156	52.8	1106	58.1		
	1500	1657	46	1611	55.7	1562	65.1	1512	73		
	1800	2063	55.5	2017	66.7	1967	78	1918	88.5	1895	92.3
	2200	2603	69	2557	82.2	2508	96.2	2459	109.7	2436	115.8
	2650	3211	85.3	3165	100.9	3116	117.7	3067	135	3045	143.3
HF 825	1000	1415	46.5	1340	56.5	1265	64.6	1195	67.6		
	1200	1820	55.3	1750	67.0	1675	77.1	1605	82.7		
	1500	2420	68.6	2350	82.7	2280	96.0	2210	105.5		
	1800	3010	82.1	2940	98.6	2870	114.9	2800	128.4	2775	132.6
	2200	3785	100.5	3715	120.3	3645	140.7	3575	159.3	3550	166.8
	2500	4350	114.5	4285	136.8	4215	160.2	4150	182.9	4120	192.6

Performance based on inlet air at standard temperature of 68° F, an ambient pressure of 14.7 psia and 36% relative humidity.
For performance at non-standard conditions, contact your authorized Gardner Denver representative.

NEW!

HeliFlow 825 Series provides:

- Higher Flow Capabilities
- Unmatched Noise Reduction
- Optimized Heat Transfer
- Increased Shaft Strength vs. the Competition

The leader in every market we serve

by continuously improving all business processes

with a focus on innovation and velocity

Gardner Denver®

Gardner Denver, Inc.

1800 Gardner Expressway
Quincy, IL 62305
866-428-4890
www.gardnerdenver.com/gdproducts

PD-HF-IND 11th Ed. 9/19

Please recycle after use.

QuickPik

Specified Max Blower Capacity

HeliFlow - 408

Product Information

CORRECTED VALUES	ORIGINAL UNITS	ENGLISH UNITS	METRIC UNITS
Ambient Pressure	1020 ALTI-FT	14.151 PSIA	0.976 bar a
Elevation	1020 ALTI-FT	1020 ALTI-FT	311 alti-m
Inlet Pressure	14.151 PSIA	-0.000 PSIG	0 bar g
Inlet Pressure Loss	0.3 PSIG	0.300 PSIG	0.021 bar g
Inlet Temp	100 F	100 °F	38 °C
Inlet Flow	324 SCFM	381 ICFM	648 m³/h
Discharge Pressure	8.2 PSIG	8.200 PSIG	0.565 bar g
Discharge Pressure Loss	0.2 PSIG	0.200 PSIG	0.014 bar g
MEASURED VALUES	**ORIGINAL UNITS**	**ENGLISH UNITS**	**METRIC UNITS**
Speed	2842 RPM	2842 RPM	2842 RPM
RPM % Of Max	71	71	71
Power	20.5 HP	20.5 HP	15.287 kW
Discharge Temp	233 °F	233 °F	112 °C
Temp % of Max	66	66	66
Noise	82 dBa	82 dBa	82 dBa
Pressure % of Max	58	58	58
Adiabatic Efficiency	58.69%	58.69%	58.69%

PHYSICAL	
Weight	201 lbs.
Gear Diameter / Center Distance	4 in.
Connection Size	4i/4d in.
Case Length	8 in.
WR^2	1.3 lb-ft^2
Orientation	horizontal

PERFORMANCE	
Max Delta P	15 PSI
Max Temp	350 °F
Max Speed	4000 RPM
Min Speed	955 RPM
Max Case Pressure	25 PSIG
Max Delta T	250 °F

Created: 05-31-2023

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AMBIENT GAS PARAMETERS	ENGLISH UNITS	METRIC UNITS
Molecular Weight	28.404 lbm/lbmol	28.404 kg/kgmol
R Value	54.393 ft.lbf/lbm.R	0.293 kJ/kg.K
Density	0.067 lbm/ft ^{3}	1.072 kg/m^3

GAS MIX:	VOL
Air	100%

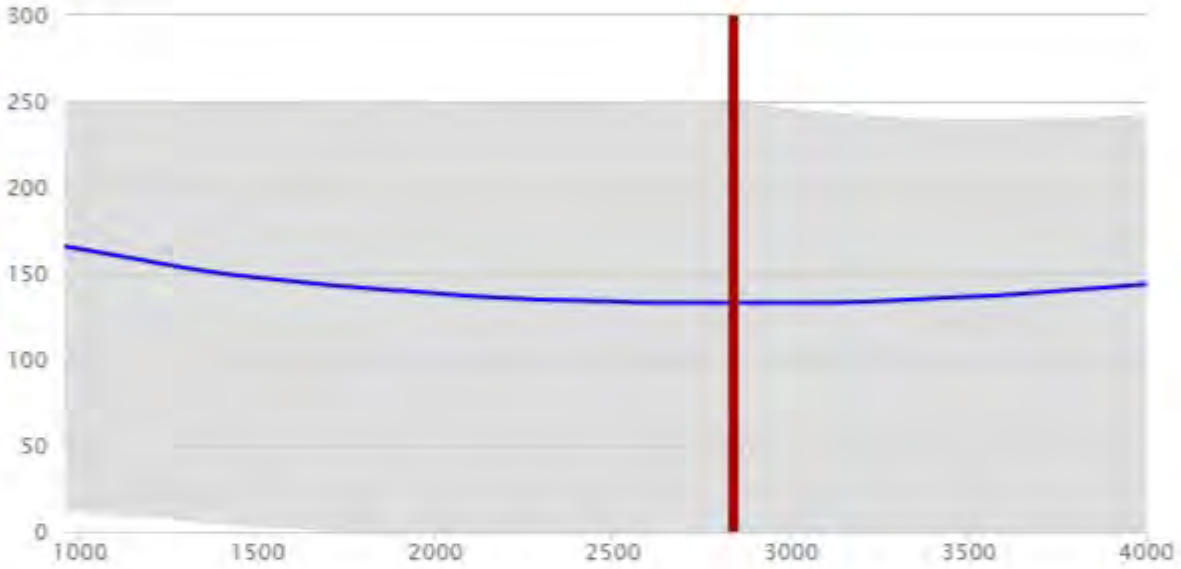
Performance Curves

Temperature Rise

DEFINED CONDITIONS
133 F

RPM
2842

Published Data
Defined Conditions

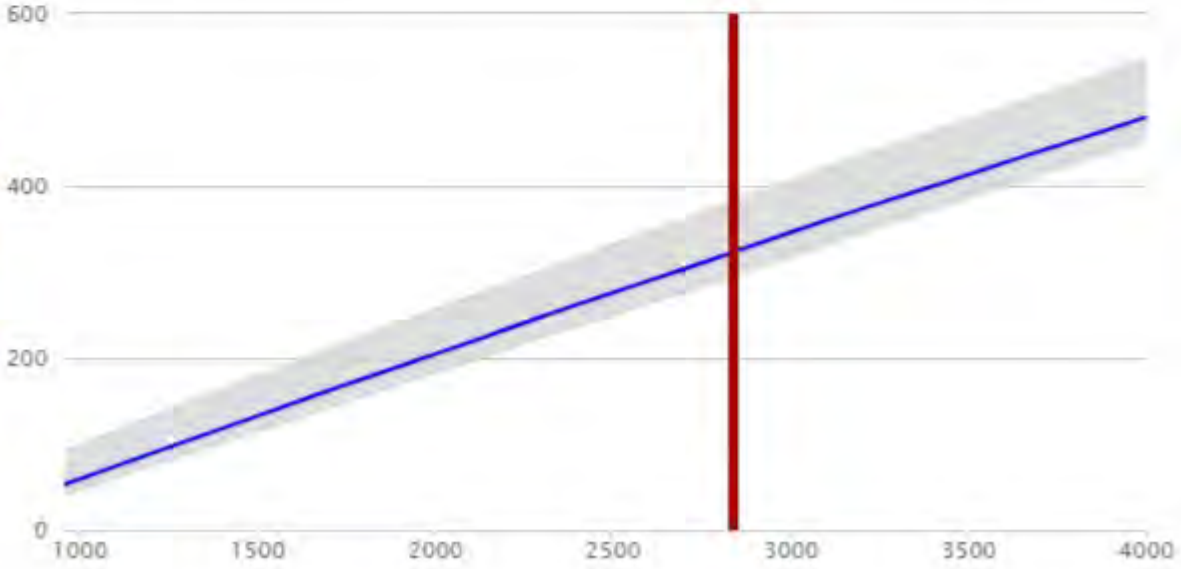


Flow

DEFINED CONDITIONS
323 SCFM

RPM
2842

Published Data
Defined Conditions



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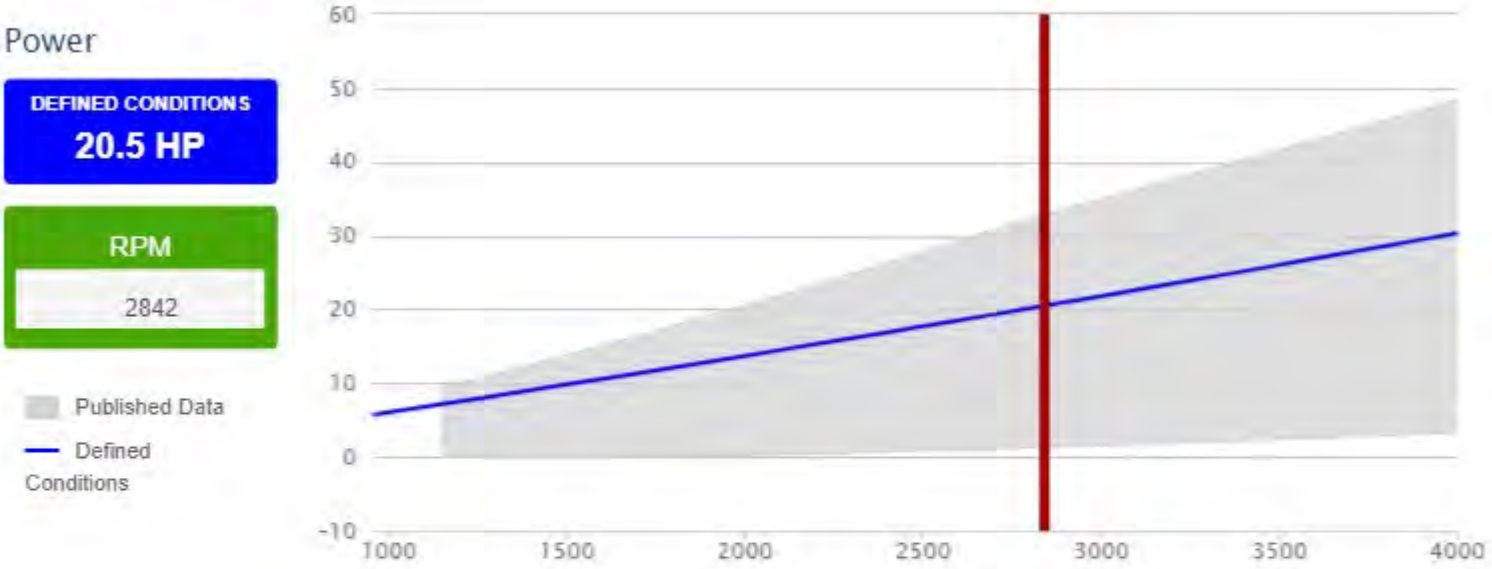
Performance Curves

Power

DEFINED CONDITIONS
20.5 HP

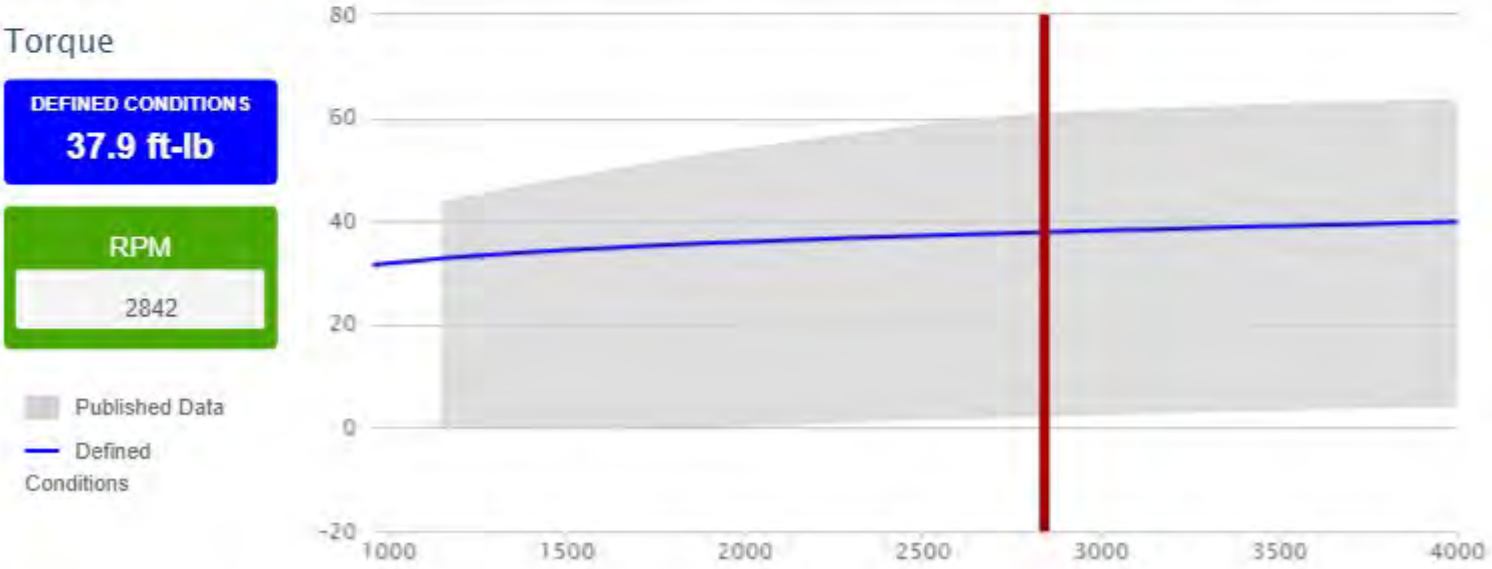
RPM
2842



Torque

DEFINED CONDITIONS
37.9 ft-lb

RPM
2842



Created: 05-31-2023

QuickPik

Sutorbilt Legend - 6MDSL

Product Information

CORRECTED VALUES	ORIGINAL UNITS	ENGLISH UNITS	METRIC UNITS
Ambient Pressure	1020 ALTI-FT	14.151 PSIA	0.976 bar a
Elevation	1020 ALTI-FT	1020 ALTI-FT	311 alti-m
Inlet Pressure	14.151 PSIA	-0.000 PSIG	0 bar g
Inlet Pressure Loss	0.3 PSIG	0.300 PSIG	0.021 bar g
Inlet Temp	100 F	100 °F	38 °C
Inlet Flow	290 SCFM	341 ICFM	580 m³/h
Discharge Pressure	8.2 PSIG	8.200 PSIG	0.565 bar g
Discharge Pressure Loss	0.2 PSIG	0.200 PSIG	0.014 bar g
MEASURED VALUES	**ORIGINAL UNITS**	**ENGLISH UNITS**	**METRIC UNITS**
Speed	1253 RPM	1253 RPM	1253 RPM
RPM % Of Max	53	53	53
Power	19.8 HP	19.8 HP	14.765 kW
Discharge Temp	240 °F	240 °F	116 °C
Temp % of Max	74	74	74
Noise	84 dBa	84 dBa	84 dBa
Pressure % of Max	62	62	62
Adiabatic Efficiency	54.43%	54.43%	54.43%

PHYSICAL	
Weight	330 lbs.
Gear Diameter / Center Distance	6 in.
Connection Size	5i/5d in.
Case Length	8 in.
WR^2	5.09 lb-ft^2
Orientation	horizontal

PERFORMANCE	
Max Delta P	14 PSI
Max Temp	325 °F
Max Speed	2350 RPM
Min Speed	637 RPM
Max Case Pressure	25 PSIG
Max Delta T	225 °F

Created: 05-31-2023

QuickPik

AMBIENT GAS PARAMETERS	ENGLISH UNITS	METRIC UNITS
Molecular Weight	28.404 lbm/lbmol	28.404 kg/kgmol
R Value	54.393 ft.lbf/lbm.R	0.293 kJ/kg.K
Density	0.067 lbm/ft ^{3}	1.072 kg/m^3

GAS MIX:	VOL
Air	100%

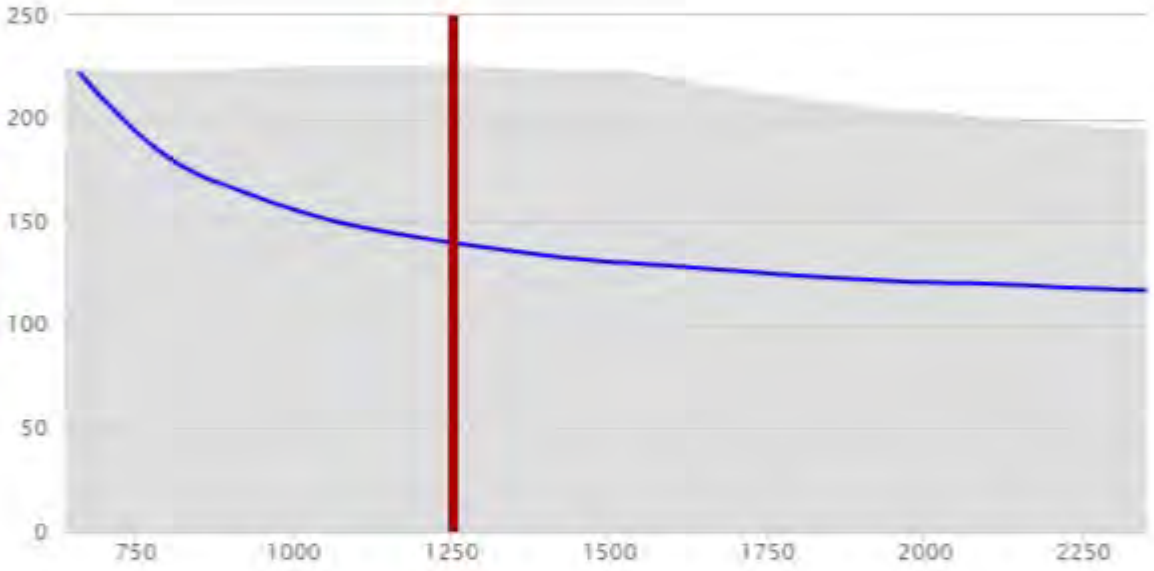
Performance Curves

Temperature Rise

DEFINED CONDITIONS
140 F

RPM
1253

Published Data
Defined Conditions

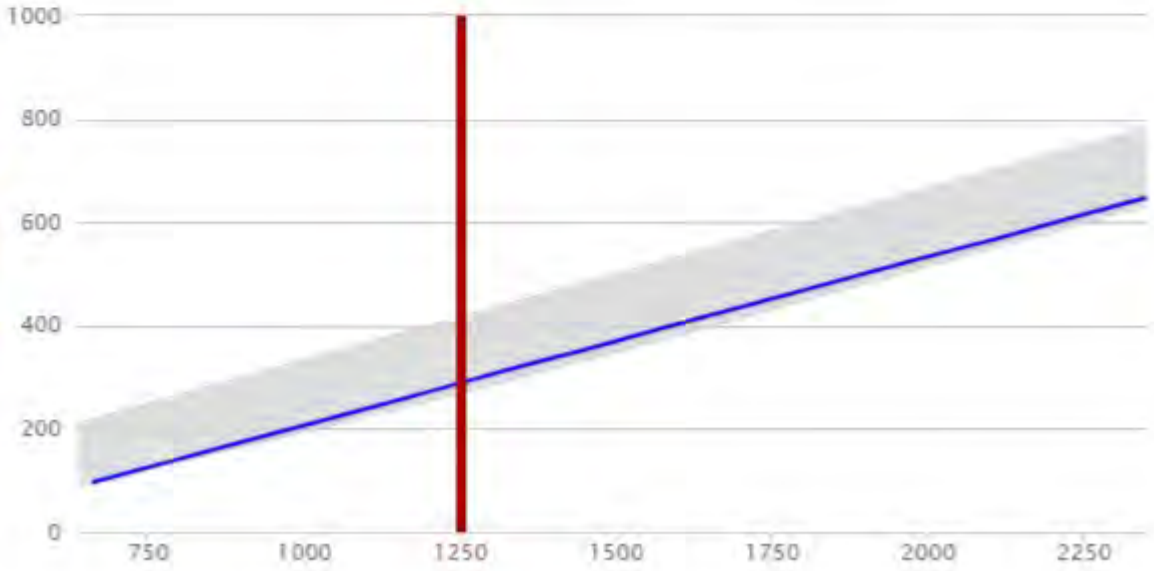


Flow

DEFINED CONDITIONS
290 SCFM

RPM
1253

Published Data
Defined Conditions



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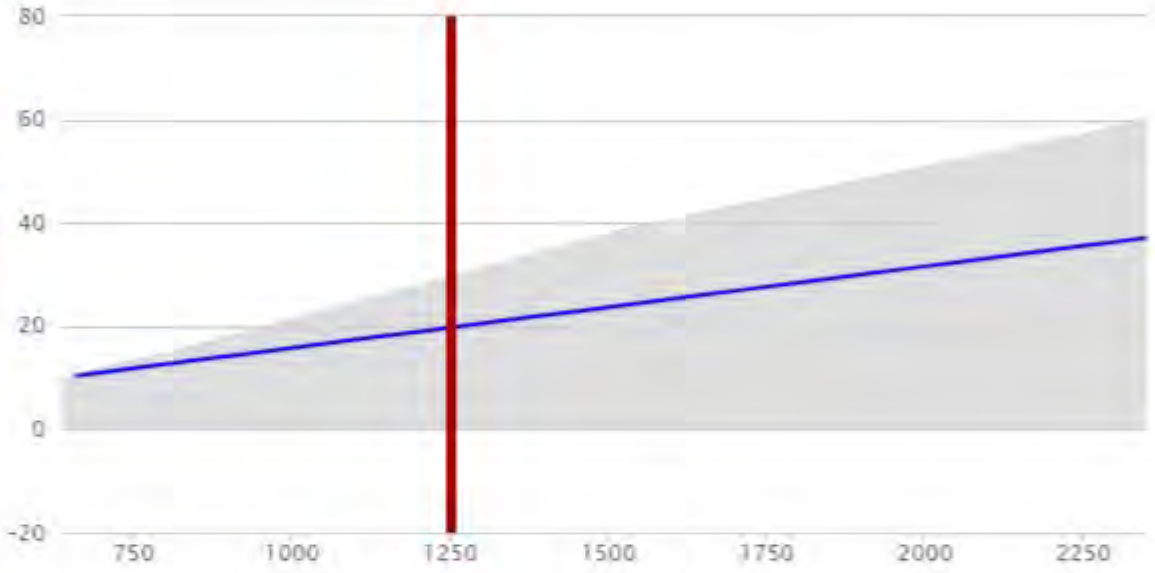
Performance Curves

Power

DEFINED CONDITIONS
19.8 HP

RPM
1253



Published Data
Defined Conditions

Torque

DEFINED CONDITIONS
83.0 ft-lb

RPM
1253

Published Data
Defined Conditions

Created: 05-31-2023

QuickPik

Anticipated Performance

Sutorbilt Legend - 6MDSL

Product Information

CORRECTED VALUES	ORIGINAL UNITS	ENGLISH UNITS	METRIC UNITS
Ambient Pressure	1020 ALTI-FT	14.151 PSIA	0.976 bar a
Elevation	1020 ALTI-FT	1020 ALTI-FT	311 alti-m
Inlet Pressure	14.151 PSIA	-0.000 PSIG	0 bar g
Inlet Pressure Loss	0.3 PSIG	0.300 PSIG	0.021 bar g
Inlet Temp	100 F	100 °F	38 °C
Inlet Flow	250 SCFM	294 ICFM	500 m³/h
Discharge Pressure	8.2 PSIG	8.200 PSIG	0.565 bar g
Discharge Pressure Loss	0.2 PSIG	0.200 PSIG	0.014 bar g
MEASURED VALUES	**ORIGINAL UNITS**	**ENGLISH UNITS**	**METRIC UNITS**
Speed	1131 RPM	1131 RPM	1131 RPM
RPM % Of Max	48	48	48
Power	17.9 HP	17.9 HP	13.348 kW
Discharge Temp	246 °F	246 °F	119 °C
Temp % of Max	76	76	76
Noise	83 dBa	83 dBa	83 dBa
Pressure % of Max	62	62	62
Adiabatic Efficiency	52.03%	52.03%	52.03%

PHYSICAL	
Weight	330 lbs.
Gear Diameter / Center Distance	6 in.
Connection Size	5i/5d in.
Case Length	8 in.
WR^2	5.09 lb-ft^2
Orientation	horizontal

PERFORMANCE	
Max Delta P	14 PSI
Max Temp	325 °F
Max Speed	2350 RPM
Min Speed	637 RPM
Max Case Pressure	25 PSIG
Max Delta T	225 °F

Created: 05-31-2023

QuickPik

AMBIENT GAS PARAMETERS	ENGLISH UNITS	METRIC UNITS
Molecular Weight	28.404 lbm/lbmol	28.404 kg/kgmol
R Value	54.393 ft.lbf/lbm.R	0.293 kJ/kg.K
Density	0.067 lbm/ft ^{3}	1.072 kg/m^3

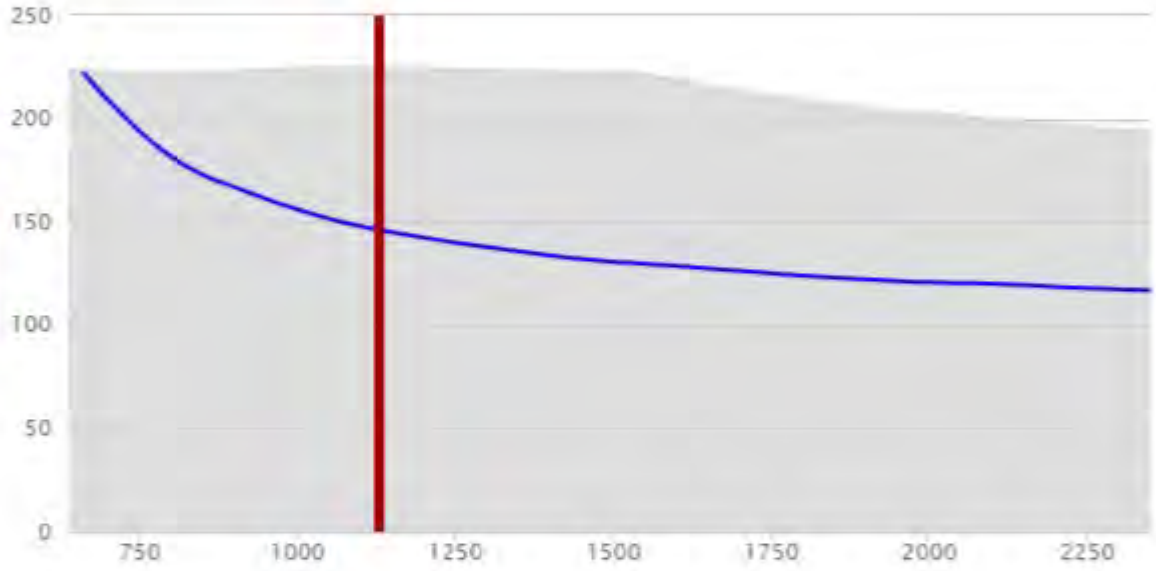
GAS MIX:	VOL
Air	100%

Performance Curves

Temperature Rise

DEFINED CONDITIONS
146 F

RPM
1131

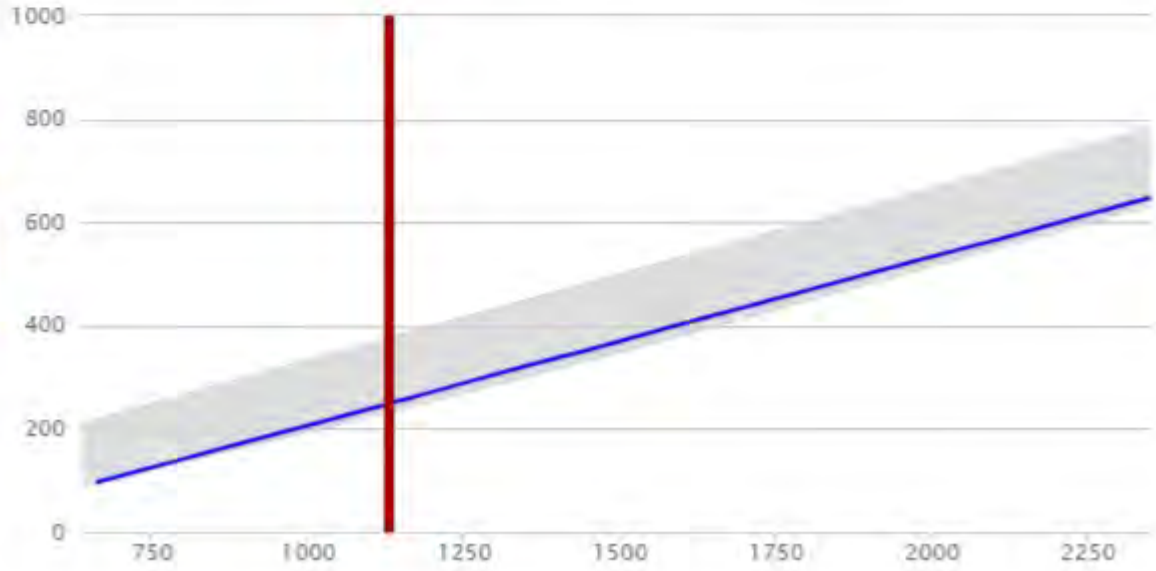


Published Data
Defined Conditions

Flow

DEFINED CONDITIONS
250 SCFM

RPM
1131



Published Data
Defined Conditions

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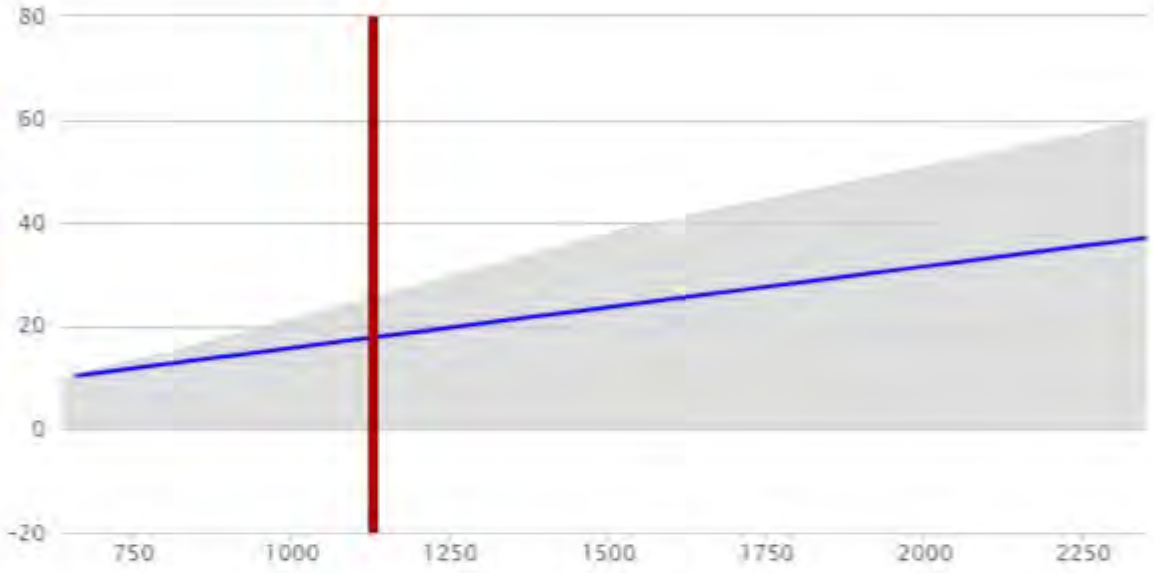
Performance Curves

Power

DEFINED CONDITIONS
17.9 HP

RPM
1131



Published Data
Defined Conditions

Torque

DEFINED CONDITIONS
83.2 ft-lb

RPM
1131

Published Data
Defined Conditions

Created: 05-31-2023

Flygt N-pump Series

SELF-CLEANING PUMPS WITH SUSTAINED HIGH EFFICIENCY

FLYGT
a xylem brand

Sustained high efficiency is priceless

Flygt N-pumps take on the toughest applications and get the job done. Every component is designed and manufactured to deliver sustained high efficiency. Thanks to the patented N-technology with its innovative self-cleaning impeller, Flygt N-pumps deliver the highest total efficiency – lowering your energy bill and reducing unplanned maintenance costs. That adds up to total peace of mind – and big savings over the long term.

Our vast fluid handling knowledge and dedication to research and development lead to technological advances and continuous improvement.

That's why our Flygt N-pumps are at work in more than a hundred thousand installations worldwide. They have proven to be the best and most reliable choice for both dry and submersible installations far and away over our competition.

Robust and reliable
Every Flygt N-pump is tested in the factory to ensure high performance and premium quality. Flygt products deliver outstanding, cost-effective performance that has been proven in applications such as:

- Wastewater
- Stormwater
- Sludge
- Industrial effluent
- Raw water
- Cooling water

THE N-PUMP ADVANTAGE

- Patented technology
- Innovative design
- Sustained high efficiency
- Self-cleaning ability
- Modular design
- Reliable
- Fewer unplanned service calls

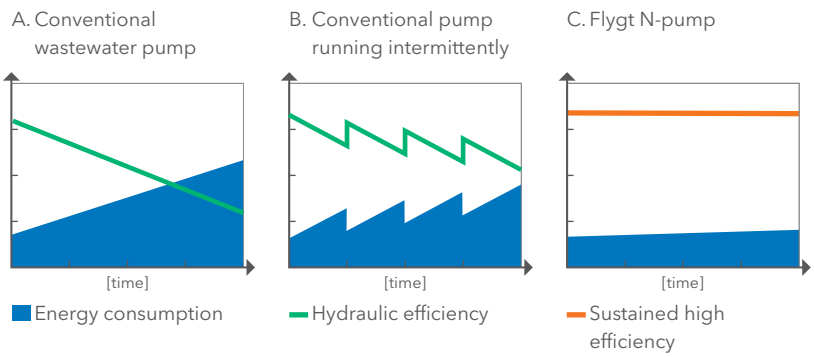
BROAD RANGE CAPACITY

- Ratings from 2.2 hp to 870 hp
- Discharges up to 20" (500 mm)
- Flows up to 16,000 US GPM (1,000 l/s)
- Heads up to 400 ft (120 m)
- Submersible and dry installations
- Every Flygt pump is performance tested in the factory
- Can handle dry solids up to 8%

Self-cleaning N-pump saves money

Sustained high efficiency

When solid objects such as stringy fibrous material and modern trash enter the inlet of a conventional pump, they tend to get caught on the leading edges of the impeller vanes. This buildup reduces the impeller's efficiency, resulting in increased power consumption (Fig. A) and generating increased energy charges.



As solids continue to build up inside the impeller, motor thermal protection can trip causing the pump to stop and leading to costly unplanned service calls. If a conventional wastewater pump runs intermittently, the solids buildup will be removed by backflushing when the pump is shut off at the end of the operating cycle. When the next cycle begins, efficiency returns to its initial value since the impeller is free from solid objects (Fig B).

The high efficiency of the Flygt N-pump is sustained over time due to its self-cleaning ability, keeping energy costs to a minimum (Fig. C).

All Flygt N-pumps have the same self-cleaning performance regardless of duty point.

THE SELF-CLEANING CONCEPT

Stage 1. Most solid objects entering the pump will pass through the impeller between the impeller vanes. If an object gets caught on the leading edge of one of the vanes, it will slide along the backswept shape towards the perimeter of the inlet.

Stage 2. The solid object will slide along the tip of the impeller vane inside the relief groove. The guide pin in the insert ring will push all types of solids away from the center of the impeller, along the leading edge and out through the relief groove.

Broad capacity range to suit your application

Flexible and modular design
Flygt N-technology enables you to tailor the hydraulics to meet the requirements of virtually any application. Choose the hardened cast iron version for typical wastewater applications and the chopper ring version for cutting long fibers or solids. The Hard-Iron™ version should be used in abrasive applications and waters that could cause erosion corrosion due to high oxygen content.

Whatever you choose, you never sacrifice pump efficiency – and you can easily switch the module if the operating conditions change.

Cast iron

Cast iron impeller with hardened edges and insert ring for typical pumping applications.

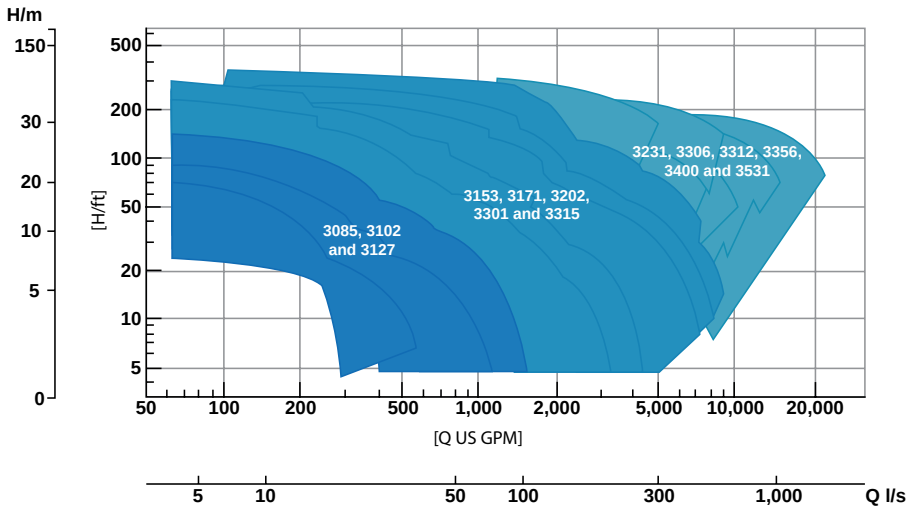
Hard-Iron™ (60 HRC)

Extra durable option for abrasive and erosion corrosion applications.

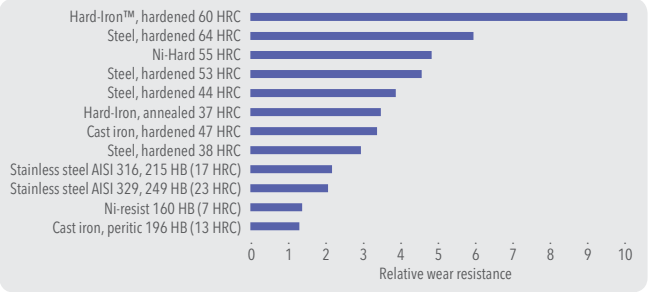
Chopper ring for cutting long fibers or solids.

Top performance with a broad capacity range

- Large capacity pumps
- Medium capacity pumps
- Low capacity pumps



Composite curves for comparison purposes only. Consult engineering data for exact flow and head capabilities.



HARD-IRON™ (60 HRC) FOR THE TOUGHEST WASTEWATER CHALLENGES

Accelerated wear tests prove that Hard-Iron™ hydraulic components keep on working efficiently with minimal wear after pumping water with a very high concentration of coarse sand (2,400 tons).

Flygt N-pumps with Hard-Iron™ components continue to deliver sustained high efficiency without clogging or erosion corrosion, prolonging lifetime by 200 percent compared to standard hardened cast iron hydraulics.

Designed and engineered for longer life

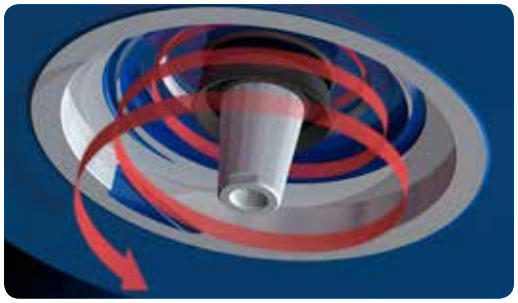
Xylem specially designs and manufactures Flygt N-pump components, such as the motor, seals and shaft, to optimize operation and prolong pump service life.

Motor
The Class H squirrel-cage induction motor delivers outstanding performance and superior heat transfer in submersible and dry installations. Heat losses are concentrated around the shrink-fitted stator, which is cooled by means of the surrounding water. The motor has a NEMA Class B maximum operating temperature rise of 80°C (176°F) to ensure long service life. All motors are capable of fully utilizing the available power while operating on a variable frequency drive.

For an even higher overall efficiency, premium efficiency motors IE3 are available.

Long-life seals
Durable tungsten carbide seals offer exceptional mechanical strength as well as superior sliding properties even when running dry. These low-friction seals withstand thousands of hours of high-pressure operation under extreme conditions without cracking, seizing up or showing signs of unacceptable wear.

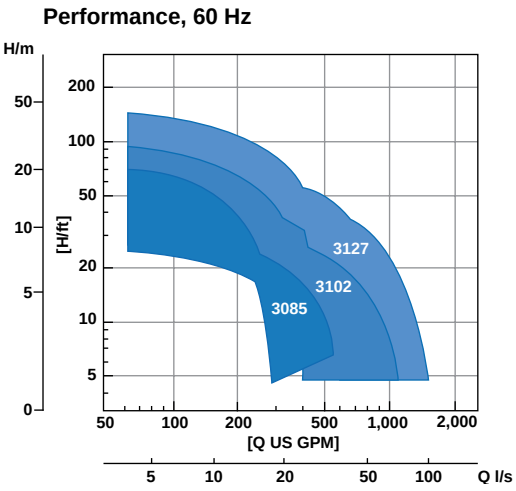
Low shaft deflection
To minimize vibration, promote quiet operation, and prolong seal and bearing life, all Flygt N-pumps feature a short shaft overhang to reduce shaft deflection.



SPIN-OUT™ SEAL PROTECTION FOR PUMPS WITH CAVITIES IN THE SEAL CHAMBER

The patented Spin-out™ design expels abrasive particles from the seal chamber, providing protection against wear of the outer seal. As an integral part of the seal chamber, Spin-out™ is as simple as it is effective.

Low capacity pumps



This series of Flygt N-pumps includes three models that handle capacities up to 1,600 US GPM (100 l/s). Like all Flygt N-pumps, these contribute to reducing the total life cycle costs of your installation.

Power ratings and size

Model	3085	3102	3127
Rating, hp	2.2–4	5–6	7.5–11
Discharge, in	3" (80 mm)	3" (80 mm)	3" (80 mm)
		4" (100 mm)	4" (100 mm)
		6" (150 mm)	6" (150 mm)

Methods of installation

P

For semi-permanent wet well installations. The pump is installed with twin guide bars on a discharge connection.

S

A semi-permanent freestanding installation. Transportable version with pipe or hose connection.

T

A vertically-mounted, permanent dry well or in-line installation with flange connections for suction and discharge pipework.

Z

A horizontally-mounted, permanent dry well or in-line installation with flange connections for suction and discharge pipework.

L

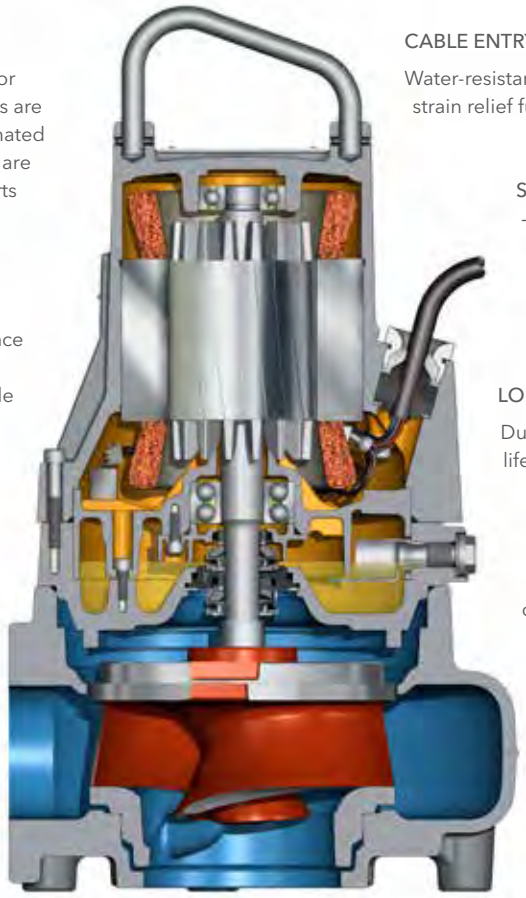
A semi-permanent installation of a pump within a vertical steel or concrete column.

BETTER HEAT TRANSFER

Our specially designed and manufactured motor provides enhanced cooling because heat losses are concentrated around the stator. Trickle impregnated in resin (Class H insulation), the stator windings are rated at 180°C (355°F) and enable up to 30 starts per hour.

COMPLIANCE

Each pump is tested and approved in accordance with national and international standards, including 60034-1 and CSA. Pumps are available in explosion-proof versions for use in hazardous environments, and are approved by the Factory Mutual, European Standard and IEC.



CABLE ENTRY

Water-resistant cable entry provides both sealing and strain relief functions to ensure a safe installation.

SENSORS

Thermal sensors embedded in the stator windings prevent overheating. Optional leakage sensors in the stator and oil housings are also available.

LONG-LIFE BEARINGS

Durable bearings provide a minimum service life of 50,000 hours.

ENDURING SEALS

The Griploc™ system consists of two sets of mechanical shaft seals that operate independently to provide double security against leakage.

Griploc™ seal

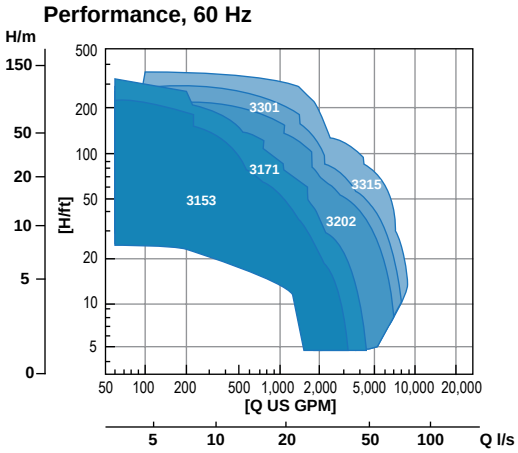
With a robust design, Griploc™ seals offer consistent performance and trouble-free operation in challenging environments. Solid seal rings minimize leakage and the patented griplock spring, which is tightened around the shaft, provides axial fixation and torque transmission. In addition, the Griploc™ design facilitates quick and correct assembly and disassembly.

Adaptive N-impeller

The Flygt N3085 – N3127 feature an adaptive self-cleaning N-impeller that can move axially to enable easy passage of large solids through the pump.

Medium capacity pumps

For demanding pumping duties, five models handle fluid transport for capacities up to 8,000 US GPM (500 l/s). Highly efficient, these heavy-duty models provide clog-free performance in order to achieve the best overall life cycle cost.



Power ratings and size

Model	3153	3171	3202	3301	3315
Rating, hp	12–23	25–35	35–75	60–105	85–160
Discharge, in	3" (80 mm)	4" (100 mm)	4" (100 mm)	6" (150 mm)	6" (150 mm)
	4" (100 mm)	6" (150 mm)	6" (150 mm)	10" (250 mm)	10" (250 mm)
	6" (150 mm)	10" (250 mm)	8" (200 mm)	12" (300 mm)	12" (300 mm)
	8" (200 mm)			14" (350 mm)	14" (350 mm)
	10" (250 mm)				

Methods of installation

P

For semi-permanent wet well installations. The pump is installed with twin guide bars on a discharge connection.

S

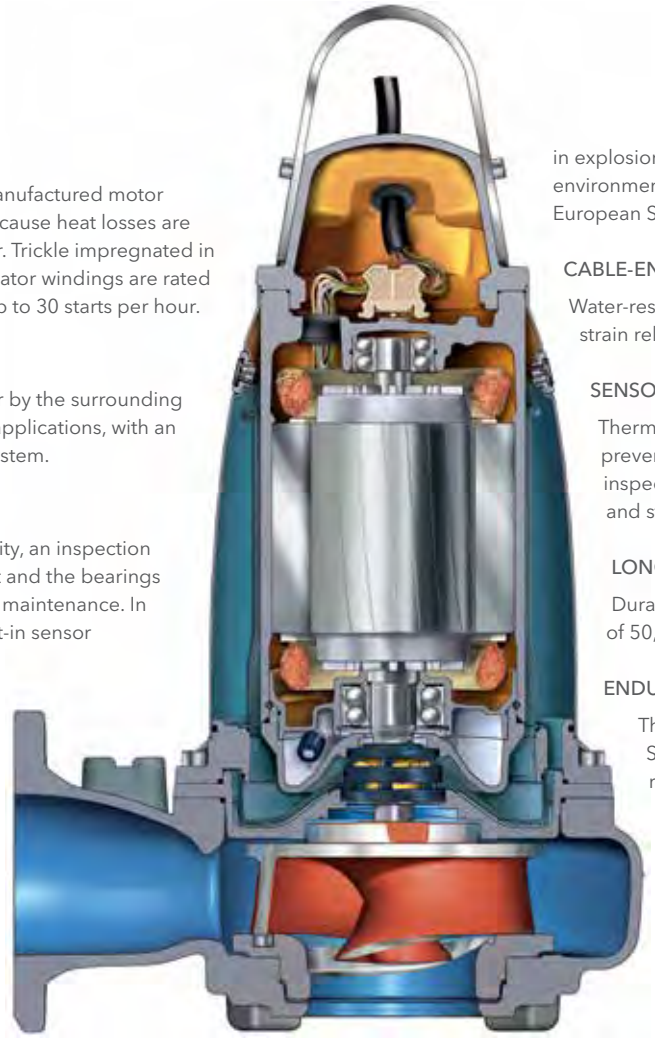
A semi-permanent freestanding installation. Transportable version with pipe or hose connection.

T

A vertically-mounted, permanent dry well or in-line installation with flange connections for suction and discharge pipework.

Z

A horizontally-mounted, permanent dry well or in-line installation with flange connections for suction and discharge pipework.



BETTER HEAT TRANSFER

Our specially designed and manufactured motor provides enhanced cooling because heat losses are concentrated around the stator. Trickle impregnated in resin (Class H insulation), the stator windings are rated at 180°C (355°F) and enable up to 30 starts per hour.

EFFICIENT COOLING

These pumps are cooled either by the surrounding liquid or, in more demanding applications, with an internal closed-loop cooling system.

INSPECTION CHAMBER

To increase operational reliability, an inspection chamber between the seal unit and the bearings enables rapid spot checks and maintenance. In the case of a seal failure, a built-in sensor provides an early warning of any fluid buildup, thus reducing the risk of expensive repair work.

COMPLIANCE

Each pump is tested and approved in accordance with national and international standards, including IEC60034-1 and CSA. Pumps are available in explosion-proof versions for use in hazardous environments, and are approved by the Factory Mutual, European Standard and IEC.

CABLE-ENTRY

Water-resistant cable entry provides both sealing and strain relief functions to ensure a safe installation.

SENSORS

Thermal sensors embedded in the stator windings prevent overheating, and a leakage sensor in the inspection chamber minimizes the risk for bearing and stator failure.

LONG-LIFE BEARINGS

Durable bearings provide a minimum service life of 50,000 hours.

ENDURING SEALS

The Flygt Plug-in™ seal with the Active Seal™ system offers increased sealing reliability and zero leakage into the motor, thereby reducing the risk of bearing and stator failure.

Flygt Plug-in™ seal with Active Seal™ system
The Flygt Plug-in™ seal is a seal unit that eliminates the risks associated with incorrect installation and careless handling. It comprises the Active Seal™ system in one easy-to-handle unit.

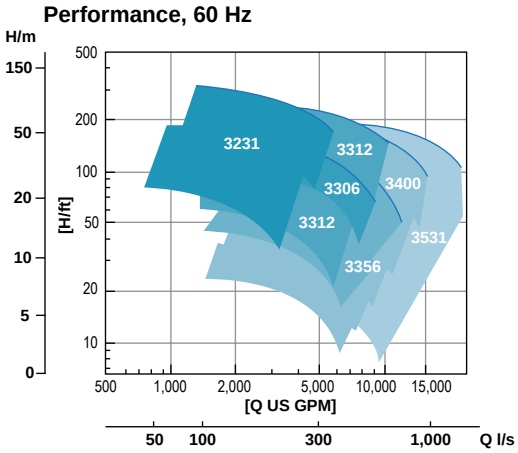
The Active Seal™ system is a patented zero-leakage double-seal system that actively prevents liquid from entering the motor cavity, thereby reducing the risk for bearing and stator failure. It comprises a unique inner seal that acts as a micro-pump and an outer seal that prevents leakage of pumped media into the buffer chamber.

Inner seal with laser-cut spiral grooves.

Laser-cut grooves on the inner seal create a hydrodynamic pumping effect that prevents any leakage from entering the motor. This translates into enhanced sealing reliability, reduced downtime and fewer unscheduled maintenance checks. In addition, regular service inspections can be prolonged in many applications.

Large capacity pumps

When higher capacity is required, the Flygt N-pump series has five pumps to do the job. These models deliver unprecedented pumping power – reliably and efficiently.



Power ratings and size

Model	3231	3306	3312	3356	3400	3531
Rating, hp	90–335	70–280	90–470	70–280	60–470	60–870
Discharge, in	8" (200 mm)	12" (300 mm)	12" (300 mm)	14" (350 mm)	16" (400 mm)	20" (500 mm)

Methods of installation

P

For semi-permanent wet well installations. The pump is installed with twin guide bars on a discharge connection.

S

A semi-permanent freestanding installation. Transportable version with pipe or hose connection.

T

A vertically-mounted, permanent dry well or in-line installation with flange connections for suction and discharge pipework.

Z

A horizontally-mounted, permanent dry well or in-line installation with flange connections for suction and discharge pipework.

BETTER HEAT TRANSFER

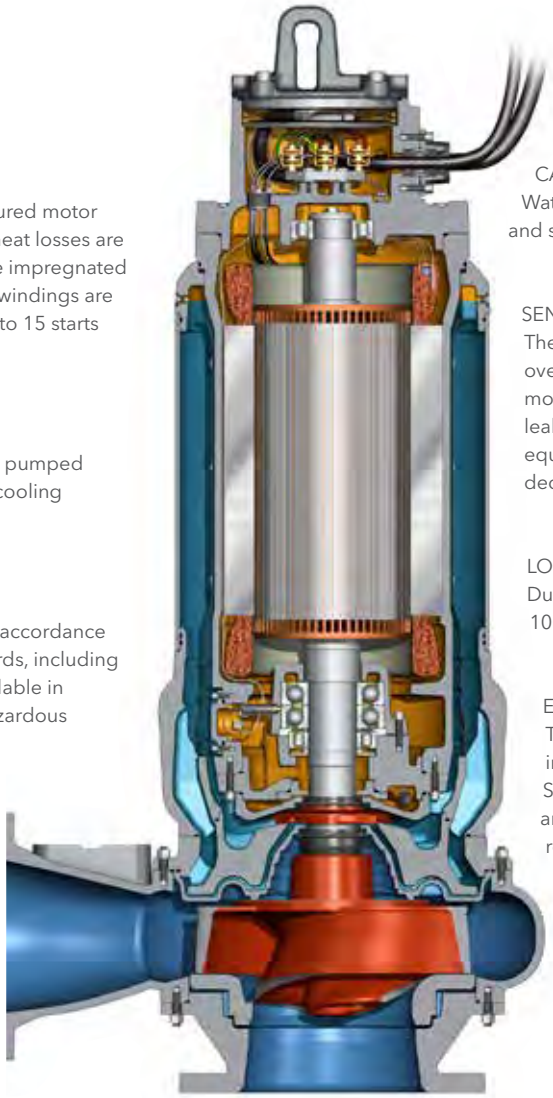
Our specially designed and manufactured motor provides enhanced cooling because heat losses are concentrated around the stator. Trickle impregnated in resin (Class H insulation), the stator windings are rated at 180°C (355°F) and enable up to 15 starts per hour.

EFFICIENT COOLING

These pumps are cooled either by the pumped liquid or with an internal closed-loop cooling system.

COMPLIANCE

Each pump is tested and approved in accordance with national and international standards, including IEC 60034-1 and CSA. Pumps are available in explosion-proof versions for use in hazardous environments, and are approved by the Factory Mutual, European Standard and IEC.



CABLE ENTRY

Water-resistant cable entry provides both sealing and strain relief functions for a safe installation.

SENSORS

Thermal sensors in the stator windings prevent overheating, and an analog temperature sensor monitors the lower bearing. The stator housing/ leakage chamber and the junction box are equipped with leakage sensors. The sensors decrease the risk of bearing and stator failure.

LONG-LIFE BEARINGS

Durable bearings provide a minimum service life of 100,000 hours.

ENDURING SEALS

Two sets of mechanical shaft seals work independently for double security. The Active Seal™ system offers increased sealing reliability and zero leakage into the motor, thereby reducing the risk of bearing and stator failure.

Zero leakage into the motor cavity

The Active Seal™ system is a patented zero-leakage double-seal system that actively prevents liquid from entering the motor cavity, thereby reducing the risk for bearing and stator failure. It comprises a unique inner seal that acts as a micro-pump and an outer seal that prevents leakage of pumped media into the buffer chamber.

Laser-cut grooves on the inner seal create a hydrodynamic pumping effect that prevents any leakage to enter the motor.

This translates into enhanced sealing reliability, reduced downtime and fewer unscheduled maintenance checks. In addition, regular service inspections can be prolonged in many applications.

Complete solutions for your needs

Ready-to-install pre-engineered, prefabricated pumping solutions

Flygt offers several packaged solutions combining our premium N-pumps with dedicated monitoring and control options and pre-fabricated pump stations designed for your needs. The prefabricated pump stations are available in a range of designs and sizes, all supplied complete with the necessary materials and equipment to allow ease and speed of installation and commissioning.

Our packaged solutions have a self-cleaning design and are tested as a system to work perfectly together to give you the ultimate performance within wastewater pumping.

Flygt SmartRun™

Flygt Multismart™

MONITORING AND CONTROL

Our state-of-the-art solutions are designed to ensure pumps work at optimum efficiency, to provide key data, to increase reliability and to prevent pump breakdown.

Our monitoring and control systems are designed for use in a variety of pumping applications. It is the specific conditions at each pump station that help you decide the best monitoring and control solution for your needs. Whether it's wastewater, stormwater, effluent, RAS, WAS, lightly contaminated water or clean water, it all demands a different solution. Naturally each system is designed to work well on its own. However, our pumps and monitoring & control systems are optimized to work even better together.

All Flygt monitoring and control equipment integrate easily into SCADA control systems for remote monitoring and control. Flygt PumpView puts you in Total Control, Your Way.

Engineered pumping solutions

Flygt's standard pump station designs are based on our long history in wastewater pumping. Our engineers work closely with you, from design and system analysis to selection of pumps, installation and monitoring & control solutions. Whether we recommend a proven Flygt standard design or develop a custom solution for you, we can offer you reliable and cost-effective pumping solutions that meet your specific requirements.

FLYGT N-PUMPS: SUBMERSIBLE AND DRY INSTALLATIONS

Flygt N-pumps are an excellent choice for handling solids in dry-pit installations. Originally designed for submersible conditions, our pumps eliminate the risk of damage to the motor due to station flooding. Submersible or dry-installed Flygt N-pumps deliver superior clog-free operation with minimal maintenance and substantial energy savings.

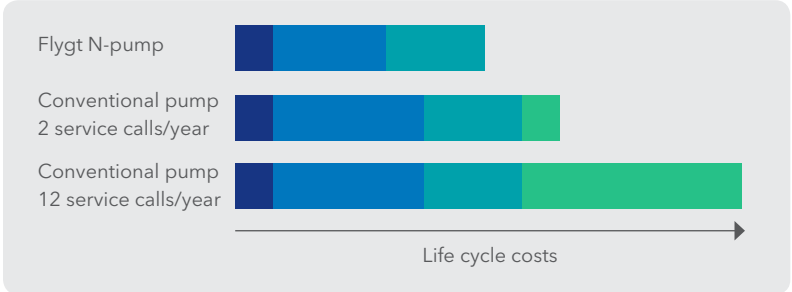
The power to adapt

Options table

Customize your Flygt N-pump with optional equipment.

Flygt N-pump model	3085	3102	3127	3153	3171	3202	3301	3315	3231	3306	3312	3356	3400	3531
Option/Product														
Motor														
Premium efficiency (IE3)	◖	◖	◖	◖	◖	◖	◖		◫	◫	◫	◫	◫	◫
Hydraulic														
Guidepin	●	●	●	◐	◐	◫								
Hard-Iron™	◐	◐	◐	◐	◐	◐	◐	○	○		○	○		○
Chopper			○	◫	◫	◫								
Adaptive N	●	●	●											
Seal system														
Griploc™ seal	●	●	●											
Plug-in™ seal				●	●	●	●	●						
Active Seal™				●	●	●	●	●	●	●	●	●	●	●
Spin-out™	●	●	●	●	●	●	●	●	◖	◖	◖	◖	◖	◖
Seal flush									○	○	○	○	○	○
Cooling system														
1. w/o cooling jacket	●	●	●	○	○	○	○	○	○	○	○	○	○	○
2. Closed Loop Cooling				●	●	●	●	●	◫	◫	◫	◫	◫	◫
3. Pump media									●	●	●	●	●	●
4. External				○	○	○	○	○	○	○	○	○	○	○
Installation														
P	●	●	●	●	●	●	●	●	●	●	●	●	●	●
S	●	●	●	●	●	●	◐	◐	●	●	●	◫	◫	◫
T	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Z	●	●	●	●	●	●	●	●	●	●	●	●	●	●
L		●	●											
Accessories														
Flush valve	○	○	○	◫	◫	◫	◫	◫						
Pump monitor *Prepared for*														
– Mini CAS	●	●	●	●	●	●	●	●						
– MAS					○	○	○	○	●	●	●	●	●	●
Pump control														
– SmartRun™	○	○	○	○	○	○	○							
– MultiSmart™				○	○	○	○	○	○	○	○	○	○	○
– FGC	○	○												

● = Standard
○ = Optional
◐ = Standard but also optional depending on model
◖ = Standard or not available depending on model
◫ = Optional or not available depending on model



SELF CLEANING SAVES MONEY

Schematic overview of calculations made on a 30kW Flygt N-pump

Purchase cost
Energy cost
Service cost
Unplanned maintenance cost

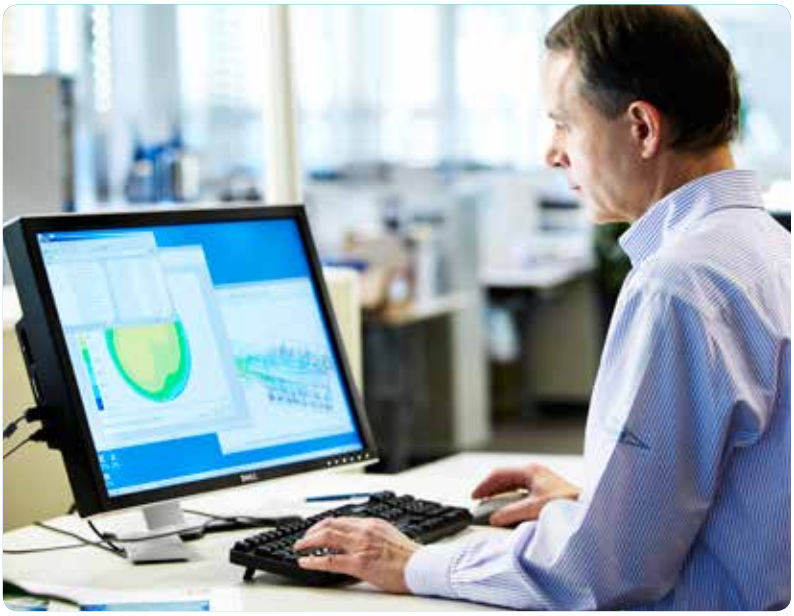
Supporting your business, every step of the way

Extensive engineering know-how
Xylem has extensive knowledge of fluid dynamics and vast practical experience in designing, operating and maintaining efficient wastewater transport systems. We provide a broad range of engineering services, including:

- System analysis and calculations
- Sump design
- Water hammer calculations
- Pump start analysis
- Transient analysis
- Computational Fluid Dynamics (CFD)
- Scale model testing

In short, we can assist you with everything you need for optimal performance and economical, energy-efficient operation.

Empower your system
With Flygt monitoring and control products, you can control and optimize the performance of every component of your system. This helps reduce stress on pumps, valves and mains, enable reliable, efficient operation, and prolong service lifetime.



Support for your Flygt pumps
Our global network of local service centers and service partners provide integrated services to support safe, efficient and reliable operation. To ensure trouble-free operation and minimal downtime, count on us for quick, professional response and quality maintenance services, using genuine Flygt spare parts.

EXTENSIVE MONITORING AND CONTROL

We supply hardware and software for complete process systems – from individual pump drives, starters, sensors and controllers to system software and scalable SCADA systems.

GENUINE FLYGT SPARE PARTS AND WARRANTY

When downtime isn't an option, rely on our global service network to deliver genuine Flygt spare parts to you – quickly and efficiently. All Flygt spare parts are backed by a solid 15-year availability guarantee. Large capacity pumps offer a 20-year availability guarantee.

Xylem [ˈzīləm]

1) The tissue in plants that brings water upward from the roots
2) A leading global water technology company

We're 12,000 people unified in a common purpose: creating innovative solutions to meet our world's water needs. Developing new technologies that will improve the way water is used, conserved, and re-used in the future is central to our work. We move, treat, analyze, and return water to the environment, and we help people use water efficiently, in their homes, buildings, factories and farms. In more than 150 countries, we have strong, long-standing relationships with customers who know us for our powerful combination of leading product brands and applications expertise, backed by a legacy of innovation.

For more information on how Xylem can help you, go to xyleminc.com.

FB002 • Flygt N - Pump Series Brochure • 7/2015 • NACT

xylem
Let's Solve Water

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SPECIFICATIONS

DOCUMENT #W100

YSI IQ SensorNet 2020 XT

Continuous Water Quality Monitoring for Process Control

Powerful yet simple, the YSI **IQ SensorNet 2020 XT** is a modular water quality system for complete process control designed for wastewater. The 2020 XT network can accept additional sensors easily at any time and grow as your facility grows. Benefits include better network visibility and management, early detection of network failures, improved compliance with regulatory targets, and cost savings (energy, pump/blower maintenance, labor).

- 3-year instrument warranty
- User-replaceable cables and sensors. Many sensors provide ultrasonic cleaning.
- Centralized power supply along entire network; 2-wire cable provides power and communications
- Lightning protection along network
- 2020 XT provides tactile buttons; easily use while wearing gloves
- Modular expansion from 1 to 20 sensors; ability to extend network with additional modules
- Up to 48 output channels are possible
- LED status light
- Programmable access permission
- System redundancy if two terminals are used; use in one location or move from point to point

Building a system is easy...choose the IQ SensorNet 2020 XT, determine which modules are needed (control, communications, etc.), determine distances for cabling and select parameters.

Parameters:

Dissolved Oxygen (optical or electrochemical)
pH
ORP/Redox
Conductivity/Salinity
Temperature
Turbidity*
TSS (total suspended solids)*
Ammonium
Nitrate
Potassium
COD (chemical oxygen demand)*
TOC (total organic carbon)*
DOC (dissolved organic carbon share of TOC)*
SAC (spectral absorption coefficient)*
BOD (biochemical oxygen demand)*

* ultrasonic cleaning for sensors

YSI.com/IQSN2020

IQ SensorNet 2020 XT Terminal/Controller Specifications

Certifications	ETL, cETL (conforms with relevant UL and Canadian standards), CE
Electromagnetic Compatibility	EN 61326, Class B; FCC Class A, EMC for indispensable operation
Integrated Lightning Protection	According to EN 61326 enhanced over-voltage protection for *entire system*, implemented in each component
Cable	2-wire with shield for power supply and communications; resistant to polarity reversal; comprehensive EMC shield control; cable topology within network can be in the form of a line, tree, star or multiple star
	Total cable length max. = 1000 m (3280 ft) without signal amplifying; with signal amplifying module MIQ/JBR add an additional 1000 m
Radio	Radio transmission Class 1 with a range of 100 m (328 ft); max 300 m (984 ft)
Module Coupling at Rear	Combined mechanical and electrical connection for rapid coupling to modules; no wiring required
USB Interface	USB-A (host)
Display	Graphic display; resolution 320 x 240 pixels; visible area 114 x 86 mm (4.49 x 3.39 in); backlit
Control Keys/Buttons	5 operation keys: 3 master keys for Measurement (M), Calibration (C), Set/System settings (S)
	2 function keys for confirmation/switching menu OK (OK) and Escape (ESC)
	4 directional button for quick selection of software functions and input of alphanumeric values
Datalogger	MIQ/TC 2020 XT; data memory for up to 525,600 data sets
Electrical	Directly via the IQ SensorNet when coupled to an MIQ module
Temperature Conditions	Operating Temperature: -4 to 131 °F (-20 to 55 °C)
	Storage Temperature: -13 to 149 °F (-25 to 65 °C)
Enclosure	Material: ASA (Acrylonitrile-Styrene-Acryloesterpolymer)
	Rating: IP-66, equivalent to NEMA 4X (not suitable for conduit connection)
	Dimensions: 210 W x 170 H x 40 D mm (8.27 W x 6.69 H x 1.57 D in)
	Weight: 0.7 kg (1.54 lbs)
	Warranty: 3 years

IQ SensorNet 2020 XT Module (MIQ) Specifications

Module Coupling at Front	Combined mechanical and electrical connection for rapid docking and removal of the terminal and docking additional modules
Module Coupling at Rear	Combined mechanical and electrical connection for docking additional modules; a total of 3 modules as a stacked mounted unit
Cable Feeds	4 screw cable glands M 16 x 105
Terminal Connections	Screw terminal strips; terminal area for solid connectors 0.2 to 4.0 mm for flexible connectors 0.2 to 2.5 mm; accessible through cover Used for connecting sensors or as an input/output or for looping through/branching of the IQ SensorNet cable
Additional Functions	Two LEDs (yellow and red) for monitoring the operating voltage; lightning protection; connection resistant to reversed polarity; integrated local identity; integrated switchable terminal resistor (SN terminator)
Enclosure	Material: PC 20% GF (Polycarbonate with 20% fiberglass)
	Rating: IP-66, equivalent to NEMA 4X (not suitable for conduit connection)
	Dimensions: 144 W x 144 H x 52 D mm (5.67 W x 5.67 H x 2.05 D in)
	Weight: 0.5 kg (1.1 lbs)
	Warranty: 3 years

IQ SensorNet 2020 XT Ordering Information (order 2020 XT, modules, cables, sensors separately)

MIQ/TC 2020 XT Item #470 000Y	Central terminal/controller unit only. Required to be installed once at any point, remains in the system and cannot be removed. Operation mode is shown through status LED. Up to 20 sensors can be connected.
MIQ/TC 2020 XT-H3 #470 016Y	Multiparameter system consisting of 2020 XT, MIQ/CR3 (3 analog and 3 relays) and MIQ/PS (power supply). Up to 20 sensors Item can be connected.
MIQ/TC 2020 XT-H3 C6 #470 017Y	Multiparameter system consisting of 2020 XT, MIQ/C6 (6 analog outputs) and MIQ/PS (power supply). Up to 20 sensors can Item be connected.

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SPECIFICATIONS

DOCUMENT #W102

YSI IQ SensorNet FDO®

Optical Dissolved Oxygen Sensor

The FDO is an optical, luminescent based DO sensor for the IQ SensorNet system. During the biological nutrient removal process at wastewater treatment plants, continuous and precise measurement of dissolved oxygen concentration is of vital importance for optimal performance and trouble-free operation. Efficiency and energy demand is mainly determined by the performance of the aeration control system. The FDO is a reliable, proven, long-term solution for continuous DO data that can help optimize your process and lower energy costs.

Parameters:

Dissolved Oxygen (optical)

Temperature

- **Intelligent Sensor Cap**
  The sensor cap is individually factory calibrated. Calibration data is stored on a chip that is embedded in the sensor cap. No need to enter calibration coefficients. When a new cap is installed, the coefficients are recognized and sent directly to the controller terminal eliminating the need to manually enter information.

- **Equal Path Reference System**
  The optical measurement and reference paths are identically designed. This allows for identical aging of the components which enables accurate compensation and eliminates calibrations. That's correct, there is no calibration required.

- **Green Light Technology**
  Softer, low-intensity excitation light increases the lifetime of the cap. This translates into a two year warranty on the standard cap.

The FDO's lower energy green light excitation technology extends the sensor cap lifetime.

Learn More:

Scan with a smart phone or tablet, to see the FDO angled sensor tip allow bubbles to pass by.

YSI.com/FDO

IQ SensorNet FDO Optical Dissolved Oxygen General Specifications

Sensor Cap Replacement	Yes; the cap, can be replaced. Automatic recognition by the sensor of the cap including the factory calibration.	
Calibration Capability	Yes; not required, factory calibrated	
Interferences	None	
Minimum Flow Rate	None; no flow requirement	
Response Time at 25 °C	700 IQ and 700 IQ SW - T90 = <150 seconds; T95 = <200 seconds	
	701 IQ and 701 IQ SW - T90 = <80 seconds	
Signal Output	Digital	
Lightning Protection	Yes	
Power Consumption	0.7 watts	
Maximum Pressure	10 bars (145 psi); with sensor connection cable	
Electrical Connections	2-wire shield cable with quick sensor connection	
Conformance/Certifications	EN 61326, Class B, FCC Class A; Intended for indispensable operation, CE, cETLus	
Temperature Conditions	Operating Temperature:	23 to 122 °F (-5 to 50 °C)
	Storage Temperature:	-13 to 122 °F (-25 to 50 °C)
Sensor	Material:	Housing - VA steel 1.4571; Sensor Cap and Locking Cap - POM (Polyoxmethylene), PVS, silicone, PMMA
	Rating:	IP-68; waterproof
	Dimensions:	400 L x 40 D mm (15.75 L x 1.57 D in)
	(length x diameter)	400 L x 59.5 D mm (15.75 L x 2.34 D in) Salt Water version
	Weight:	900 g (1.98 lbs)
		1,500 g (3.31 lbs) Salt Water version
	Warranty:	2 years

IQ SensorNet FDO Optical Dissolved Oxygen Technical Specifications

Dissolved Oxygen Range		
	Concentration	0 to 20.00 mg/L
	Saturation	0 to 200.0%
Dissolved Oxygen Resolution		
	Concentration	0.01 mg/L
	Saturation	0.1%
Temperature		
	Measurement	23 to 140 °F (-5 to 60 °C)
	Compensation	32 to 140 °F (0 to 60 °C)

IQ SensorNet FDO Ordering Information (order 2020 XT terminal, modules, cables, sensors separately)

FDO 700 IQ (#201 650Y)	Optical DO sensor for monitoring and control; includes 1 factory calibrated sensor cap.
FDO 700 IQ SW (#201 652Y)	Salt Water Design Optical DO sensor for monitoring and control; includes 1 factory calibrated sensor cap.
FDO 701 IQ (#201 660Y)	Optical DO sensor for monitoring and control; faster response time; includes 1 fast response factory calibrated cap.
FDO 701 IQ SW (#201 653Y)	Salt Water Design Optical DO sensor for monitoring and control; faster response time; includes 1 fast response factory calibrated cap.
SC-FDO 700 (#201 654Y)	Replacement; universal factory calibrated sensor cap for FDO 700 IQ and FDO 700 IQ SW
SC-FDO 701 (#201 655Y)	Replacement; fast response factory calibrated sensor cap for FDO 701 IQ and FDO 701 IQ SW

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CONTROL SYSTEM

INTRODUCTION

The ABJ control system is the nucleus of the process. The control system is "time-based" rather than "flow-based" and typically operates the following equipment:

- Decanters
- Process blowers
- Air Control Valves
- Waste Sludge Pumps
- Submersible Mixers (future use)
- D.O. System

The control system consists of a control panel including a Human Machine Interface (HMI), programmable logic controller (PLC), control switches, pilot lights, VFDs and motor starters.

The control system is designed by Sanitaire and is assembled in a UL, C/UL approved shop. The control panel and the PLC program are factory tested prior to shipment. During the start-up of the ABJ system, the authorized field representative will check the installation, place the system into operation and make necessary field settings and program adjustments.

After the system has been placed into service, there are minimal adjustments required by the operator such as sludge pump start and wasting times and blower run time. These adjustments are made through the HMI interface.

PROGRAMMABLE LOGIC CONTROLLER (PLC)

The PLC contains a microprocessor, memory and input/output devices. It controls all of the process operations, monitors equipment status and alarm conditions. A backup battery protects RAM memory with further memory protection from an EEPROM or flash memory. The PLC has LED indicators showing Run, Fault and Battery Low status. The PLC is equipped with direct modem communications. In addition, the PLC will also include a DH+ or Ethernet communication ability to communicate with an operator HMI and SCADA system.

HMI

The ABJ process uses a HMI (Human Machine Interface) for graphical representation and monitoring of all plant alarms and events. The HMI consists of a non-PC interface that mounts in the main control panel door. It will be a full color touch screen type unit to allow for full control of the SBR process, connecting to the plant SCADA as required. The HMI allows the operator to make changes to setpoints and display the cycle times.

The alarm page provided with the HMI allows the operator to see what alarm has occurred with a time and date stamp. The operator can acknowledge and clear alarm faults.

SCADA SYSTEM (Optional Adder)

The ABJ process uses a SCADA (Supervisory Control and Data Acquisition) system for graphical representation and monitoring of all plant alarms and events. The SCADA system consists of a computer with A-B FactoryTalk Software, including FactoryTalk View SE Station software licenses. The SCADA software allows the operator to make changes to setpoints and displays the cycle time, phase of each tank and the time remaining in each phase. If level transmitters are installed in the tanks, the screen can display the depth of water in each tank.

The alarm viewer provided with the SCADA system allows the operator to see what alarm has occurred and tell the operator if it is a high, medium or low priority alarm. All alarms displayed are date stamped so the operator can see the time and day that the alarm occurred. The operator can print the alarm page on the provided printer. The operator can also acknowledge and clear alarms at this screen. The SCADA system is also equipped with trend charts. The trend charts allow D.O. levels and other process related items to be displayed and charted. This gives the operator the ability to monitor the levels over a period of time. The values are also exported to a .mdb file so the plant personnel can use a spreadsheet program, such as Excel to view the values and print them out.

CONTROL SWITCHES AND PILOT LIGHTS

Control switches and indicating lights are provided on the control panel for ABJ furnished equipment. In addition, a local control box at the basin permits the manual raising or lowering of the decanter in the tank.

During normal operation, equipment selector switches are placed in the “Auto” mode. Manual operation is also possible but does not provide the process interlocks that are incorporated with automatic operation.

If a component is not used or has failed, it can be switched to the “Off” position and the control system will continue without the function of that item.

PROCESS AND EQUIPMENT INTERLOCKS

The control system includes switches and sensors that provide information to the PLC to prevent process upsets and equipment damage. Additionally, circuit breakers and motor circuit projectors are used to protect the motors from electrical overloads.

The decanter actuators include end position limit switches that verify that the decanter has reached the bottom water level or has returned to the “park” position. The air control valves have end position limit switches.

- If a valve fails to open, the blower is stopped.
- If the air valve fails to close, decanting is inhibited.
- If the decanter fails, the air valve is inhibited from opening.

A high water float switch or level transmitter is provided in each basin to detect flows greater than the peak dry weather conditions. Based on the float switch signal or the level rate of change, the PLC will then evaluate whether to remain in the normal cycle or switch to the storm cycle.

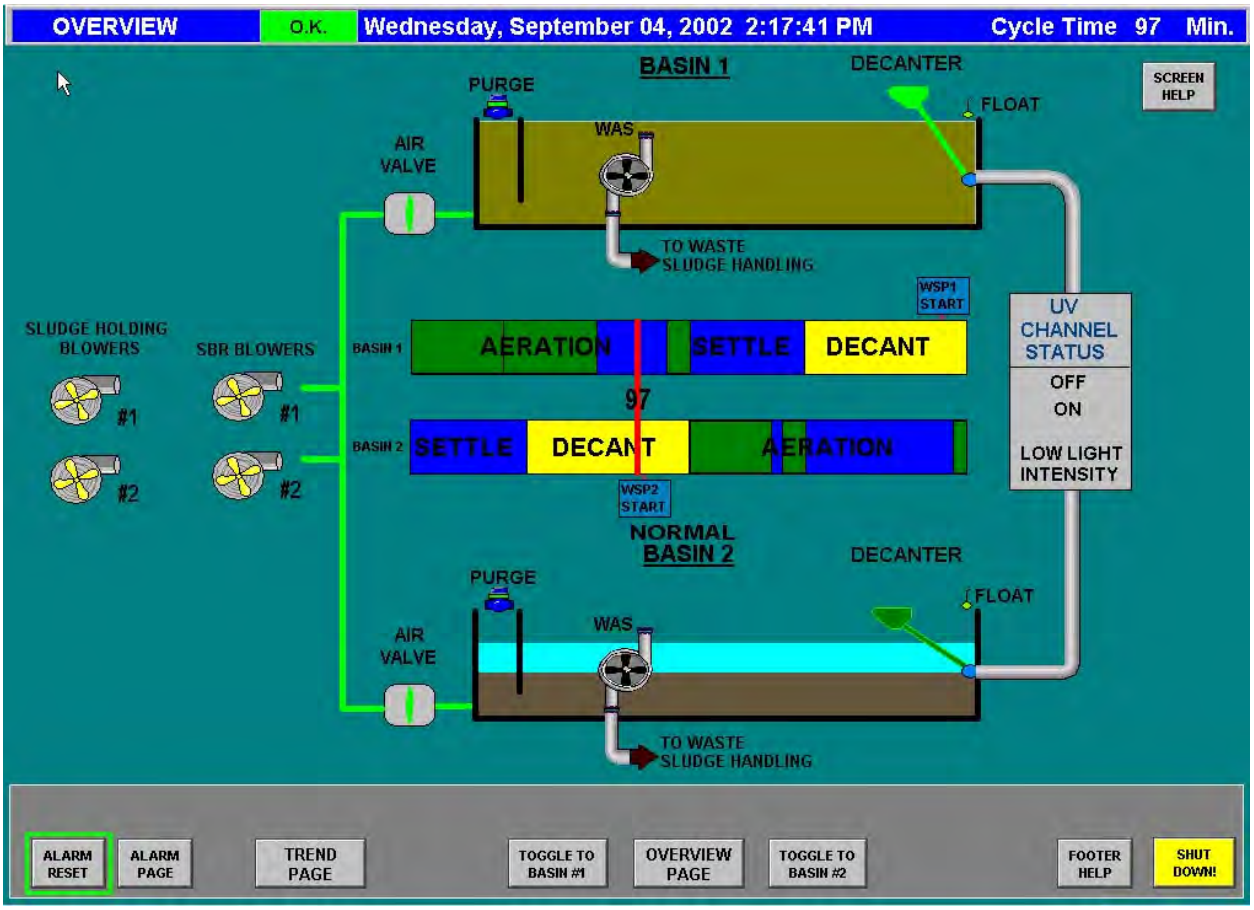
Webport

A webport is installed as standard equipment in the control panel to allow the PLC, HMI and SCADA to be accessed via internet The PLC program can be monitored and /or modified in real time from remote locations. The HMI or SCADA can have modifications made and then download via the internet.

REMOTE ACCESS

Sanitaire can allow for remote monitoring of the plant. This is useful for small plants that are not staffed during evening or weekend hours. With remote access, the operator uses a internet connection to interface with the SCADA from an offsite location. The operator is able to view and acknowledge alarms and monitor plant equipment without having to go to the plant.

SCADA SCREEN



OPERATION OF THE ICEAS® PROCESS

ICEAS EQUIPMENT

Operation of the ICEAS process is facilitated through the use of simple mechanical equipment and state-of-the-art controls. Although the ICEAS process technology is conceptually sophisticated, its mechanical simplicity is elegant and is operationally reliable. The system uses a limited number of moving or powered components and a simple control system. The ICEAS process uses the following equipment to provide a completely functional system:

- Decant Mechanism
- Blowers
- Control System
- Aeration System
- Waste Sludge Pumps
- Air Control Valves

Operation of the equipment listed above in conjunction with the ICEAS process is discussed in this section.

ABJ ICEAS NIT PROCESS *Note: See attached cycle charts for project specific cycle information.*

The typical ICEAS-NIT normal cycle as discussed in the process section is 4.0 hours or 240 minutes in duration. The cycle is divided as follows:

Air-on:	120 minutes
Settle:	60 minutes
Decant:	60 minutes

The typical storm cycle operation in the ICEAS-NIT is configured as a 3.0-hour cycle or 180 minutes in duration. Similar to the normal cycle, the storm cycle is divided as follows:

Air-on:	90 minutes
Settle:	45 minutes
Decant:	45 minutes

In the NIT normal cycle, the aeration phase is split into 3-40 minute segments (or 3-30 minute segments during storm cycle). The operator has an option to select the span of aeration during the 40-minute segments. The first two 40-minute segments will operate with air-on followed by air-off. The sequence is reversed in the third segment, which will operate with air-off followed by air-on.

ABJ ICEAS NDN PROCESS

The typical ICEAS-NDN normal cycle as discussed in the process section is 4.8 hours or 288 minutes in duration. The cycle is divided as follows:

Air-on:	96 minutes, 4-24 minutes
Air-off:	72 minutes, 3-24 minutes

Settle: 60 minutes
Decant: 60 minutes

The typical storm cycle operation in the ICEAS-NDN is configured as a 3.6-hour cycle or 216 minutes in duration. Similar to the normal cycle, the storm cycle is divided as follows:

Air-on: 72 minutes, 4-18 minutes
Air-off: 54 minutes, 3-18 minutes
Settle: 45 minutes
Decant: 45 minutes

The seven segments of air-on and air off phases are alternatively applied. The operator has the flexibility to adjust the 0-24 (or 0-18) minute phase per basin through HMI to optimize the process performance.

DECANTER OPERATION

DECANT MECHANISM

The decanter is designed to remove clarified effluent from the top of the basin during the decant phase of the operational cycle. It is installed on the basin wall at the end opposite from the pre-react zone. The decanter is lowered and raised using an electro-mechanical actuator. The actuator moves between top and bottom limit switches whenever the decanter is in operation ensuring that the decanter travels from the "park" position to the bottom water level (BWL). The decanter is parked above top water level (TWL) during the aeration and settling phases of the cycle, thereby eliminating any possibility of solids carryover during these periods.

The decanter speed is controlled by a series of pulses or through use of a variable frequency drive (VFD). As a result, the decanter discharge rate is relatively constant from the time the decanter enters the water to the time it reaches the bottom water level (BWL).

DECANTER OPERATION

During the decant phase, after receiving a signal from the PLC, the decanter travels from the "park" position to the design bottom water level (BWL). Upon reaching the BWL, the decanter will pause for a few minutes to ensure completion of the discharge flow over the weir. The decanter then returns to the "park" position, where it will remain until the start of the next decant phase.

At park position, the decanter provides "fail safe" overflow protection in the event of a power failure. Settled supernatant will flow via gravity over the decanter weir and into the effluent collection system. The decanter scum guard float will prevent the carry over of any floatables during such emergency periods.

The decanter *does not require effluent valves, valve vaults, flexible joints, throttling arrangements or dewatering supports*. This eliminates the costs associated with these components and the risks associated with valve failures (i.e. solids carryover and effluent quality deterioration.)

The decanter weir is always visible from the basin walkway. This feature provides the operator with a continuous visual check of the effluent quality, *a feature not available with floating or fixed decanters*.

Redundant limit switches are provided on the actuator to ensure reliable operation whenever the decanter is in motion. The limit switches are fully integrated with process control time overrides and interlocks, thereby eliminating the potential for blower activation during decant.

The decanter mechanism can be used to optimize disinfection system operation downstream of the ICEAS process. A float switch can be installed on the decanter weir, which will contact the water surface before the decanter, thereby activating the disinfection system prior to discharge of the treated water.

AERATION BLOWER OPERATION

AERATION BLOWERS

Air is supplied to the aeration system in the basin using aeration blowers. The blower size is based on the process air requirements defined by the influent flow and loadings. Both positive displacement and centrifugal blowers are used in wastewater treatment. Blower operation can be optimized through the inherent flexibility of the ICEAS process and utilization of some of the control techniques discussed below.

BLOWER CONTROL

The blowers, piping and air control valves are configured to suit the process requirements of the project and to maximize the flexibility in the plant operation. Blowers can be arranged in various configurations (i.e. one primary blower at 100 percent capacity or one primary blower at 50 percent capacity and one secondary blower at 50 percent capacity) depending upon design preferences. In most cases, one 100 percent capacity spare blower will be provided. See drawing No. 700.

The typical control strategies available for blower operation are listed below:

- PD or Centrifugal Blowers: Start & Stop – Without DO Control
- PD or Centrifugal Blowers: Start & Stop – With DO Control
- PD Blowers with VFD's: With DO Control
- Centrifugal Blowers with Inlet Valve: With DO Control

PD OR CENTRIFUGAL BLOWERS: START & STOP – WITHOUT DO CONTROL

In the absence of the mechanism to control blower output and DO measuring device in the basin, the air supply to satisfy the oxygen requirements can be controlled by starting and stopping the blowers. This is typically done as shown in the following example:

Example:
Assume the ICEAS process is under normal cycle operation. Based on the flow and loadings, it is determined to lower the air requirements by 50 percent to the ICEAS basins. The above scenario under ICEAS-NIT and ICEAS-NDN process are described below:

NORMAL CYCLE IN NIT MODE

The operator enters 20 minutes for air-on time per 40-minute segment on the HMI. This would result in the following cycle:

Air-on:	60 minutes, 3-20 minute segments
Air-off:	60 minutes, 3-20 minutes segments
Settle:	60 minutes
Decant:	60 minutes

This feature is typically utilized during start-up of the plant or during initial years of operation where low flow and loading conditions prevail.

NORMAL CYCLE IN NDN MODE

The operator enters 12 minutes for the air-on time per 24-minute segment on the HMI. This would result in the following cycle:

Air-on:	48 minutes, 4-12 minutes
Air-off:	120 minutes, 3-40 minutes
Settle:	60 minutes
Decant:	60 minutes

Essentially, the reduction in the air-on time is converted to air-off time by keeping the segments of settle and decant unchanged.

PD OR CENTRIFUGAL BLOWERS: START & STOP – WITH DO CONTROL

Dissolved Oxygen concentration in the basin can be controlled by starting and stopping the blower. Under this operating strategy, the operator enters a low DO set point and a high DO set point through the HMI. The blower runs until the high DO set point is reached. Once this has occurred, the blower shuts down. When the low DO set point level is reached, the blower starts again.

PD BLOWERS WITH VFD'S: WITH DO CONTROL

DO can be controlled by using a VFD with the PD blower. The operator enters a desired DO set point through the HMI. Based on a 4-20 mA signal from DO probes installed in the ICEAS basins, blower speed is controlled by the PLC to maintain the desired DO level in the tank. If the blower is running at its lowest speed and the DO level exceeds +0.5 mg/l above the set point for a predetermined amount of time, the blower will shut down. When the DO level drops to –0.5 mg/l below the set point, the blower will restart.

CENTRIFUGAL BLOWERS WITH INLET VALVE: WITH DO CONTROL

When using centrifugal blowers for DO control, an automatic modulating inlet valve is required to control the blower output. The operator enters the desired set point at the HMI. The blower inlet mechanism is then adjusted to maintain the set point. If the blower is running at its lowest speed and the DO level exceeds +0.5 mg/l above the set point for a predetermined amount of time, the blower will shut down. When the DO level drops to –0.5 mg/l below the set point, the blower will restart.

AERATION SYSTEM OPERATION

Aeration is applied to the ICEAS basins for a pre-determined amount of time during each cycle. Typically, air is cycled back and forth between two basins via automatic air control valves. The two basins will never require air at the same time. In this way, a single duty blower can serve both basins.

To optimize system efficiency, it is sometimes necessary to reduce the amount or duration of airflow to the basins. Various strategies of DO control were previously discussed.

Both the SANITAIRE Fine Bubble Membrane and Stainless Steel Coarse Bubble diffusers are designed to accommodate both on/off operation and a wide range of airflows.

AIR CONTROL VALVE OPERATION

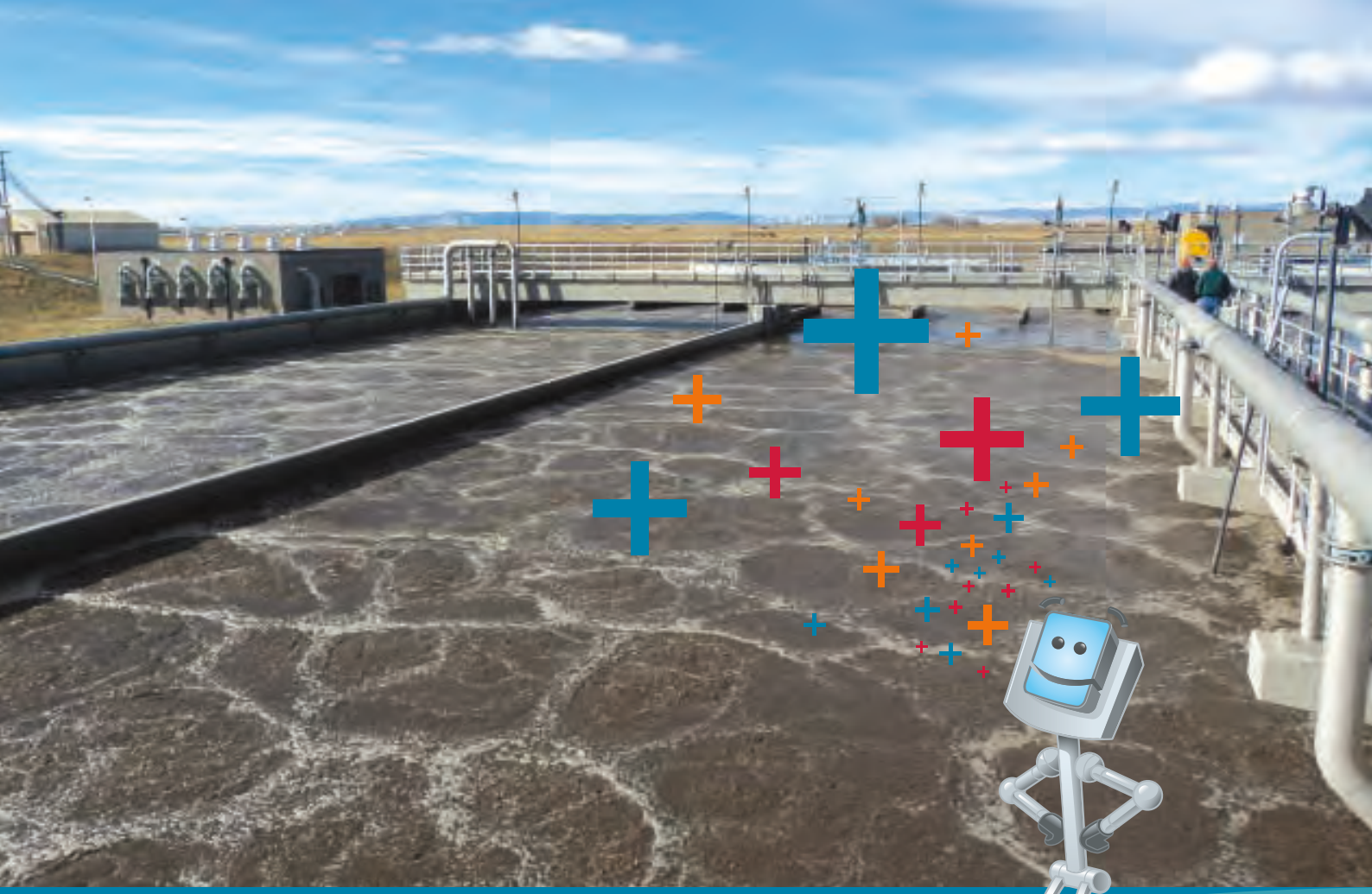
The typical two-basin ICEAS process is designed such that only one basin receives air at a time. Essentially, one blower operates continuously while air is cycled back and forth between basins through the use of automatic air control valves.

In the sequence of air control valve operation, the valve to the basin, which is about to receive air, opens prior to closing the valve to the basin in the aeration phase. This reduces the number of blower starts. If the system is designed with only one tank, automatic air control valves are not necessary. The air control valves are fully integrated with process control time overrides and interlocks, thereby eliminating the potential for blower activation during decant.

WASTE SLUDGE PUMP OPERATION

The ICEAS process is dependent upon a healthy microorganism population, which means that sludge needs to be wasted regularly. The plant operator must monitor the MLSS level in the basin in conjunction with the system sludge age and adjust the waste sludge pump run time accordingly. Sludge is typically wasted during the decant phase of the cycle to take advantage of maximum solids concentration.

The HMI panel allows the operator to set the waste sludge pump start time and run time.



OSCAR Process Performance Optimizer

FOR BIOLOGICAL TREATMENT PROCESSES

Wastewater +rea+men+

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Real-time control adds up to optimized performance.

The benefits of an OSCAR system are clear.

The OSCAR control system is a customizable, integrated system comprised of hardware, software, and services. Designed to be used with Sanitaire biological treatment solutions, OSCAR helps plants meet their performance requirements and operating budgets.

Reliable Treatment

Dynamically adapts to changing conditions to optimize contaminant removal for guaranteed effluent quality

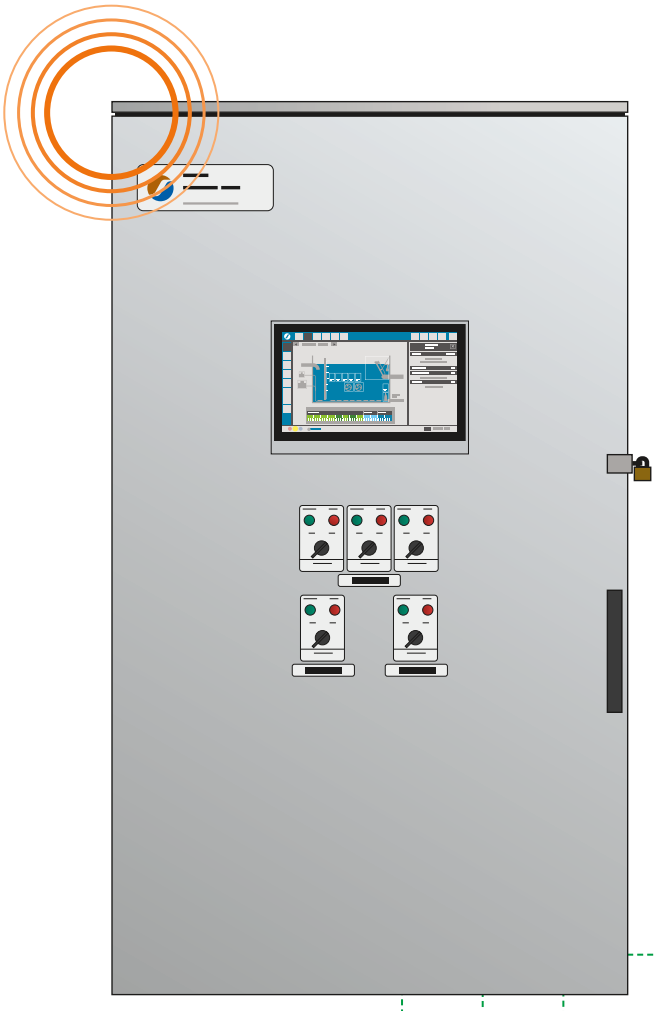
Efficient Operation

Optimizes equipment operation resulting in energy savings between 10-30% and reduced or sometimes eliminated chemical consumption

Operator Friendly

Provides greater ease of use through intuitive controls and remote accessibility, saving some operators 3-5 hours each week

Let me show you how I have helped other plants achieve their treatment goals!



The OSCAR control system looks beyond the energy efficiency of individual components to the entire biological process for a variety of applications.

Leveraging Xylem's extensive product, controls, and biological process expertise, the OSCAR system was developed to provide a comprehensive solution for a plant's needs.

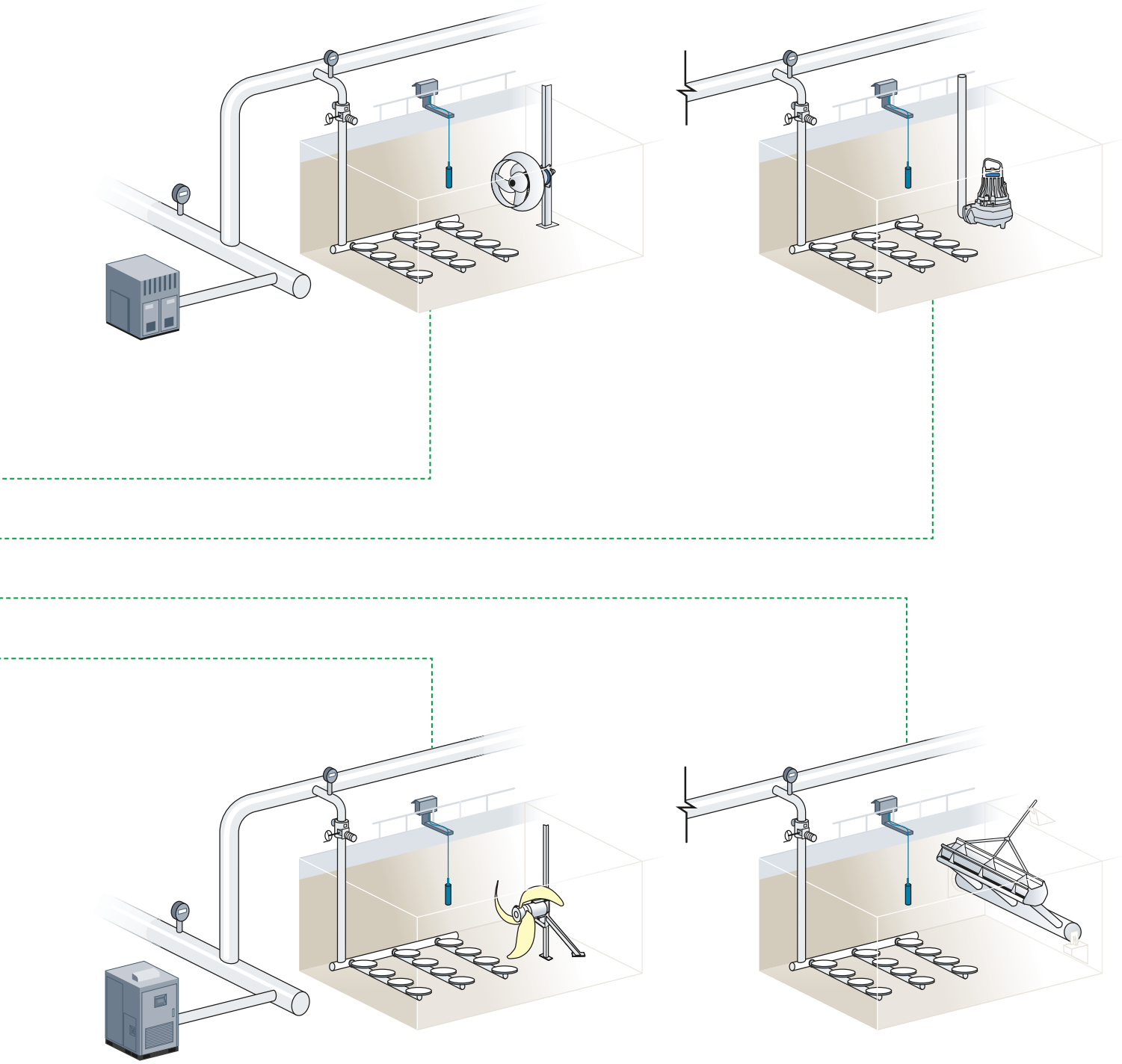
Remote Connectivity

Secure remote accessibility and control ensures that plants can:

- View and interact with all screens, setpoints and alarms remotely
- Allow Xylem access for remote troubleshooting and support
- Monitor and make process adjustments both in and out of plant
- Seamlessly embed into third party SCADA packages

Accounts can include multiple users with customized access levels.

Unlike other control systems, Sanitaire has designed the OSCAR system based on years of feedback from wastewater plants, allowing for customization and easy expansion as future requirements change.



The OSCAR system was designed to work seamlessly with Xylem's suite of products, including Sanitaire aeration and decanters, Flygt pumps and mixers, and WTW/YSI/MJK instrumentation. The result is the most optimized, efficient solution in the industry.

An integrated platform for complete control.

Hardware

The OSCAR system control panel and instrumentation connects the process equipment to the control algorithms.

Engineered-to-order control panel consisting of:

- PLC, HMI, Webport
- Power equipment
- Control switches/lights

Instrumentation options for real-time monitoring of:

- Process, flow, and level parameters
- Influent, effluent, sludge, and in-basin locations
- DO, NH_4, NO_3, TSS, PO_4, ORP, pH, COD/TOC/BOD, conductivity, turbidity, temperature

Integrating smart sensors allows the control system to bring back more than just a 4-20mA signal and use the extra data to make critical decisions.

Services

Each OSCAR system is engineered to meet project specific needs, and all panels are tested prior to shipment ensuring swift installation. Additional standard services include:

- Submittal and O&M documentations
- Commissioning and startup
- Mechanical, electrical and process training

At Xylem, our biological process experts work with consulting engineers, end users, contractors, and system integrators to ensure proper design of the entire wastewater treatment plant.

If you can't measure it, you can't control it – much less optimize it.

Software

Selective OSCAR system control algorithms can be customized depending on the plants goals:

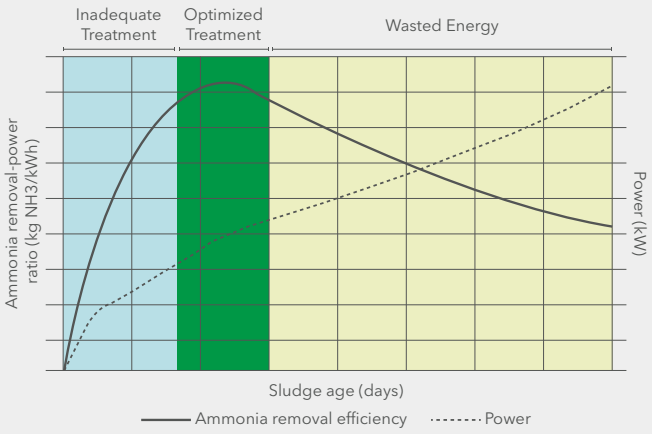
- Equipment control
- Aeration control
- Nutrient control
- Biomass control

An intuitive user interface with built-in software functionality grants a plant the tools necessary to be successful, such as:

- Imbedded electronic manuals
- Setpoint save and restore
- Translation
- Alarm prioritization and troubleshooting

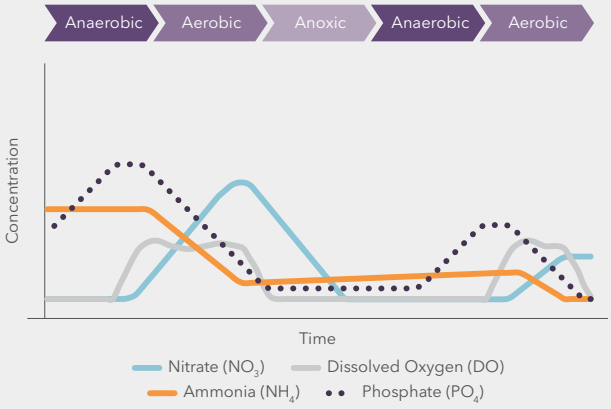
At Xylem, we know our sensors, and we understand the process. This means operators can rest easy, knowing we have developed safety nets to detect sensor or process issues, and, if critical, automatically switch to a safe mode of operation.

OSCAR system with SIMS controller



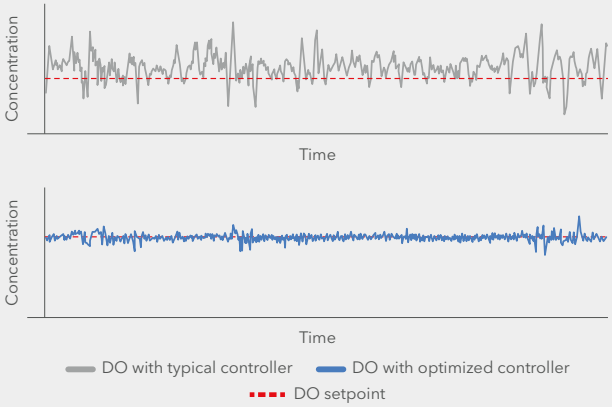
Biomass control ensures a plant is operating at the optimal sludge age for treatment

OSCAR system with NURO controller



Nutrient control optimizes the conditions necessary for nitrogen and phosphorus removal

OSCAR system with aeration controller



Aeration control stabilizes the dissolved oxygen concentration

Xylem |'zīləm|

1) The tissue in plants that brings water upward from the roots;
2) a leading global water technology company.

We're a global team unified in a common purpose: creating advanced technology solutions to the world's water challenges. Developing new technologies that will improve the way water is used, conserved, and re-used in the future is central to our work. Our products and services move, treat, analyze, monitor and return water to the environment, in public utility, industrial, residential and commercial building services, and agricultural settings. With its October 2016 acquisition of Sensus, Xylem added smart metering, network technologies and advanced data analytics for water, gas and electric utilities to its portfolio of solutions. In more than 150 countries, we have strong, long-standing relationships with customers who know us for our powerful combination of leading product brands and applications expertise with a strong focus on developing comprehensive, sustainable solutions.

For more information on how Xylem can help you, go to www.xylem.com

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OSCAR Control Panel

REAL-TIME MONITORING | REAL-TIME CONTROL | REAL-TIME SAVINGS

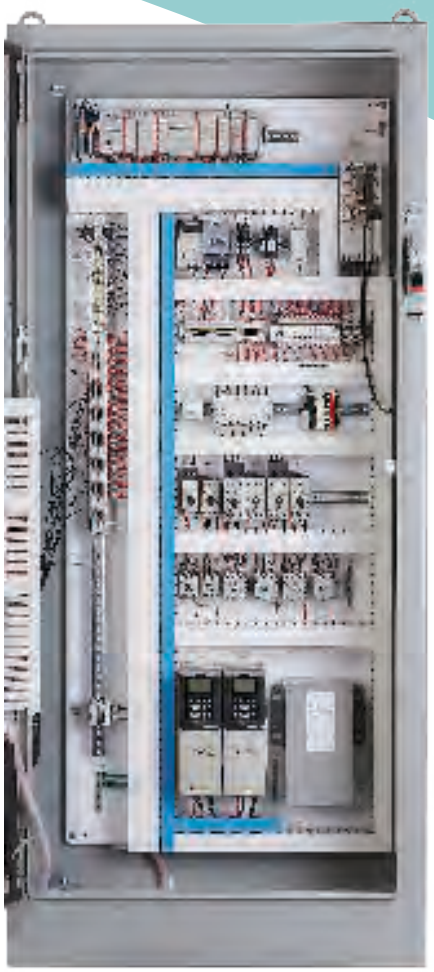
The OSCAR process performance optimizer includes a control panel comprising of hardware, services and software that is engineered to order and customized to meet project-specific needs.

Control panel hardware

- UL 508, C/UL, CE rated control panel, CSA optional
- NEMA 12/IP55 enclosure, unless otherwise specified
- Programmable logic controller (PLC) –Allen Bradley and Siemens supported
- Human Machine Interface (HMI) – industrial computer with 15.5" display with 16:9 aspect ratio
- Control switches/pilot lights
- Encrypted webport modem
- Smart sensor controller and communications module integrated with PLC via Ethernet/IP (AB) or ProfiNet (Siemens) communication
- Integrated motor starters and/or variable frequency drives in the control panel, wall mounted or in a motor control center for proper control and protection of equipment

Control panel services

- Complete 24/7 phone support with remote accessibility by Xylem engineers and technicians
- All drawings, project documentation, PLC and HMI programs saved on Xylem's secure backed up network for unparalleled customer support for the life of the plant
- Spare PLC and HMI components maintained at Xylem, in the event of an emergency at a plant, can be programmed for the plant and sent out quickly to get the plant back up and running until replacement hardware can be ordered
- Systems are completely shop tested with process emulation prior to shipment – provides quality assurance and fast, trouble-free plant commissioning



Reliable, secure and easy to use. The OSCAR system control panel connects the process equipment to the control algorithms to optimize treatment performance.

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OSCAR CONTROL PANEL

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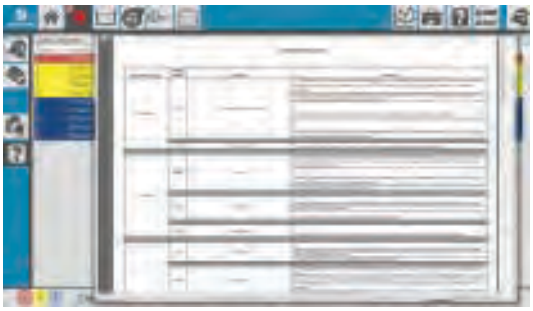
Control panel software

The control panel software includes process controllers, remote accessibility and intuitive HMI graphics/screens. Some of the features of the HMI include:

- Documentation and manuals available directly on the HMI for simple troubleshooting and process optimization. (1) Operation & Maintenance Manuals for all Xylem equipment (2) Process operational description and controls functional design specification documents.
- Setpoint restore allows an operator to save up to four groups of setpoints that can be reloaded at any time – great for seasonal fluctuations!
- Alarm troubleshooting guides are available for each alarm directly in the HMI to ensure alarms can be solved quick and easy – Tips & tricks make life easier!
- Alarms prioritized in three levels guides an operator to focus on the most critical alarms first. Alarm indicator always visible displaying number of alarms in each category, enlarges and flashes for active alarms or alerts.
- HMI trending capability simplifies process overview and troubleshooting. A typical system can store up to 10 days of data for online process variables and up to 1 year for calculated process variables. Data is available for download.
- Maintenance health dashboards for core Xylem equipment keep track of equipment and ensure maintenance is done as needed.
- Optional user authentication allows for customized access based on credentials.



An intuitive user interface equips operators with the tools necessary to successfully and efficiently operate a treatment plant.

Backed by Sanitaire biological process expertise and supported by Xylem's suite of premium products, the OSCAR system is committed to process optimization. Let one of our process experts show you how OSCAR takes the guesswork out of process controls.

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OSCAR Knows Aeration Control

REAL-TIME MONITORING | REAL-TIME CONTROL | REAL-TIME SAVINGS

OSCAR process performance optimizer with aeration control configurations is a customized control system used for activated sludge processes. It stabilizes the process by matching aeration needs to treatment goals, while reducing energy consumption. Some possible aeration configurations include:

- **Dissolved oxygen (DO) control** - the core of any aeration control system, using DO sensors
- **Cascade DO control** - using airflow meters together with DO sensors to regulate the valve position, increases the accuracy of the air supply and further stabilizes the DO level
- **Ammonia based aeration control (ABAC)** - combines the DO controller with ammonia sensors to target an effluent ammonia concentration from the process
- **Most Open Valve (MOV)** - provides additional energy savings by adjusting the pressure to minimize pressure losses while still ensuring an adequate air supply
- **Air bumping** - reduces diffuser fouling and associated pressure losses

Advanced sensors result in advanced control. The OSCAR system uses state of the art WTW/YSI IQ SensorNet sensors for reliable monitoring of DO, ammonia (NH_4) and nitrate (NO_3). By reducing grab samples, real-time monitoring and control provides peace of mind that the effluent quality is maintained at all times.

VARiON® Plus 700 IQ ▸
Ammonium & Nitrate measurement

AmmoLyt® Plus 700 IQ ▸
Ammonium measurement

NitraLyt® Plus 700 IQ ▸
Nitrate measurement

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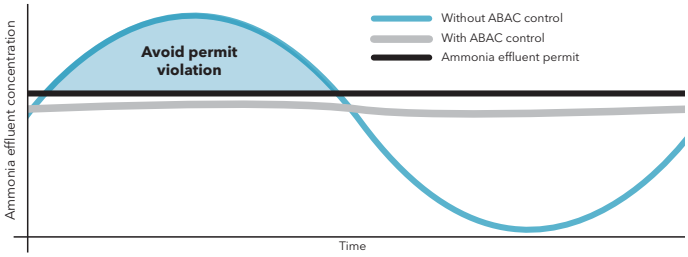
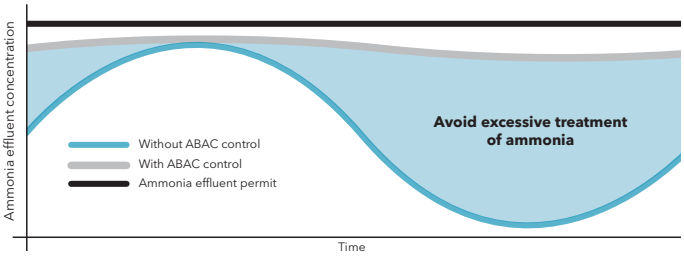
Biological Nitrogen Removal (BNR) optimized

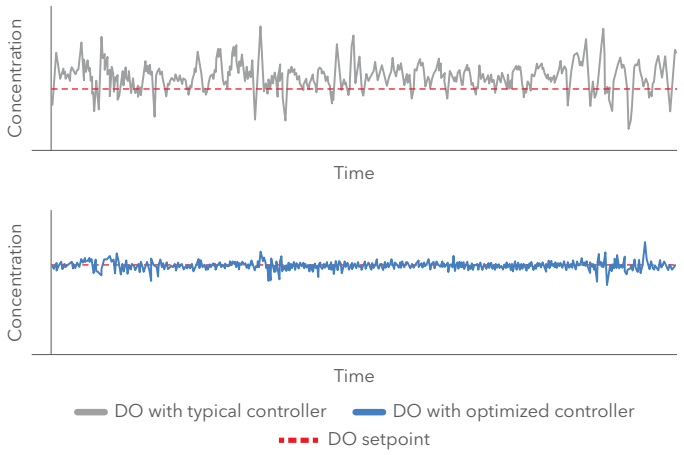
Many conventional treatment systems try to achieve BNR using DO levels alone to control the process. Trying to save energy while using only DO control risks permit violation. Using DO control alone to ensure compliance at all times waste energy. The OSCAR system with ammonia based aeration control is smarter and more flexible. With continuous monitoring of the effluent ammonia level, the air supply can be adjusted to match the actual oxygen requirement at all times, providing energy savings and keeping the plant in compliance.





Stability through advanced control

By adding MOV and cascade logics to the DO control, the system can fine tune the air supply to provide the aeration required at the lowest pressure loss and energy consumption. Anytime the DO concentration in the tank exceeds the setpoint, energy is being wasted. The OSCAR system with aeration controls stabilizes the operation and maintains the effluent quality, ultimately saving energy and money.



Backed by Sanitaire biological process expertise and supported by Xylem's suite of products, the OSCAR system ensures process optimization. Optimal treatment starts with optimal aeration control. Let one of our process experts show you how aeration controls for activated sludge takes the guesswork out of energy savings.

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OSCAR Knows Biomass Control

REAL-TIME MONITORING | REAL-TIME CONTROL | REAL-TIME SAVINGS

OSCAR process performance optimizer with SIMS controller helps monitor and control biosolids to meet treatment objectives while saving energy. The SIMS controller is available with any Sanitaire biological process solution.

Four control modes offer full flexibility to optimize process stability and energy efficiency, based on the operational preference:

SMART SRT MODE

Smart solids retention time (SRT) mode uses real-time conditions, including effluent ammonia target and basin temperature, to determine and maintain a required SRT for any point in time by adjusting the biomass wasted

SRT MODE

SRT mode uses an operator selected SRT to adjust the biomass wasted and maintain a healthy and stable biology in the process

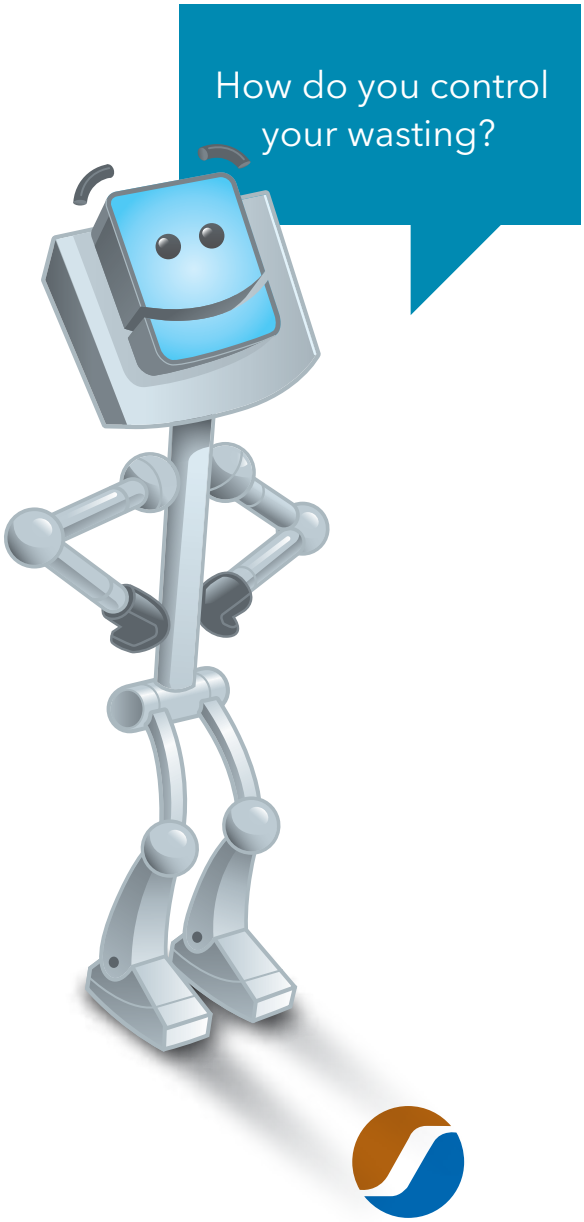
MLSS MODE

MLSS mode uses an operator desired Mixed Liquor Suspended Solids (MLSS) concentration to adjust the biomass wasted

TIME MODE

Time mode enables biomass wasting based on operator selected settings for the waste pump

Real-time monitoring for real-time control. Robust WTW/YSI sensors are used to measure total suspended solids (TSS). By monitoring MLSS in the basins, as well as flow and TSS of wasted sludge, the OSCAR system calculates and tracks the SRT for each aeration basin.



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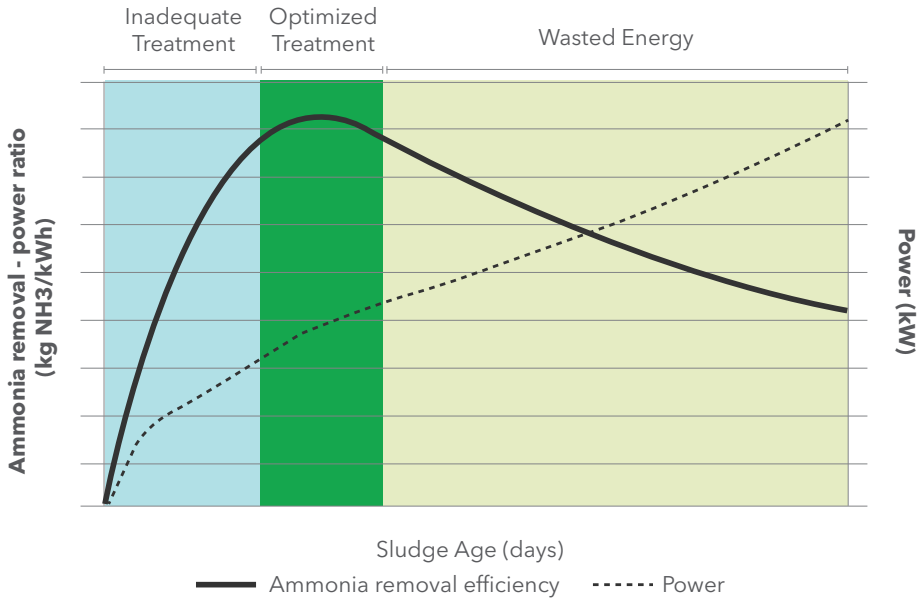
OSCAR KNOWS BIOMASS CONTROL

2547 . OSCAR SIMS Controller . 1 . Master . 1 . 20170823

Healthy Bugs = Quality Effluent = Happy Operator

Although sludge age, or SRT, is considered a very effective tool for activated sludge process control, it can be difficult to maintain in practice. Changes in influent flow and loading, as well as effluent draw off, can make stable biosolids maintenance a trial and error process.



Too low SRT causes unstable operation and inadequate treatment, risking permit violations. Too high SRT causes a waste of energy by aerating more solids than are needed for treatment.

- **SIMS controller stabilizes the process.** Increasing or decreasing sludge age can't happen overnight. The SIMS controller makes slow, realistic changes to the process keeping the biomass healthy and happy.
- **SIMS controller saves energy**. Excessive sludge age is not only hurting the process but also costs money. With the SIMS controller adjusting wasting, energy savings of 10-15% can be realized.
- **SIMS adjusts automatically.** Taking into consideration key parameters such as dissolved oxygen, required effluent ammonia and temperature allows the OSCAR system to use smart protocols to track trends and make timely adjustments, maintaining the SRT within the range for optimum treatment in real-time.
- **SIMS ensures trouble-free control.** The SIMS controller incorporates Sanitaire's expertise on biological process and online sensors to detect any process upsets automatically and take necessary actions, ensuring a trouble-free control and peace of mind.
- **SIMS controller makes monitoring fast and simple**. Intuitive user-friendly screens ensure operators are always in the know.

Backed by Sanitaire biological process expertise and supported by Xylem's suite of premium products, the OSCAR system ensures process optimization. Optimal treatment starts with optimized biosolids control. Let one of our process experts show you how the SIMS controller takes the guesswork out of biosolids management.

xylem
Let's Solve Water

www.xylem.com

Clarifications & Exceptions

Section	Description
Sheet 03D-01	One (1) aeration grid will be provided for each ICEAS basin. This grid will cover both the pre-react and main-react zones. The air distributors will run through the ports located at the bottom of the pre-react divider wall. Adder for two (2) grids per basin provided.
Sheet 03D-01	The baffle walls shown within the pre-react zone are not required. Short-circuiting of the influent flow is eliminated by the pre-react divider wall.
Sheet 07Y-06	Only one (1) level transducer will be required per basin since the pre-react and main-react zones are hydraulicly connected.
Sheet 07Y-08	A local blower control panel for each blower will not be provided. Blower controls will be located in the SBR master control panel, located in the blower building.
Sheet 07Y-06	The local controls for the decanter and WAS pump in each basin will share a local control panel. One (1) local panel per basin.
Sheet 03D-01	RAS piping bringing sludge from the sludge pump to the pre-react zone is not required or provided.
Sheet 03D-01	To satisfy the effluent limits based on the influent conditions provided, each ICEAS basin will need to be 58’ L (including a 12” thick divider wall) x 20’ W with an assumed top water level (TWL) of 18’.
Sheet 03D-01	Each decanter will need to be 10’ long instead of 5’ as shown on this drawing.
Sheet 07Y-08	Due to the cyclical operation of the SBRs, only one basin will be receiving air at a time, therefor mass flow meters will not be required or provided to measure the air flow in each basin.
Paragraph 2.6	Gardner Denver blowers are provided in our base offering. An adder for Aerzen blowers is provided on the pricing sheet.
Paragraph 2.13.F	OIS SCADA package will be provided as an adder on the pricing sheet.
Paragraph 2.13.B.2	In-panel PLC spare not available with specified CompactLogix PLC. A shelf spare is included. An adder price for in-panel spare PLC using ControlLogix is included on pricing sheet.
General	Class 1 Div. 2 not provided. Adder can be provided if needed.
Paragraph 2.7	Mixers not required or provided. Additional room provided in ICEAS control panel for future mixer power equipment.
General	Sanitaire is providing a continuous influent process requiring non-hydrostatic baffle walls across the width of the tank. Fixed aeration grids are included. Influent control valves not required to transition flows between basins (i.e. true-batch SBR system). Effluent valves are not required on the decanters. Influent manifold not required. RAS pumping not required.
General	Red-lined P&ID drawings provided.

APPENDIX C -
WARRANTY AND TECHNICAL SUPPORT INFORMATION

SANITAIRE

a xylem brand

Xylem
247 W. Freshwater Way, Suite 200
Milwaukee, WI 53204
tel 414.365.2200
fax 414.365.2210

ICEAS® SBR Process Performance Guarantee

Installed at the

_____ WWTF
SANITAIRE Project # _____

Sanitaire, a Xylem brand, hereinafter referred to as "SANITAIRE", has contracted with _____ hereinafter referred to as the "Customer", to supply the equipment and certain services in accordance with Project # _____ for an ICEAS Intermittent Cycle Extended Aeration System Process, hereinafter referred to as the "ICEAS Process" at the _____Wastewater Treatment Facility (WWTF). SANITAIRE guarantees the performance of the ICEAS Process as follows, hereinafter referred to as "Performance Guarantee":

1) **Effluent Guarantee**. SANITAIRE guarantees that the ICEAS Process shall meet effluent wastewater quality, as determined during the Performance Test defined herein, 30-day average equal to or less than the following (hereinafter referred to "Guaranteed Effluent"):

Biochemical Oxygen Demand (BOD_5)		mg/l
Total Suspended Solids (TSS)		mg/l
Ammonia Nitrogen (NH_3-N)		mg/l
Total Nitrogen (TN)		mg/l
Total Phosphorous (TP) - *		mg/l

* - Metal salt addition may be required to meet the effluent phosphorus limit

2) **Operating Conditions**. SANITAIRE provides this Performance Guarantee conditioned upon the following:

A. The Influent wastewater to the ICEAS Process shall meet the limits and conditions as follows (hereinafter referred to as "Influent"):

a. The Influent shall be equal to or less than the following conditions:

Maximum Month Flow		MGD
Max. __-Hr Cycle Flow		MGD
Max. __-Hr Cycle Flow		MGD
BOD_5		lb/d

TSS		lb/d
Ammonia Nitrogen (NH_3-N)		mg/l
Total Kjeldahl Nitrogen (TKN)		lb/d
Minimum Ratio of BOD to TKN		unitless
Total Phosphorous (TP)		lb/d
Total Fat, Oil and Grease (FOG)	100	mg/l
pH, range	6.5-8.5	s.u.

b. The Influent temperature range shall be __ to __ °C.

c. Sufficient alkalinity, as $CaCO_3$, shall be available to maintain a minimum pH in the ICEAS basins of 6.8.

(USER NOTE: SELECT Paragraph d, e if with Tertiary Filter)

d. Cloth media filtration will only remove TP that is associated with TSS removed by the filter. Solids include both biological and chemical solids. Since only insoluble, particle-associated phosphorus is capable of being removed by cloth media filtration, phosphorus speciation (by others) may be necessary to determine the concentrations of soluble and insoluble phosphorus in the influent. If the proportions of soluble (unfilterable) and insoluble phosphorus are such that removal to achieve the desired effluent is not practical, it may be necessary to provide (by others) for proper conditioning of the wastewater, to allow for the required removal.

e. Influent TP shall be either in a particle associated form or in a reactive soluble (ortho-) phosphate form or a form that can be converted to reactive phosphorus in the biological system. Soluble, non-reactive phosphorus species are considered recalcitrant and cannot be removed by chemical precipitation with metal salts. Influent and effluent water quality analysis would be required (by others) to determine the phosphorus speciation with respect to insoluble, soluble reactive, and soluble non-reactive to determine if the effluent TP guarantee limit can be achieved.

f. Influent nitrogen is characterized as Total Kjeldahl Nitrogen (TKN), which is composed of organic-nitrogen (particulate and dissolved) and ammonia-nitrogen species. Biological transformations in the activated sludge process result in an effluent Total Nitrogen (TN) composed of dissolved and particulate organic and inorganic nitrogen components. The inorganic components are ammonia (NH_4), nitrate (NO_3) and nitrite (NO_2). Activated sludge can be designed to specifically oxidize NH_4 to NO_3 and/or NO_2

(nitrification) and to biologically reduce these compounds to nitrogen gas (denitrification). Complex hydrolysis and deamination process convert organic nitrogen to ammonia within the activated sludge process. There is a portion of influent organic nitrogen that will remain soluble and will not be converted to ammonia, this is referred to as dissolved organic nitrogen (DON) and is not accessible for treatment with the activated sludge process. The proposed system cannot guarantee effluent organic nitrogen less than the effluent DON since the DON is not accessible for biological treatment and a function of the influent characterization.

g. The Influent shall not have concentrations of pollutants that are inhibitory to biological treatment, or have other physical or chemical characteristics that detrimentally affect the biological ICEAS Process or the settleability of the waste. If toxicity and/or inhibition are suspected during any period of this Performance Guarantee, Influent shall be analyzed for those parameters included in Appendix A. In the event that one or more pollutants exceed the threshold concentration defined, and/or determination of physical/chemical interference is made, it shall be the responsibility of the Customer to remove the non-conforming pollutants from the Influent to the Process.

B. The WWTF shall have been built, installed and operated strictly in accordance with the approved drawings and specifications.

C. The ICEAS Process shall be operated and maintained in accordance with the Plant Operations and Maintenance Manual and all manufacturer requirements and recommendations. Documentation supporting operation and maintenance procedures shall be maintained, and shall be provided to SANITAIRE upon request.

D. The equipment, fixtures or other components of the project provided, furnished or installed by parties other than SANITAIRE shall function in accordance with the manufacturer's specification and the facility plans and specifications issued by the Engineer.

E. SANITAIRE shall have been paid in full for services and equipment provided.

F. Monthly performance data related to the ICEAS Process shall be provided to SANITAIRE during the entire Performance Guarantee period.

G. SANITAIRE equipment is covered by a separate mechanical warranty. This Performance Guarantee shall not apply to:

a. Damage to any equipment or part thereof due to misuse, mishandling, neglect, alteration or physical damage;

b. Repair or alteration to equipment by others not approved by SANITAIRE or without SANITAIRE's written approval.

3) **Preliminary Test**. A Preliminary Test shall be performed to establish that the Influent wastewater characteristics are within the specified limits, that the WWTF is mechanically functioning properly, and that the effluent wastewater has achieved equilibrium following startup. SANITAIRE shall be notified at least five (5) business days prior to commencing the Preliminary Test. The Preliminary Test shall be conducted within sixty (60) to one hundred twenty (120) days, or at a time mutually agreeable to the Customer and SANITAIRE, after the WWTF and the ICEAS Process have been placed into continuous service, and having achieved equilibrium operating conditions.

Steady-state or equilibrium conditions shall be demonstrated as reflected by no downward trend in effluent value concentrations over a period of five (5) days of 24-hour composite samples (hereinafter referred to as "Steady-state"). All testing will be in accordance with the terms outlined in Appendix B.

Analyses performed by the Customer during the Preliminary Test shall include those tests required by the Customer's regulatory discharge permit, those tests necessary for normal plant operation and may include any additional analysis deemed desirable by the Customer.

(USER NOTE: Only include this section if an extended warranty is required:)

4) **ICEAS Process Performance Guarantee Term.** The term of this performance warranty shall be _-years from substantial completion of the project, or __ months after after the WWTF and the ICEAS Process have been placed into continuous service, whichever comes first. After successful completion of the 30-day Process Performance Guarantee Test as defined herein, SANITAIRE shall provide support services to the WWTF as required to maintain compliance with the effluent limits listed in paragraph 1).

5) **ICEAS Process Performance Guarantee Test**. The ability of the ICEAS Process to achieve the Guaranteed Effluent will be determined on the basis of the thirty (30) day test specified in Section 4 of Appendix B and hereinafter referred to as the "Performance Test". The Performance Test shall commence within thirty (30) days after satisfactory completion of the Preliminary Test. All testing will be in accordance

with the terms outlined in Appendix B. SANITAIRE shall be notified five (5) business days prior to commencing the Performance Test.

6) **Performance Test Non-Compliance**. In the event that the Guaranteed Effluent is not obtained during the Performance Test, the following steps shall be taken:

   a) The Customer shall notify SANITAIRE of this condition and shall provide satisfactory evidence that the Influent was within specified conditions.

   b) Upon issuance of this system deficiency as provided above, SANITAIRE shall provide a written performance evaluation of the system, and may recommend operational changes to obtain compliance, upon which the Customer shall initiate said operational changes within a reasonable period of time. If installation of additional equipment or modifications to equipment provided by SANITAIRE are required, then SANITAIRE shall initiate all steps it deems necessary, at no cost to the Customer, to fulfill its Performance Guarantee herein; including where necessary:

      Repairing, modifying, and/or replacing any of the equipment provided by SANITAIRE, causing the ICEAS Process to not produce the Guaranteed Effluent;

      Evaluating, correcting, altering or changing the ICEAS Process to enable it to produce the Guaranteed Effluent.

      Within thirty (30) days of the effluent wastewater achieving Steady-state conditions, the Customer may then recommence the Performance Test. If the Guaranteed Effluent is not within specified values after this initial retest, then SANITAIRE may recommend additional operational changes and within a maximum period of thirty (30) days after the effluent wastewater achieves Steady-state conditions, retest the system. Including the initial retest, SANITAIRE shall be allowed a total of three (3) such periods to address system deficiencies and retest.

7) **Performance Test Suspension**

   a) Adverse circumstances may develop beyond the control of the Customer which may interfere with the Performance Test after the test has begun. In this event, after corrective measures have failed or cannot be developed within 24-48 hours, the test shall be suspended and the Customer shall notify SANITAIRE of the necessary suspension. Any samples under analysis associated with the upset condition shall be disregarded from performance calculations.

b) During a test suspension, the Customer may take corrective actions as necessary, including but not limited to actions to ensure the Influent meets the specified conditions. When conditions and circumstances have returned to normal, and the effluent wastewater has again reached Steady-state, a suspended test may be resumed following notification of SANITAIRE. The corrective action period shall not exceed a maximum duration of ninety (90) days from notice of suspension to SANITAIRE, beyond which the ICEAS Process shall be deemed to have met all requirements of this Performance Guarantee.

c) SANITAIRE may in its sole discretion collect data and/or review data generated by the Customer. If in the opinion of SANITAIRE such data provides significant evidence that a test be suspended or that certain data be disregarded from performance calculations, then SANITAIRE shall present such information to the Customer and the Customer shall suspend the performance test and/or disregard such data identified by SANITAIRE.

(USER NOTE: SELECT Paragraph 7 if BOND:)

8) **Performance Bond.** SANITAIRE shall provide a Performance Bond in the amount equal to one hundred percent (100%) of the price of the SANITAIRE equipment and services contract between SANITAIRE and the Customer. Upon successful completion of the Performance Test, the Customer shall release the bond back to SANITAIRE and SANITAIRE shall have no further liability hereunder. In no event shall SANITAIRE's aggregate liability under this Performance Guarantee exceed the amount of the Performance Bond. In the event that the equipment furnished by SANITAIRE cannot be placed into service, or the Performance Test cannot be completed within eighteen (18) months after the execution of the contract between the Customer and SANITAIRE, due to reasons beyond the reasonable control of SANITAIRE, the Customer shall return the bond to SANITAIRE and SANITAIRE shall have no further liability hereunder.

(USER NOTE: Select Paragraph 8 if NO BOND:)

9) **Aggregate Liability.** In no event shall SANITAIRE's aggregate liability under this Performance Guarantee exceed 10% of the price of the SANITAIRE equipment and services contract between the Customer and SANITAIRE. In the event that the equipment furnished by SANITAIRE cannot be placed into service, or the Performance Test cannot be commenced within eighteen (18) months after the execution of the contract between the Customer and SANITAIRE, due to reasons beyond the reasonable control of SANITAIRE, the system shall be deemed to have met all requirements of this Performance Guarantee and SANITAIRE shall have no further liability hereunder.

10) THIS PERFORMANCE GUARANTEE IS EXCLUSIVE AND IN LIEU OF ALL OTHER EXPRESS OR IMPLED WARRANTIES, GUARANTEES, CONDITIONS OR TERMS OF WHATEVER NATURE RELATING TO THE PROCESS PROVIDED HEREUNDER, WHICH ARE HEREBY EXPRESSLY DISCLAIMED AND EXCLUDED. SANITAIRE'S LIABILITY FOR BREACH OF THE PERFORMANCE GUARANTEE STATED HEREIN IS LIMITED TO THE REMEDIES AND LIMITATIONS SET FORTH HEREIN. IN NO EVENT SHALL SANITAIRE BE LIABLE FOR ANY OTHER FORM OF DAMAGES, WHETHER DIRECT, INDIRECT, LIQUIDATED, INCIDENTAL, CONSEQUENTIAL, PUNITIVE, EXEMPLARY OR SPECIAL DAMAGES, INCLUDING BUT NOT LIMITED TO LOSS OF PROFIT, LOSS OF ANTICIPATED SAVINGS OR REVENUE, LOSS OF INCOME, LOSS OF BUSINESS, LOSS OF PRODUCTION, LOSS OF OPPORTUNITY OR LOSS OF REPUTATION.

11) All claims, disputes or other matters in question arising out of, or relating to, this Performance Guarantee shall be resolved if possible by negotiations between the Customer and SANITAIRE. If such negotiations do not resolve the controversy or claim, then (except with regard to the exercise of equitable remedies as hereinafter provided) the claim or controversy shall be finally settled by arbitration in accordance with the Construction Industry Arbitration Rules of the American Arbitration Association then prevailing unless the parties agree otherwise. The arbitration shall be conducted in English and in accordance with the governing law of this Agreement. Judgment upon an arbitration award may be entered in any court having jurisdiction or application for a judicial acceptance of the arbitration award or an order of enforcement as the case may be. Costs of arbitration shall be borne equally by both parties. Any party may give written notice to the other of it's demand for arbitration. The demand for arbitration shall be made within a reasonable time after the claim, dispute or other matters in question has arisen and after negotiations between the parties have failed to resolve the claim or controversy, but in no event beyond any applicable statute of limitations. Notwithstanding the foregoing, either the Customer or SANITAIRE may apply to a court of competent jurisdiction for the imposition of an equitable remedy (such as a Restraining Order or an Injunction) upon a showing of the elements necessary to sustain such remedy.

12) This Performance Guarantee shall be governed by and construed in accordance with the laws and statutes of the State of Wisconsin, United States of America, without regard to conflict of laws provisions.

13) For the purpose of any notices required to be given hereunder, SANITAIRE shall be notified by mailing such notice certified mail return receipt requested or by overnight courier service to the following address:

Xylem
247 W. Freshwater Way, Suite 200
Milwaukee, WI 53204
tel 414.365.2200
fax 414.365.2210

SANITAIRE
a xylem brand

Appendix A

Threshold Concentrations of Pollutants that are Inhibitory To Biological Treatment Processes

Pollutant	Activated Sludge Process (mg/L)	Nitrification Process (mg/L)	Ref.
Inorganic Compounds			
Ammonia	480		5
Arsenic	0.1		1,2,5
Boron	0.05-10		4
Cadmium	1-10	5.2	1,2
Calcium	2500		4
Chloride		180	5
Chromium (Hexavalent)	1-10	0.25	1,2
Chromium (Trivalent)	15-50	15-50	1
Copper	0.1-1.0	0.05-0.5	1,2,4,5
Cyanide	0.05-5	0.03-0.5	*1,4 5*
Iron	5-500		4
Lead	0.1-100	0.5-1.7	1,2,4,5
Manganese	10		4
Magnesium		50	4
Mercury	0.1-5.0	2-12.5	1,2,4
Nickel	1-5	0.25-5	1,2,4,5
Silver	0.25-5	0.25	1,2,4
Sulfate	500*	500*	5 (* for anaerobic treatment)
Sulfide	25-30		5
Zinc	0.03-10	0.01-10	1,2,5,4

Pollutant	Activated Sludge Process (mg/L)	Nitrification Process (mg/L)	Ref.
Organic Compounds			
1,2 DICHOLOROBENZENE	5		3
1,2 DIPHENYLHYDRAZINE	5		3
DICHLOROBENZENE	5		3
2,4,6 TRICHOLOROPHENOL	50-100		2,5
2,4 DICHLOROPHENOL	64	64	1
2,4 DIMETHYLPHENOL	40-200		1
2,4 DINTROPHENOL	1-110**	150	3,2
2,4 DINTROTOLUENE	5		3
2-CHOLORPHENOL	20-200		1
ANTHRACENE	500		2,5
BENZENE	100-500		1
BENZIDINE	5-500		2,1
CHLOROBENZENE	140		6
CHLORFORM	500	10	6,2
ETHYLBENZENE	200		1
HEXACHLOROBENZENE	5		3
NAPHTHALENE	500		1,2,5
NITROBENZENE	30-500		1
PENTACHLOROPHENOL	0.95-150		1,2,5
PHENANTHRENE	500		2,5
PHENOL	50-200	4-10	1
TOLUENE	200		1

Source: Comprehensive Environmental Response Compensation and Liability Act (CERCLA) Site Discharges to POTWs Guidance Manual (EPA/540/G-90/005 Aug 1990)

Ref-1 Anthony and Breimhurst, 1981; Ref-2 Russell, Can and Jenkins, 1983; Ref-3 Tabak, Quave, Mashni, and Berth, 1981; Ref-4 USEPA, 1987h; Ref-5 USEPA, 1987i (Reference did not distinguish between total and soluble pollutants inhibition levels); Ref-6 Volskay and Grady,1988

Note: This listing is partial and additional compounds and values may be applicable.

Appendix B

ICEAS Process Performance Guarantee Testing

1. **Testing Methodology**. The Customer's personnel shall operate the ICEAS Process and take the specified measurements and samples. Testing may include tests to closely monitor and troubleshoot ICEAS Process performance as well as tests for regulatory reporting purposes (NPDES) and Performance Guarantee testing. Each of the Influent and Effluent samples shall be analyzed according to specified Influent and Guaranteed Effluent values. Other tests may be performed on the Influent or Guaranteed Effluent samples if deemed necessary or desirable by the Customer. Analysis shall be conducted by independent, State certified laboratory personnel, and/or State certified Customer laboratory, mutually agreed upon by the Customer and SANITAIRE. All operating, sampling and analytical testing costs shall be paid for by the Customer to ensure impartiality of the testing procedures. Flow measuring devices and meters shall have been appropriately calibrated. SANITAIRE shall be allowed to participate in the analysis of any and all samples collected during all tests, and shall also be permitted to independently collect and analyze additional samples. All data from such analyses shall be provided to the Customer.

2. **Sample Collection and Analysis**. Sampling equipment should be used which assures automatic 24 hour composite collection, with continuous flow and/or no periods of in line liquid stagnation between flow intervals. The sampling lines shall be cleaned with bleach solution and thoroughly flushed with potable water before any tests and at not less than seven (7) day intervals during the performance tests. If automatic sampling equipment is not available or malfunction occurs during testing, a manual program of grab samples at 2 hour intervals may be substituted until the equipment is available or repaired. In the event that a manual program is necessary, the Customer shall provide SANITAIRE assurance that trained operators will be employed.

   The sampling, sample holding and analytical testing shall be conducted in accordance with the most recent edition of "Standards Methods for the Examination of Water & Wastewater" published jointly by the American Public Health Association (APHA), American Water Works Association (AWWA) and Water Environment Federation (WEF). Should situations develop requiring a deviation or modification from any procedure noted in Standard Methods, the Customer and SANITAIRE shall mutually approve such modification in writing. The Customer shall submit to SANITAIRE the operating and test data on a

weekly basis during the Performance Test Period. In the event certain data appear QA/QC flagged by laboratory method, or otherwise questionable, this data may be rejected upon mutual agreement between the Customer and SANITAIRE. If the rejected data includes an Influent or a Guaranteed Effluent value per this Performance Guarantee, then all data for the Influent and the Guaranteed Effluent for that day shall be rejected. A 25 percent portion of all Influent samples shall be retained for up to thirty (30) days for possible heavy metals analysis with preservatives added as recommended in Standard Methods.

3. **Flow Measurement and Full Flow Simulation**. In an attempt to test the ICEAS Process at design conditions, alternate means of flow reapportionment through the on-line equipment may be devised to a mutually satisfactory agreement between the Customer and SANITAIRE. In lieu of insufficient wastewater flow to meet design conditions, less than all of the system may be operated to approach design conditions. In this event, the flow apportionment shall be within +/-10% of the design hydraulic loading, but in no case shall the organic loads exceed the design average, with surplus flow directed through adjacent equipment. In this latter event, the Guaranteed Effluent sample shall be taken or sampled prior to discharge to a collection point common to or mixed with effluent from adjacent equipment.

4. **Performance Test**. The Performance Test will require the collection and laboratory analysis of not less than twelve (12) nor more than thirty (30) pairs (not necessarily consecutive) of Influent and Guaranteed Effluent daily composite samples, during a thirty (30) day testing period (hereinafter the “Performance Test”). If the arithmetic average calculated for each of the Guaranteed Effluent parameters in Section 1 over the thirty (30) day Performance Test are equal to or less than those values set forth in Section 1, then the Customer shall deem the system to have met all requirements of this Performance Guarantee, and shall so notify SANITAIRE in writing of this successful completion.

   In addition to the daily composite Influent and Guaranteed Effluent samples, testing and measurements of the ICEAS Process during the thirty (30) day Performance Test shall also include the following:

   A. Daily Field Measurements
      a. ICEAS Process Influent Flow Rate
      b. Influent pH
      c. Effluent pH
      d. Influent Water Temperature
      e. Ambient Air Temperature

f. Dissolved Oxygen (during middle of aeration phase)

B. Three (3) Times a Week Grab Samples
   a. MLSS (one per basin)
   b. MLVSS (one per basin)
   c. 30 Minute Settling Test (one per basin)
   d. 60 Minute Settling Test (one per basin)
   e. Sludge Volume Index (one per basin)
   f. Influent Total Kjeldahl Nitrogen (TKN)
   g. Influent Alkalinity
   h. Effluent Total Kjeldahl Nitrogen (TKN)
   i. Effluent Alkalinity