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ENVIRONMENTAL HEALTH

Engineering Report

Proposed Wastewater Treatment Plant

Bellefield at Historic Hyde Park

US Route 9
Town of Hyde Park
Dutchess County, New York

RECOMMENDED FOR APPROVAL

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DUTCHESS COUNTY DEPARTMENT OF HEALTH
APPROVED
DATE: 5/13/2022
PROJECT: BELLEFIELD WWTP
FOR BUILDERS
HYDE PARK
SEE PLANS
, P.E.
SUPERVISING PUBLIC HEALTH ENGINEER

Prepared for:

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500 Mamaroneck Avenue
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1.0 INTRODUCTION

T-Rex Hyde Park Owner LLC, the Owner-Applicant, is proposing a multi-phase mixed-use residential/commercial development on this 340-acre property situated across from the Culinary Institute of America (CIA) on the east side of NYS Route 9 between St. Andrews Road and West Dorsey Lane in the Town of Hyde Park. The project is expected to be constructed in several phases of development with each phase consisting of one or several sub-phases.

The initial phase of the proposed development will involve the construction of residential units, commercial retail space, community space and the Inn at Bellefield, a 133-room hotel at the corner of Route 9 and West Dorsey Lane. The Inn at Bellefield will be constructed first as part of Phase 1A. Future phases would comprise the remainder of the proposed development consisting mainly of the construction of residential dwellings and light commercial retail space. The Applicant is currently working with potential builders, partners and tenants for developing the remainder of the proposed project.

The site is served by municipal water but does not have municipal sewer service. The site is located within the Hyde Park Water System (County Water District Zone of Assessment AB) owned and operated by the Dutchess County Water & Wastewater Authority (DCWWA). The applicant intends to connect to the Hyde Park water system to supply water to the project.

The Owner and Applicant is proposing to construct an on-site wastewater treatment plant (WWTP) for the treatment and disposal of wastewater generated on-site. The WWTP will be constructed as a modular system that will initially serve the Inn at Bellefield with an average daily wastewater flow of 21,500 gallons per day (gpd). As the remainder of project is eventually developed, WWTP components will be added to accommodate the expected flows associated with future phases of development.

Wastewater will be treated to meet the water quality discharge limits set forth in the SPDES Permit. The treated effluent will be discharged to the nearby Maritje Kill, a Class B stream.

This report has been prepared to substantiate the design of the proposed wastewater treatment plant (WWTP) at development buildout.

2.0 PROJECT BACKGROUND

The Town of Hyde Park Town Planning Board approved the St. Andrews at Historic Hyde Park Planned Unit Development (St. Andrews PUD) in 2007. The project was the subject of an Environmental Impact Statement that was accepted as complete in December 2005, and the Town Planning Board adopted a SEQR Findings Statement on August 29, 2007. On the same date, the Planning Board approved a Concept Plan depicting the general configuration of land uses for the site.

This PUD encompasses 339.618 acres of land in the southeast quadrant of the intersection of US Route 9 and St. Andrews Road, as shown on Figure 1. The parcel is identified on the Town of Hyde Park official tax map as parcel 133200-6163-01-131849. The approved Concept Plan included a mixture of residential and commercial uses throughout the western portion of the site, and a conservation easement for the eastern portion of the site.

The PUD allows for the development of 558 residential units comprised of single-family homes, townhomes, duplex homes, apartments, flats and live/work units. The PUD also permits the development of 1,005,895 square feet (sf) of non-residential uses comprised of a mix of retail and commercial spaces including hotels, restaurants, shops, cafes and offices. Non-residential development also provides space for community building(s) and education facility for the Culinary Institute of America.

The Applicant and current property owner, T-Rex Hyde Park Owner LLC, submitted an application for Final Development Plan approval (subdivision and site plan) to the Planning Board for the first sub-phase of the project (Sub-Phase 1-A) for the proposed Inn at Bellefield, a five-story hotel to be constructed near the corner of Route 9 and West Dorsey Lane. On June 13, 2017, the Town of Hyde Park Town Board adopted an Amended SEQRA Findings Statement related to the St. Andrews PUD. The Town of Hyde Park Planning Board adopted a SEQR resolution and Notice of Determination of Non-Significance on January 3, 2018 for the proposed Phase 1-A development pursuant to Part 617 pertaining to Article 8 of the Environmental Conservation Law (State Environmental Quality Review Act).

The 339.62-acre property has been subdivided into three (3) separate lots as shown on the subdivision plats (filed map No. 12627). The subdivided lots can be described as follows:

- Lot 1 334.45 acres Owner: T-Rex Hyde Park Owner, LLC. Parcel ID #133200-6163-01-131849
- Lot 2 3.49 acres Owner: T-Rex/Shaner Hyde Park Parcel ID #133200-6163-01-010622
- Lot 3 1.68 acres Owner: TR Sewage Works Corp. Parcel ID #133200-6163-01-000897

Lot 1 with an acreage of 334.45 acres consists of the remaining undeveloped vacant land. Lot 2 is land owned by a hotel developer and upon which the Inn at Bellefield will be constructed. Lot 3 is the Sewer Parcel owned by the TR Sewage Works Corp., a Transportation Corporation registered in New York State upon which the on-site wastewater treatment plant (WWTP) will be constructed.

The proposed WWTP will be located near the Maritje Kill along Route 9. The Applicant has submitted an application to the NYSDEC to amend the existing SPDES permit #NY0281140 for the discharge of up to 342,000 gallons of treated wastewater per day on average to the Maritje Kill from proposed Development.

The proposed 342,000-gpd WWTP will be built in four (4) distinct phases to full buildout to parallel the development of the project as follows:

- Phase 1 – Existing Headworks and Improvements previously approved
- Phase 2 – 1st Treatment Train (MBR building #1 + aeration tanks #1 & #2)
- Phase 3 – 2nd Treatment Train (MBR building #2 + aeration tanks #3 & #4)
- Phase 4 – 3rd Treatment Train (MBR building #3 + aeration tanks #5 & #6)

The construction of the WWTP will parallel the development of the project with additional treatment trains placed in service to accommodate anticipated sewage flows from future phases and sub-phases of development. Plant capacity will be built to accommodate the flows from the development over the time required to achieve project buildout. The project is expected to take 10 to 15 years to achieve full buildout.

A Wastewater Development Phasing Plan showing proposed phases of site development per neighborhood is shown in Appendix A.

3.0 SITE DESCRIPTION

3.1 Topography

The area in the vicinity of the project site is mostly covered with trees and contains remnants of old farm buildings and structures. While the western side of the parcel is relatively flat and level along US Route 9, the ground quickly slopes upward to the east.

A USGS map of the project site is attached (see Figure 1).

3.2 Soils

Refer to Figure 2 for the soil types encountered on-site.

A review of the United States Department of Agriculture Soil Conservation Services Soil survey soil maps for Dutchess County, NY, has identified seven (7) soil types on the subject site, as shown on Figure 2. The soil types encountered on-site are: Dutchess-Cardigan complex, undulating, rocky (DwB), Hoosic gravelly loam, nearly level (HsA), Hoosic gravelly loam, 25 to 45 percent slopes (HsE), Knickerbocker fine sandy loam, undulating (KrB), Nassau-Cardigan complex, undulating, very rocky (NwB), Nassau-Cardigan complex, rolling, rocky (NwC), and Nassau-Cardigan complex, hilly, very rocky (NwD) and Sun silt loam (Su).

More than 30% of the project parcel consists of the NwD soil type. The proposed Inn at Bellefield hotel and WWTP is located within the area mostly covered by the KrB soil type. The eastern portion of the site and the area near West Dorsey Lane contain the NwC and DwB soil types. Rock outcrops are visible in the southern portion of the site near West Dorsey Lane. The area designated for future phases of the project are covered by the NwB, NwC, HsA and HsE soil types.

The KrB soil type belongs to the hydrologic group A. The KrB soils have slopes between 2 and 6%, are somewhat excessively drained and are characterized by a depth to bedrock and water table greater than 80 inches. The KrB soils have excellent permeability (2.0-6.0 in/hr) and are suitable for the placement of subsurface sewage disposal system. These soils are classified as SP-SM, SM and ML per the Unified Soil Classification System (USCS).

3.3 Water Resources

The Maritje Kill, a NYSDEC regulated Class B stream is located just north of the project site (water index No. H-120). This stream is tributary to the Hudson River. According to the National Wetland Inventory (NWI), there are a few federally regulated wetlands near US Route 9 and West Dorsey Lane. There are no NYSDEC regulated wetlands on-site. A map showing existing water resources on-site as well as those mapped by the NYSDEC is attached (see Figure 3).

4.0 PROJECTED WASTEWATER FLOWS AND CHARACTERISTICS

4.1 Projected Wastewater Flows – Project Buildout

Projected wastewater flows were estimated using typical hydraulic loading rate values taken from Table B-3 of the New York State Department of Environmental Conservation's (NYSDEC) "Design Standards for Wastewater Treatment Works– Intermediate Sized Sewerage Facilities" (2014 Edition) manual with exceptions as noted. The estimated wastewater flows take into account the allowable 20% reduction in flows due to the mandated use of water saving plumbing fixtures for new construction.

St-Andrews PUD – Concept Plan & Building Program

Wastewater flows for the proposed development at full buildout were estimated based on the Concept Plan and Building Program originally developed for the St. Andrews PUD and approved by the Town in 2007 and documented in the SEQRA DEIS and FEIS documents. Estimated wastewater flows for the proposed development at full buildout are summarized in Table 1 (See Appendix A for detailed flow estimation). Wastewater flows for the project buildout include the estimated flow for the Inn at Bellefield Hotel.

As shown in Table 1, projected wastewater flows at full buildout are estimated as follows:

Table 1: Projected Wastewater Flows

Average Daily Flow (ADF):	341,071 gpd (236.9 gpm)
Maximum Day Flow (MDF):	682,142 gpd (473.7 gpm) (P.K. = 2)
Peak Hourly Flow (PHF):	1,364,283 gpd (947.4 gpm) (P.K. = 4)

Amended Development Program

The Owner/Applicant is in the process of developing an amended development program for the site. The proposed development program will include a mixture of residential and non-residential uses similar to the approved Concept Plan & Building Program but with a relatively larger number of residential units and less non-residential space. The proposed development program is still being drafted and has not been officially presented to the Town of Hyde Park Planning Board for review and approval.

The proposed development program will consist of five (5) distinct neighborhoods connected via a network of roadways with a mix of residential and non-residential uses (see map of proposed neighborhood concept plan in Attachment C). The amended program currently proposes approximately 1,310,742 square feet (sf) of residential space with 844 residential units of various types (family homes, cottages, condos, apartments) and approximately 817,578 sf of non-residential space for commercial retail, offices, hotels and restaurants.

Projected wastewater flows for the proposed development program at buildout are shown in Table 2 below (See Appendix A – Table 4 for detailed flow estimation).

Table 2: Projected Wastewater Flows (Amended)

Average Daily Flow (ADF):	341,644 gpd (237.0 gpm)
Maximum Day Flow (MDF):	683,288 gpd (475.0 gpm) (P.K. = 2)
Peak Hourly Flow (PHF):	1,366,576 gpd (949.0 gpm) (P.K. = 4)

4.2 Wastewater Characteristics

Wastewater generated from the proposed development will be domestic in nature and void of any industrial solid, hazardous or toxic waste. Stormwater run-off from the development will be directed to a separate stormwater collection and management system.

For design purposes, the wastewater is assumed to have a composition typical of high strength untreated domestic wastewater. Table 3 below lists the typical values for the physical, chemical and biological constituents.

Table 3: Typical Wastewater Composition

Parameter	Limit[1]	
Biochemical Oxygen Demand – 5 day (BOD_5)	350	mg/L
Total Suspended Solids (TSS)	400	mg/L
Settleable Solids	20	mL/L
Total Kjeldahl Nitrogen (TKN)	70	mg/L
Phosphorous (P – total)	12	mg/L
Ammonia (NH_3)	45	mg/L
Oil & Grease	100	mg/L
pH	6.5 - 8.5	
Temperature	68	°F
Alkalinity	90	mg/L

Notes:
[1] Based on Metcalf & Eddy, Wastewater Engineering, 4th Edition, 2003.

4.3 SPDES Permit Effluent Limit

The on-site WWTP will discharge treated effluent to the nearby Maritje Kill. The Maritje Kill is classified by the NYSDEC as a Class B stream as indicated on the Environmental Resource Mapper. TR Sewage Works Corp. has a SPDES permit #NY0281140 for the discharge of 21,500 gallons of treated wastewater per day to the nearby Maritje Kill for the Phase 1A consisting of the Inn at Bellefield, a 133-room hotel currently under construction. The SPEDES permit effluent discharge limits currently in effet for the Inn at Bellefield are presented in Table 4 below.

Table 4. Bellefield at Historic Hyde Park- SPDES Permit Effluent Discharge Limits

Parameter	Limit	Units
Flow	21,500	gpd
Biochemical Oxygen Demand – 5 day (BOD_5)	5	mg/L
Total Suspended Solids (TSS)	10	mg/L
Settleable Solids (SS)	0.3	mL/L

Ammonia (NH_3) as N (June-Oct)	0.62	mg/L
Ammonia (NH_3) as N (Nov-May)	0.9	mg/L
Dissolved Oxygen (DO)	7.0	mg/L
pH	6.5-8.5	
Fecal Coliform (FC) -30 day Geom. Mean	200	CFU/100 mL
Total Residual Chlorine (TRC)	0.02	mg/L

The applicant has submitted and application to the NYSDEC to amend the existing SPDES permit to increase the discharge of treated effluent from a permitted flow if 21,500 GPD to a proposed flow of 342,000 GPD for full buildout of the Bellefield at Historic Hyde Park Project.

5.0 PROPOSED WASTEWATER TREATMENT PLANT

5.1 General Description of Wastewater Treatment Facility

The proposed WWTP will be located on the south bank of the Maritje Kill near Route 9. The WWTP will be designed as a modular system to initially accommodate the flows from initial development while allowing expansion of the plant to accommodate the ultimate flows as future phases of the project are completed.

The proposed 342,000-gpd WWTP will be built in four (4) distinct phases to full buildout to parallel the development of the project as follows:

- Phase 1 – Existing Headworks and Improvements previously approved
- Phase 2 – 1st Treatment Train
- Phase 3 – 2nd Treatment Train
- Phase 4 – 3rd Treatment Train

The construction of the WWTP will parallel the development of the project with additional treatment trains placed in service to accommodate anticipated sewage flows from future phases and sub-phases of development. Plant capacity will be built to accommodate the flows from the development over the time required to achieve project buildout.

The WWTP will consist of three (3) identical treatment trains installed in parallel, each including aeration tanks, membrane bioreactors and UV light treatment for disinfection. Each train will be sized for an average daily flow of 114,000 gpd. Therefore, at full buildout, the WWTP will be capable of treating up to 342,000 gallons of wastewater per day on average.

Using the amended site development program, wastewater flows to each phase of the WWTP have been estimated by individual neighborhood development as shown in Table 5 below. For example, the table below shows the Village Neighborhood contributing 71,200 gpd (including the

Inn at Bellefield hotel sewer flow) into the WWTP phase 2 MBR along with the St. Andrews Neighborhood and the Out-of-District users.

Table 5: Estimated Contributing Wastewater Flows to WWTP Phases

NEIGHBORHOOD	SEWER FLOW	GPD	WWTP Phase 2	WWTP Phase 3	WWTP Phase 4	
			GPD	GPD	GPD	
The Village	**108,700**	**gpd**	71,200	37,500		
The Terrace	**48,090**	**gpd**		45,815	2,275	
The Ridge	**36,100**	**gpd**		30,685	5,415	
The Crescent	**105,954**	**gpd**			105,954	
St. Andrews	**14,800**	**gpd**	14,800			
Out-of-District User(s)	**28,000**	**gpd**	28,000			
	341,644	**gpd**	**114,000**	**114,000**	**113,644**	**341,644**

The proposed WWTP will consist of a lift station, vertical bar screen, influent flow equalization tank, inline backwashing filters, aeration tanks, membrane bioreactors, UV disinfection, treated effluent pump station, and a sludge tank.

All process tanks will be buried below grade with sealed manhole/access covers. Membrane bioreactors, instrumentation and controls, air blowers and UV treatment units will be housed inside a pre-fabricated steel structure. The plant will have no open tankage thereby minimizing the potential for odors.

The plant design will include a central carbon filtration odor control system for the removal and treatment of potential odors from wastewater treatment processes. Dewatering of wastewater sludge is proposed to be accomplished via the use of mechanical belt press. The belt press will be housed in a separate building. Belt press facility will be constructed as part of Phase 3 of the WWTP.

The plant will be provided with a minimum 250-foot setback to proposed habitable areas.

5.2 Basis of Design and WWP Construction Phasing

The 2014 Edition of the Recommended Standards for Wastewater Facilities (Ten States Standards) stipulates that the design capacity of a wastewater treatment plant (WWTP) should be based on the average daily flow (ADF). The WWTP should also be able to safely treat the expected maximum daily flow (MDF) and peak hourly flow (PHF) by use of influent flow equalization and/or unit processes sized to handle peak hourly flows.

The basis of design for the proposed WWTP at project buildout is as follows:

Table 6: Basis of Design

Average Daily Flow (ADF):	342,000 gpd (238 gpm)
Maximum Day Flow (MDF):	684,000 gpd (475 gpm) (P.K. = 2)
Peak Hourly Flow (PHF):	1,368,000 gpd (950 gpm) (P.K. = 4)

The proposed 342,000-gpd WWTP will be built in four (4) distinct phases to full buildout to parallel the development of the project as follows:

- Phase 1 – Existing Headworks and Improvements previously approved
- Phase 2 – 1st Treatment Train
- Phase 3 – 2nd Treatment Train
- Phase 4 – 3rd Treatment Train

The construction of the WWTP will parallel the development of the project with additional treatment trains placed in service to accommodate anticipated sewage flows from future phases and sub-phases of development. Plant capacity will be built to accommodate the flows from the development over the time required to achieve project buildout.

5.3 Existing/Proposed Structures and Build Phases

As mentioned, the headworks of the wastewater treatment facility has been installed and is sized to treat the ADF, and hydraulically handle the PHF. The list of major equipment that was installed during Phase 1 is listed below:

- One (1) Manhole Lift Station, rated for 1,368,000 GPD (PHF);
- Screening Building;
- One (1) Automated Vertical Bar Screen, rated for 1,368,000 GPD (PHF);
- One (1) 30,000 gal Equalization Tank ans associated EQ pumps;
- Two (2) Automatic Backwashing Filters, each rated for 1,368,000 GPD (PHF);
- One (1) 30,000 gal Sludge Tank;
- One (1) 6,600 gal Decant Dry-well.

The proposed WWTP will be consist of three (3) treatment trains each capable to treat 114,000 gpd of wastewater for a total plant capacity of 342,000 gpd on average. Each treatment train will consist of the following major components and equipment that will be installed as listed below:

- Two (2) 30,000 gal Aeration Tanks;
- One (1) Treatment Building;
- Two (2) 2,775 gal Membrane Bioreactors;
- One (1) 700 gal Backpulse Tank;
- One (1) Clean-in-Place system;
- Three (3) 210 gpm UV disinfection units;

Proposed WWTP will also include a 13,200-gal treated effluent pump station, a laboratory/maintenance building and carbon air filtration system for odor control and provisions for future sludge dewatering facility.

5.4 Influent Lift Station (Existing)

Raw wastewater from the initial and subsequent phases of development will be conveyed by two on-site pumping stations, and a gravity sewer converging at the influent lift station. The 12,700-gallon influent lift station consists of two (2) duty/stand-by submersible sewage pumps, associated piping, guide rails, shut off valves, check valves, controls, and access ladder. The influent lift station cover consists of two (2) 4-x4-foot pump hatches.

The purpose of the influent lift station is to collect, lift, and pump all raw wastewater from the site through the vertical bar screen. The influent lift pumps are KSB Model KRTD 150-253/76XEG-S, 4-inch submersible sewage pumps with a 10-inch diameter impeller, and a 10 HP/1170 RPM/480 V/3 phase/60 Hz submersible motor. The lift pumps are explosion-proof rated to NEC Class 1, Division 1, Groups C and D. The lift pumps will be with variable frequency Drive (VFD) controllers. Each pump is capable of delivering 1,056 gpm at 18.5 feet TDH. The influent lift station and associated pumps have been designed to meet the anticipated peak hourly flows at full project build out (950 gpm). The volume of the lift station wet well is adequately sized to handle flows to the WWTP at full project build out.

Specifications for the influent lift pumps are provided in Appendix B.

5.4.1. Controls

The controls for the influent lift station will be designed to alternate the lead and lag pump on every successive pumping cycle. In the event of a pump failure, the remaining functional pump will take over all pumping cycles until the failed pump is replaced or repaired.

The operation of the lift pumps will be controlled by a pressure transducer and four (4) float switches used as secondary back up should the pressure transducer fail. The pressure transducer will control the frequency of power to be delivered to the lift pumps through VFDs to maintain a steady flow. The function of each controller is described below:

- Influent Lift Station Pressure Transducer: This pressure transducer will display the wastewater level in the lift station as a percentage (stop, lead start, lag start, and surcharge). Level settings will be programmed into the PLC to control the operation of the lift pumps. As the level in the lift station increases, the power being supplied to the lift pump VFD's will also increase.
- Low-Low Level Float: Should the pressure transducer fail, this float will stop the lead and/or lag pump and activate an audio/visual alarm signal when the float is in the existing position (open circuit).
- Low Level float: Should the pressure transducer fail, this float will stop the lead lift pump when the float is in the extended position (open circuit).
- High Level float: Should the pressure transducer fail, this float will start the lead lift pump when this float switch is tilted (closed circuit).
- High-High Level float: This float will activate an audio/visual alarm signal and start the lag lift pump when the float is tilted (closed circuit).

The floats will maintain control of the lift pumps until the pressure transducer is reinstated. In addition to the floats mentioned above, pump failure alarm will be included.

5.4.2. Pump Cycle Settings

The influent lift pumps are sized to start less than six (6) times per hour during average day flow conditions, and run continuously for peak hourly flow conditions based on the expected flows of the full WWTP build out. The PLC will record the lift pump cycles, and run times to monitor pump usage.

Each lift pump will have a maximum pumping capacity of 1,056 gpm at 18.5 feet of total dynamic head (TDH). The operator will be able to adjust the VFDs and pressure transducer start/stop set points based on actual flow conditions. The lift pumps will be set to operate at 40% of their rated capacity to ensure minimum approach velocity to the vertical bar screen will be greater than 1.25 ft/s (315 gpm) under all flow conditions to prevent settling. The maximum approach velocity to the vertical bar screen will be less than 3.0 ft/s at design average flow conditions to prevent forcing of material through the screen.

5.5 Vertical Bar Screen (Existing)

A vertical bar screen (VBS), with a rated flow through capacity of 57,000 gph (PHF) will remove large debris from the incoming raw wastewater. The VBS is an Aqualitec Screentec unit with a bar spacing of ½-inch, complete with a rake and a 0.75 HP/240/480V/60Hz motor. The vertical

bar screen and associated equipment are installed inside the FRP screening building atop the equalization tank.

The mechanical vertical bar screen will be provided with ½-inch clear openings and installed at a slope of 90 degrees from the horizontal. Solids will be removed as raw wastewater flows through the mechanical bar screen. The Screentec vertical bar screen is designed with an integrated bypass with a manual screen in case of a failure of the mechanical bar screen. The manual bar screen will be provided with 1-inch clear openings and installed at a slope of 45 degrees from the horizontal. The manual bar screen will be provided with a retrieval basket for convenient removal and cleaning.

The approach velocity will be greater than 1.25 ft/s to prevent settling and no greater that 3.0 ft/s to prevent forcing of material through the screen under design average flow conditions as per Ten State Standards for Wastewater Facilities. The approach velocity to the bar screen is based on the cross-sectional area of a 10-inch dia. HDPE DIPS DR11 (200 psi) influent pump station discharge force main. This pipe has an ID of 8.96 inches.

The VBS is equipped with an Aqualitec Compactec washer compactor. Solids are lifted into the inlet hopper of the washer compactor and conveyed by a shaftless auger into the washing zone. Solids are then washed by a spray bar system, compacted and collected in a waste bin. The screened waste wash water will be directed to the equalization tank.

Coarse screened biosolids will be washed, compacted, and collected in a waste bin or basket. Collected biosolids will be loaded onto truck and transported off-site for disposal at a local municipal landfill per applicable NYSDEC regulations.

Specifications for the Aqualitec Screentec vertical bar screen and washer compactor are provided in Appendix C.

The washer compactor requires a potable water connection to supply the spray bar system. A 1-inch Watts reduced pressure zone (RPZ) model LF009M2-QT will be installed on the potable water connection for cross-connection control. A cut sheet for this RPZ is provided in Appendix D.

Provisions have been made to provide a set of in-line strainers installed on a bypass pipe inside the screening building as a backup during maintenance of the mechanical bar screen.

5.6 Influent Flow Equalization (Existing)

Screened wastewater will discharge into an equalization (EQ) tank where it will be temporarily stored prior to secondary treatment. The purpose of the flow equalization tank is to transfer the wastewater to the downstream treatment process at a steady flow rate over a 24-hour period.

The influent flow will be equalized in a 30,000-gallon precast concrete tank, complete with two (2) submersible duty/stand-by sewage pumps, ¾-inch diameter coarse bubble air diffusers for oxygen transfer and mixing requirements, associated piping, guide rail assemblies, shutoff valves, check valves, controls and appurtenances. The equalization tank has hinged and lockable aluminum access hatches. The available storage in the equalization tank between the invert of the inlet pipe and the low-low level float is approximately 19,300 gallons. The tank has an interior height of 13.45 ft minus 3.00 ft to invert of overflow pipe and minus 1.84 ft for low-low level float height equating to a working EQ height of 8.61 ft or a volume of 19,300 gallons (8.61 ft x 2,241 gal per vertical foot).

The flow equalization pumps are KSB Model KRTK 100-400/406XG-S, 3-inch submersible sewage pumps with a 10-inch diameter impeller, and a 50 HP/1180 RPM/480 V/3 Phase/60 Hz motor. The EQ pumps will be equipped with VFDs, isolation valves, check valves, and associated piping. EQ pumps will be explosion-proof rated to NEC Class 1, Division 1, Groups C and D. The EQ pumps are each capable of a maximum pumping capacity of 950 gpm at 109 feet of total dynamic head (TDH).

5.6.1 Equalization Tank

Per Ten State Standards for Wastewater Facilities, equalization basin capacity should be sufficient to effectively reduce expected flows and load variations over a 24-hour period. The capacity of the equalization tank is 30,000 gallons, with two (2) submersible pumps, each capable of pumping a peak hourly flow of 57,000 GPH for duplicity.

Instantaneous peak flows greater than 4 times the ADF will be dampened by the available 19,300 gallons of equalization volume in EQ tank. The remaining volume of 10,700 gallons in the EQ tank is used up by the freeboard volume above the incoming pipe and the minimum submergence volume requirement for the submersible pumps.

The EQ pumps (duty/standby) delivers primary treated sewage through the inline duty/standby strainers and a distribution manifold equipped with three motorized valves that directs flows to each of the MBR treatment trains.

The proposed treatment plant has the capability to handle anticipated peak flows with full redundancy including hourly diurnal flows of four times average day flow. The EQ tank functions as a flow conditioning tank to control plant operation. The plant feed pumps and permeate pumps are both equipped with VFD drives allowing the plant to operate at an optimal rate that provides necessary treatment and continuous operation. During initial operation at low flow rate and high peaking the plant will use its excess tankage to handle surges. As the development reaches completion and full flows are experienced, the peaking multiple decreases but the plant again still has capacity to manage hydraulic loads four time the average day flow. During periods of ultra-low flows at the project onset, the plant can revert to a batch mode operation with the EQ tank aerated.

5.6.2 Pre-Aeration & Agitation

To help eliminate odors, two (2) circulation air cooling Roots Blower, manufactured by Greatech have been installed, complete with ¾-inch diameter coarse bubble air diffusers inside the tank. The EQ blowers are Greatech model SdB50 with a 3HP/240/480V/3 Phase motor, and 2-inch diameter discharge connecting to 2-inch stainless-steel pipe. The motors are rated for continuous operation.

Each blower delivers approximately 60 cfm at 6.3 psi into the wastewater with 13.5 feet of submergence to maintain a DO greater than 1.0 mg/L.

Pre-aeration provides the following benefits:

- Increases dissolved oxygen (DO) concentration;
- Instigates aerobic oxidation of influent BOD_5;
- Stripping of carbon dioxide which will shift the pH into a neutral range (6.5 to 8.5) and some volatile organic compounds;
- Oxidation of hydrogen sulfide to sulfate thereby reducing potential for odors;
- Prevents the deposition of solids and the need to regularly pump the tank; and,
- Prevents septic conditions which promote odors and cause treatability issues.

5.6.3 Controls

The controls for the EQ tank will be designed to alternate the lead and lag pump on every successive pumping cycle. In the event of a pump failure, the remaining functional pump will take over all pumping cycles until the failed pump is replaced or repaired.

The operation of the EQ pumps will be controlled by a pressure transducer and four (4) float switches in each aeration train. The float switches are provided as secondary backup should the pressure transducer fail. The pressure transducer located in the EQ tank will control the frequency of power to be delivered to the permeate pumps through VFDs to maintain a steady flow. The function of each controller is described below:

- EQ Pressure Transducer: This pressure transducer will display the tank level in the EQ tank as a percentage. Alarm set points will be configured to notify the operator of low and high-water levels. Furthermore, as the wastewater level in the EQ tank increases, the power being supplied to the permeate pump VFD's will also increase. There will also be a filtration mode and standby mode level settings programmed into the PLC which will dictate whether filtration occurs.
- EQ Low-low Float: This float will turn off the duty EQ pump and will activate an audio/visual alarm signal when the float switch is in the extended position (open circuit) should the pressure transducer fail.
- EQ Low Float: This float This float will initiate standby mode when the float switch is in the extended position (open circuit) should the pressure transducer fail.
- EQ High Float: This float will initiate filtration mode when the float switch is in the tilted position (closed circuit) should the pressure transducer fail.

- EQ High-high Float: The high-level float switch will activate the audio/visual alarm when the float switch is tilted (open circuit), turning on the standby EQ pump if there is room in the aeration basins should the pressure transducer or duty pump fail.
- Aeration Low-low Level Float: This float will act as a redundant pump shut off for the EQ, MBR feed, and permeate pumps, and will activate an audio/visual alarm signal when the float switch is in the extended position (open circuit).
- Aeration Low Level Float: This float will shut off the permeate pumps and turn on the EQ pump when the float switch is in the extended position (open circuit).
- Aeration High Level Float: This float will turn off the EQ pump when the float switch is in the tilted position (closed circuit).
- Aeration High-high Level float: The high-level float switch will activate the audio/visual alarm when the float switch is in the titled position (open circuit) and turn off the EQ pumps until the alarm is acknowledged.

5.6.4 Pump Cycle Settings

The EQ pumps are sized to start less than six (6) times per hour during average day flow conditions, and run continuously for peak hourly flow conditions based on the expected flows of the full WWTP buildout. The PLC will record the pump cycles and run times to monitor pump usage.

The EQ pumps will have a maximum pumping capacity of 950 gpm at 109 feet of total dynamic head (TDH). The EQ pumps will be initially set to run for 5 minutes during a 15-minute cycle.

The operator will be able to adjust the VFDs and pressure transducer start/stop set points based on actual flow conditions. The PLC will also ensure a minimum flow rate of 220 gpm and pressure of 30 psi are always maintained to allow for automatic backwashing of the filters.

Specifications for the EQ pumps and EQ tank are provided in Appendices B and E respectively. Specifications for the aeration blowers and air diffusers are provided in Appendices F and G, respectively.

5.7 Automatic Backwashing Filters (Existing)

Two (2) automatic duty/stand-by backwashing inline filters (ABF), connected in parallel, each with a 1,500-micron screen are installed between the EQ pumps and aeration tanks to protect the membranes from small debris. The ABFs are located inside the Screening building atop the equalization tank. The ABFs are Amiad ABF 6000, with an inlet/outlet diameter of 8-inch, and a minimum working pressure of 30 psi, and a maximum flow rate of 3,100 gpm. These filters are used to remove substances that could damage the Fibracast FPM500 membranes. Approximately 25 lbs/day of solids will be collected on the screen and will be flushed and drained to the sludge tank.

Each automatic inline filter is equipped with a pressure differential switch that senses the pressure differential across the screen. When the pressure differential reaches a pre-defined value (typically 7 psi), the filter will automatically initiate a self-cleaning by opening the exhaust valve and two (2) stainless steel brushes to sweep, dislodge and flush out the trapped particles. During the self-cleaning process, the filters will continue to process filtered water with no interruption of downstream flow.

If required, aluminum sulfate will be injected post filtration for coagulation of solids to increase TSS and BOD removal efficiencies. Furthermore, caustic soda or equivalent will be injected post filtration to increase alkalinity for the nitrification process if required.

Aluminum Sulfate is used as a coagulant to support phosphorus removal. It will be injected prior to aeration cells and removed by membranes, wasting to the sludge tank. The amounts used vary depending on influent phosphorus levels, each train will have a 55-gallon drum housed within the MBR building on spill containment trays. Injection will be via duty/standby wall mounted chemical feed pumps. Drums typically last 2-3 months depending on phosphorous levels. As Bellefield is a mixed use development prediction of received levels and required volumes is very difficult to predict. The use of coagulants for the removal of phosphorus is common practice for surface discharge wastewater treatment facilities.

Caustic Soda is used for alkalinity adjustment as needed to support the biological process. The amount used depends on alkalinity levels within the wastewater received and levels of biological treatment required. Caustic Soda will be supplied by 55-gallon drums housed within the MBR building on spill containment trays. Injection will be via duty/standby wall mounted chemical feed pumps. Caustic soda is not always needed and dependent on water qualities received. As a precaution, provisions for caustic soda are included in the event it is needed. Caustic Soda is commonly used in wastewater treatment plants with alkalinity deficiencies.

Specifications for the automatic backwashing inline filters are provided in Appendix H.

5.8 Secondary Treatment

The activated sludge process is used for BOD, TSS, and ammonia removal. The activated sludge process for this plant will consist of three (3) aeration trains in total at full buildout.

5.8.1 Individual Aeration Train

Each aeration train will be comprised of two (2) 30,000 gallon precast concrete tanks connected in series with a 10-inch HDPE pipe, two (2) submersible MBR feed pumps, two (2) aeration blowers, fine bubble air diffusers, associated piping, guide rail assemblies, shutoff valves, check valves, controls and appurtenances. Each aeration tank will also be provided with two (2) risers, a concrete riser with a hinged and lockable aluminum access hatch and a polyethylene riser with polyethylene lid.

The maximum working capacity of each aeration train is 52,400 gallons, giving a minimum freeboard of 18 inches as per Ten State Standards for Wastewater Facilities. The size of the aeration tanks has been determined based on a mixed liquor suspended solids (MLSS) concentration of 7,920 mg/L. Although the MLSS is higher than 5,000 mg/L, membrane bioreactors will be used in place of secondary clarifiers.

Each tank will be equipped with 3.7" lateral fine bubble air diffusers for oxygen transfer and mixing requirements, Two (2) blowers will be designated for each aeration train, each capable of providing 353 cfm at 6.5 psi to maintain a dissolved oxygen concentration of 2.0 mg/L. The aeration blowers shall be Greatech Model SdB150 with a 30 HP/240/480V motor. The aeration blowers will connect to a 4-inch stainless-steel pipe before transitioning to a 3" CPVC pipe to each tank. The aeration blowers will be installed with VFDs, isolation valves, check valves, and associated piping.

The MBR feed pumps shall be used to feed the MBR tanks and recycle activated sludge back to the first aeration tank at a return activated sludge (RAS) ratio of 4:1. Based on average daily flow (ADF), the MBR feed pumps will each have a design pumping capacity of 396 gpm at 27 ft TDH to achieve on RAS ratio of 4:1. MBR Feed pumps shall be Grundfos Model SLV-40-A40-75-4-61R-C submersible sewage pumps with a 10-inch diameter impeller and 7.5 HP/1750 RPM/240/480 V motor. The MBR feed pumps will connect to a 6-inch PVC pipe and transition to a 6 inch HDPE pipe underground. The MBR feed pumps will be installed with isolation valves, check valves, and associated piping. A dissolved oxygen probe shall be used to monitor the dissolved oxygen in the aeration tank.

The MBR feed pumps are located in the second aeration tank and convey secondary treated effluent up to the MBR tanks, continuously filling them at 5 times the treatment flow. One times treatment flow is removed from the MBR tanks through the membranes via the membrane permeate pumps. The balance of flow (four times treatment flow) overflows out the MBR tanks through a gravity overflow (RAS) line back to first aeration tank. Both aeration tanks in a treatment train are hydraulically connected via a pipe near the bottom. This ensures continuous recycling of the wastewater while maintaining homogenous tank mixture and keeping the membranes clear.

An 8-inch recycle overflow pipe will connect the MBR tanks to the aeration tank, constructed with a minimum slope of 1% to ensure a full flow of greater than 2 ft/s. The solids retention time of the aeration tank is designed to be 9 days in winter conditions to ensure the removal of soluble BOD, conversion of particulates, and nitrification of ammonia. The food to microorganism ratio (F/M) is designed to be 0.33 lbs/lbs*day, and the BOD is estimated to be 0.047 lbs/ft^3*day, under winter conditions as well, based on average day influent concentrations.

5.8.2 Controls

The controls for the MBR feed pumps will be designed to alternate the duty and standby pump on every successive pumping cycle. In addition, in the event of a pump failure, the remaining

functional pump will take over all pumping cycles until the failed pump is replaced or repaired.

A pressure transducer located in the MBR tanks will initiate both MBR feed pumps to turn on should the water level drop below the desired setpoint to ensure the membranes are always submerged underwater.

A dissolved oxygen probe will determine the frequency of power to be delivered to the aeration blowers through VFDs to maintain the dissolved oxygen concentration at 2.0 mg/L. The aeration blowers will alternate each day. In the event of a blower failure, the remaining functional blower will take over all functions until the failed blower is replaced. The function of each controller is described below:

- MBR Tank Pressure Transducer: A pressure transducer will display the tank level in each MBR tank as a percentage. If the water level drops below 90% of the tank volume, both MBR feed pumps will turn on to ensure the water level in the MBR does not drop to expose the membrane cassettes. The pressure transducer will also turn off the permeate pumps. This level can be adjusted to ensure proper operation.
- Aeration Tank Low-Low Level Float: This float will act as a redundant pump shut off for the EQ, MBR feed, and permeate pumps, and will activate an audio/visual alarm signal when the float switch is in the extended position (open circuit).
- Aeration Tank Low Level Float: This float will shut off the permeate pumps and turn on the EQ pump when the float switch is in the extended position (open circuit).
- Aeration Tank High Level Float: This float will turn off the EQ pump when the float switch is in the tilted position (closed circuit).
- Aeration Tank High-High Level Float: This high-level float will activate the audio/visual alarm when the float switch is in the tilted position (open circuit) and turns off the EQ pumps until the alarm is acknowledged.
- Dissolved Oxygen Probe: The probe will measure the dissolved oxygen in real time. As the dissolved oxygen drifts further away from the 2.0 mg/L setpoint, the PLC will send a signal to the blower VFD to either increase or decrease frequency of power to increase or decrease the air flow rate respectively.

All blowers and MBR feed pumps are monitored by level indicators, floats, and dissolved oxygen sensors. In the event of equipment failure and consequential level deviations the plant will automatically activate the stand-by equivalent pump or blower, send an alarm message to the operator, and disable the failed pump or blower until it can be inspected, repaired or replaced.

5.8.3 Pump Cycle Settings

Each MBR feed pump is designed to have a pumping capacity of five (5) times that of the average daily flow (ADF), which equates to 396 gpm when divided into three (3) trains. The pumps will operate continuously during filtration mode to maintain a RAS ratio of 4:1. During standby mode, the MBR feed pumps will operate for 5 minutes every 30 minutes to flush the membranes. The

MBR feed pumps are also designed to ensure they can hydraulically handle one third the peak hourly flow of 19,000 gph.

Specifications for the MBR feed pumps and aeration blowers are provided in Appendix B and F respectively.

5.9 Tertiary Treatment

Tertiary treatment of wastewater will consist of three (3) individual trains of membrane bio reactors (MBR) installed in parallel. Each MBR train will be housed inside a utility building and capable to treat up to 114,000 gallons of wastewater daily on average. Fibracast Hybrid Membranes (Fibreplate) shall be used to achieve effluent of 5 mg/L BOD_5 and 10 mg/L TSS. Fibreplate combines the advantages of hollow-fibre and flat-sheet technologies, creating a highly effective ultrafiltration membrane, with low energy costs and high filtration rates for peak demands, and the unique operational robustness to recover in-situ from any plant upsets.

A Fibracast Fibreplate FPM500 membrane module with a surface area of 500 square feet, an operating flux of 10 GFD at 50° F, and an average operating pressure of 2.5 psi shall be used for this project. The maximum membrane flux of this unit is 20 GFD at 50° F and can be sustained up to a maximum of 4 hours, with a maximum transmembrane pressure of 10 psi.

Each membrane module consists of 16 sheets made from polyvinylidene fluoride (PVDF) with a nominal pore size of 0.04 microns. Each sheet has a surface area of 15.625 ft^2 on each side (16 sheets x 2 sides x 15.625 ft^2 area = 500 ft^2 per module). Each square foot can treat 10 gallons/day (flux rate at worse case 10 degrees C). With a maximum day flow of 228,000 gpd (114,000 gpd average day flow x 2) per train, 22,800 ft^2 of membrane surface area is required at a flux rate of 10 gpd/sf^2. Surface area of 22,800 ft^2 divided by 500 ft^2 per module equates to 45.6 modules. The design will include 48 membrane modules per train.

The Fibreplate design allows for higher sustained fluxes and higher throughput per unit volume. Permeate is pulled through the pores of the membrane, while suspended particulates remain inside the MBR tank and recirculate back to the aeration tank. Several membrane modules are mounted inside racks to make cassettes. Cassettes can then be stacked vertically up to three cassettes high. Cassettes are available in different sizes.

The Fibreplate configuration keeps the space between the membranes clear and reduces the potential for sludging, prolonging the filter life. Furthermore, the membranes are potted into vertical headers to form modules with unobstructed, open flow paths to avoid solids and debris accumulation. Specifications and performance data for the fiberplate hybrid membrane are provided in Appendix I.

5.9.1 Individual Membrane Train

Each MBR treatment train will consist of two (2) 2,775 gallon stainless steel MBR tanks, complete with two (2) reversing lob rotary pumps, two (2) membrane cassettes, two (2) air scouring blowers, diffuser plate, ball valves, check valves, actuated ball valves, access hatches, controls, flowmeter and appurtenances.

A Fibracast Fiberplate FPM500 membrane module shall be used with surface area of 500 ft^2 with an operating flux of 10 GFD at 50°F, and an average operating pressure of 2.5 psi. The maximum membrane flux of this unit is 20 GFD at 50°F and can be sustained up to a maximum of 4 hours, with a maximum transmembrane pressure of 10 psi.

A backpulse cycle is to be performed on the membranes every 5 minutes for a duration of 30 seconds. This will clean the membranes and improves performance and the longevity of membrane cassettes. The downtime required for backpulsing is accounted for in the operating flux parameters. Therefore, each membrane cassette (48 modules) can sustain a peak daily flow of 228,000 GPD/train continuously, and a peak hourly flow of 456,000 GPD/train up to a 4-hour period. Each MBR tank will be comprised of 48 Fibreplate FPM500 membrane modules to provide complete duplicity in sustaining a maximum daily flow of 228,000 GPD continuously and a peak hourly flow of 456,000 GPD/train up to a 4 hour period. This provides a total filtration area of 22,800 ft^2 per membrane tank, with an average permeate flux of 10 GFD at 50°F.

With a return activated sludge ratio (RAS) of 4:1, the MLSS inside the MBR tanks will be maintained at 9,900 mg/L. To remove accumulating MLSS, waste activated sludge (WAS) lines complete with actuated valves, shall be installed on the membrane tanks. A timer programmed into the PLC will determine the duration and frequency of wasting. Operators will be able to adjust these times as required. Pressure transducers will be installed in the membrane tanks to monitor the water level to ensure the membranes are always submerged.

The system is designed to prevent loss of membrane submersion through automated valves and pump controls. Any loss of submersion would trigger automated refill of the tank by the MBR feed pump and an alarm message to the operator. Each MBR feed pump is rated for five times treatment flow even in the event of valve failure membrane submersion would be maintained. Simultaneous MBR feed pump failure would be very rare but in this case the valves would close to maintain the submersion levels.

Permeate pumps will consist of two (2) reversible rotary lob pumps equipped with VFDs. Each pump will have a maximum pumping capacity of 380 gpm at 78 ft TDH to provide 100% redundancy. The permeate pumps shall be Boerger Model PL300 dual lobe rotary pump, lobe type A equipped with 7.5 HP/540 RPM/480V motor and connect to a 4-inch pipe. The reversible rotary lobe pumps will alternate operation and be provided with isolation valves, and associated piping. One (1) 700 gallon polyethylene backpulse tank shall be installed to store permeate to be used for backpulsing the membranes. A pressure transducer will be used to measure the level in the backpulse tank.

Two (2) air scouring blowers will be provided to provide 100% redundancy. Each blower will be capable of providing 432 cfm at a discharge pressure of 5.25 psi will be used to scour the Fibreplate FPM500 membranes to minimize solids accumulation. The air scouring blowers shall be Greatech Model SdB110 with a 20 HP/240/480V motor. The discharge of air scouring blowers will connect to a 4-inch stainless-steel pipe and transition to CPVC. The air scouring bowers will be provided with VFDs to manually increase or decrease the air flow rate. A pressure transducer will be installed on the air line to ensure proper operation. Furthermore, the air scouring blowers will be installed with isolation valves, check valves, and associated piping. A stainless-steel diffuser plate will be used to diffuse the air.

5.9.2 Controls

The controls for the tertiary membrane treatment system are designed to be fully automated. The MBR has three (3) modes of operation; filtration, backpulse, and standby. In filtration mode the MBR feed pumps and air scouring blowers are in operation while the permeate pump are pulling water through the membranes to produce effluent. In backpulse mode the air scouring blowers and MBR feed pumps are in operation while the permeate pumps push water back into membranes. Standby mode is where the air scouring blowers and MBR feed pumps turn on intermittently to flush the membranes.

The controls for the tertiary treatment are designed to be fully automated through the use of pressure transducers and timers. The timer will initiate a backpulse cycle every 5 minutes for a duration of 30 seconds to clean the membranes. The timer will initiate a backpulse cycle every 5 minutes, and for a duration of 30 seconds to clean the membranes. A George Fischer Signet 2551 flow meter will be installed on the permeate discharge pipe. The flow meter is designed to only record forward process flow (unidirectional). During backpulse operations, process flow will pass through the meter in the reverse direction but reverse flow will not be metered.

The PLC will record the instantaneous flowrate and totalize the flow for each treatment cycle. The permeate pumps and air scouring blowers will alternate between duty and standby modes each day. In the event of a pump or blower failure, the remaining functional pump/blower will take over all pumping/blower cycles until the failed piece of equipment is replaced or repaired.

A pressure transducer located in the MBR tanks will initiate both permeate pumps to turn off should the water level drop below the desired setpoint to ensure the membranes are always submerged underwater. A pressure transducer located on the permeate suction line will measure the transmembrane pressure. The function of each controller is described below:

- MBR Tank Pressure Transducer: A pressure transducer will display the tank level in each MBR tank as a percentage. If the water level drops below 90% of the tank volume, both permeate pumps will turn off to ensure the water level in the MBR tank does not drop to expose the membrane cassettes. This level can be adjusted to ensure proper operation.
- Transmembrane Pressure (TMP) Transducer: A pressure transducer will display transmembrane pressure in the suction line to monitor the condition of the membranes.

The TMPs should be between 0 to 8 psi during production and refilling, and 0 to 4 psi during back pulsing. If the TMP exceeds 10 psi during effluent production or 4 psi during back pulsing, both permeate pumps will turn off until the problem is rectified. If the TMP exceeds 8 psi, the PLC controller will initiate a clean-in-place (CIP) cycle. An individual MBR train can be isolated so that the other MBR trains can still produce effluent at the full rated capacity. The pressure set points can be adjusted to ensure proper operation.

- Air Scour Pressure Transducer: A pressure transducer will display the air pressure produced by the blower. If the air pressure increases above the high pressure setpoint, or decreases below the low pressure setpoint, the PLC controller will turn off filtration mode and activate an audio/visual alarm signal.
- Flowmeter: A flowmeter will measure the instantaneous flows and tabulate a total daily flow for each tertiary treatment train and hours of operation (filtration, stand-by, backpulse). It will also control the VFDs associated with the air scouring blowers.

5.9.3 Pump Cycle Settings

Each permeate pump will have a pumping capacity equal to the peak hourly flow of 19,000 gph. Fibreplate membranes require a backpulse cycle every 5 minutes for a duration of 30 seconds, plus another 30 seconds to refill the backpulse tank. Therefore, the permeate pump capacity shall be 380 gpm at 79 ft TDH, equivalent to 547,200 gpd. The pumps will alternate between duty and standby mode on a daily basis. In the event of a pump failure, the remaining functional pump will take over all pumping cycles until the failed pump is repaired or replaced. The permeate pumps will be equipped with VFDs and will be controlled by the level in the equalization tank. As the level in the equalization tank changes, so will the power being supplied to the permeate pump motor. Operators will be able to adjust this scaling as required.

Specifications for the permeate pumps and air scouring blowers are provided in Appendix B and F respectively. Specifications for the flow meter are provided in Appendix J.

5.10 Clean in Place (CIP)

One (1) chemical feed system consisting of two (2) chemical metering pumps for reliability, shall be used for membrane clean in place (CIP) processes. A clean in place is performed to disinfect and remove accumulated sludge on the membranes to maintain permeability by using a 12% sodium hypochlorite solution. The chemical metering pumps will alternate at injecting sodium hypochlorite into the permeate pumps station line. Each pump will be installed with check valves and associated tubing. The permeate pumps will also backpulse effluent simultaneously to create a 300 ppm solution and push the solution deep into the membrane cassettes for a thorough cleaning.

The sodium hypochlorite clean-in-place procedure of the membranes is completed on a weekly basis to prevent biological growth on the membrane surface and is completely contained within the membrane tanks. The weekly CIP process is timer-based with the PLC coordinating the stepped process of one tank being clean at a time including when all three trains are functional.

Each tank has full redundancy of membranes to handle peak flows both daily and hourly. The design is such that all flows are able to go through the plant under peak conditions with half the tanks off-line.

Once the soak period is satisfied the hypochlorite solution in the tanks is wasted to the sludge holding tank and refilled with fresh mixed liquor prior to restart. After a set period for settling, the sludge tank is decanted back to the EQ tank where any residual sodium hypochlorite would be diluted and taken up by the biological treatment process.

The CIP cycle will take approximately 38 minutes to complete. During the CIP cycle, no treated effluent will be produced, and therefore a maximum of about 3,000 gallons of flow equalization storage will be required in the EQ tank under average day flow conditions. The equalization tank has approximately 19,300 gallons of available storage which is sufficient for the CIP cycle.

The chemical metering pump shall be Prominent Delta DLTA 0280 capable of a flowrate of 13.2 gph at 4 psi. The operator will be able to manually adjust the chemical pump settings as required.

Specifications for the chemical metering pumps are provided in Appendix K.

5.11 UV Disinfection

Three (3) Viqua SHFM-180 units or equivalent shall be provided in each MBR treatment train to disinfect treated wastewater prior to discharge. Each unit is capable of providing a minimum UV dosage of 30 mJ/cm^2 and UV transmittance of 95% at a flow of 210 gpm. These UV units will provide disinfection against waterborne pathogens including Giardia, Cryptosporidium, and most viruses.

The UV unit shall be provided with a solenoid valve, a UV light sensor, a controller with LED status indicators and an audible alarm. The UV unit will alarm and close the solenoid valve should the UV dosage drop below 30 mJ/cm^2 or UV transmittance drop below 75%. Spare UV light bulbs should be provided and kept onsite.

An actuated valve or equivalent will be installed prior to the UV units, and will close during backpulse CIP cycles. The UV Units will be piped in parallel and capable of handling the design peak hourly flow of 19,000 gph (317 gpm) with the largest UV unit out of service.

A spare set of bulbs, ballasts and wiper assembly per train will be maintained on-site at all time Specifications for the Viqua SHFM-180 UV disinfection units are provided in Appendix L.

5.12 Sludge Storage (Existing)

The expected sludge generated shall be wasted into one (1) 30,000-gallon precast concrete sludge storage tank, complete with eight (8) ¾-inch cap coarse bubble air diffusers for oxygen transfer and mixing requirements. The sludge tank has two (2) access risers, a concrete riser with a hinged and lockable aluminum access hatch, and a polyethylene riser with polyethylene lid.

It is estimated that 1,076 lbs of waste active sludge and 25 lbs of primary sludge will be produced per day at full buildout. To maintain the mixed liquor suspended solids concentration at 7,920 mg/L in the aeration tank, wasting must occur. As previously mentioned, excess solids will be automatically wasted from the MBR tanks to the sludge tank with a timer and actuated valves. This wasting, plus the estimated 7,600 gallons of raw water backwashed filtered by the automatic backwashing filters will be sent to the sludge tank. This equates to approximately 20,645 gallons of wasted sludge per day. The wasted activated sludge is expected to have a 1% solids content. It is expected waste sludge will be pumped out and hauled off-site for proper disposal or dewatered on-site every 3-4 weeks.

According to Flow and Mass Balance diagram provided in Appendix P, the volume of waste sludge has been estimated to be 8,000 gpd at the buildout WWTP average daily flow of 342,000 gpd. The wasted sludge will be hauled off to appropriate off-site facility for disposal during Phase 2 of the WWTP and dewatered on-site beginning with Phase 3 of the WWTP. At full buildout, the sludge tank will provide approximately 4 days of storage. During Phase 2 of the WWTP with a flow of 114,000 gpd, the sludge tank will have capacity to hold approximately 11 days of waste sludge. The plant design would permit operators to recycle a larger proportion of waste sludge back to the head of the plant, thereby reducing the actual volume of sludge needed to be hauled off or dewatered.

Two (2) floats will be installed in the sludge tank. The low level and high-level floats will notify the operator when the sludge tank is half full and full respectively. It is the operator's responsibility to measure the sludge supernatant level and decant accordingly. When the high-level float is tilted (open circuit), it will prevent wasting from occurring. It will be the responsibility of the operating authority to have the excess sludge removed from site by a DEC permitted hauler to a DEC permitted disposal site.

Two (2) rotary lobe pumps (sludge decant pumps) attached to a 3-inch floating decant suction line will alternate at transferring supernatant from the sludge tank to the equalization tank when wastewater flows to the plant are less than 114,000 gpd on average. Once the flows generated onsite surpass this volume, the pumps will need to be repurposed to transfer sludge to a proposed dewatering facility. A flow meter would be installed on the transfer pump discharge line to measure the quantity of sludge being processed. The rotary lobe transfer pumps are located inside the 6,600-gallon decant dry-well. Decanting will increase the solids content in the sludge tank to 2% for more effective handling. Each rotary lobe transfer pump has a rated pumping capacity of 121 gpm at 45 ft TDH. The transfer pumps shall be Boerger model AL 75 dual lobe rotary pump, lobe type A, with a 3 HP/650 RPM/480V motor, connecting to 3-inch PVC discharge pipe that transitions to 3-inch HDPE pipe. The transfer pumps will be installed with isolation valves, a check valve, and associated piping.

Two (2) blowers, each capable of providing 37.5 cfm at 6.28 psi each are used to maintain a dissolved oxygen concentration between 1.0-2.0 mg/L. The blowers will be operating in an alternating duty/standby arrangement. The sludge blowers shall be Greatech model SdB50 with

a 3 HP/240/480V motor, and 2-inch diameter discharge connecting to 2-inch stainless-steel pipe before transitioning to a 2-inch CPVC pipe. The actual rated capacity of the aeration blowers is 62 cfm at 6 psi. The sludge blowers are installed with starters, isolation valves, check valves, and associated piping. A dissolved oxygen probe shall be used to monitor the dissolved oxygen in the aeration tank.

The sludge tank will have an overflow pipe which will drain by gravity to the plant influent lift station.

In Phase 2 of the WWTP with only a single treatment train in service, wasted sludge will be hauled off-site at a frequency of once or twice a month. In Phase 3 of the WWTP with two (2) treatment trains in service, the wasted sludge will be conveyed to the belt press dewatering building for treatment. The belt press equipment, appurtenances and dump box will be completely enclosed within building. The building will be provided with its own activated carbon filtration system as well. See Section 5.16 for belt press information.

5.12.1 Controls

The sludge tank is equipped with low level and high-level floats for equipment protection and prevent any environmental spills respectively. A dissolved oxygen probe determines the frequency of power to be delivered to the sludge blower through a VFD to maintain the dissolved oxygen concentration between 1.0-2.0 mg/L. The function of each controller is described below:

- Sludge Tank Low Level Float: When the sludge tank low level float switch is tilted (closed circuit), it will notify the operator with a visual/audible alarm that the tank is half full.
- Sludge Tank High Level Float: when the sludge tank high-level float switch is tilted (open circuit), it will notify the operator with a visual/audible alarm that the tank is full and prevent wasting from occurring. It is the responsibility of the operating authority to have the sludge contents removed off site.
- Sludge Tank Dissolved Oxygen Probe: The probe will measure the dissolved oxygen in real time. As the dissolved oxygen drifts further away from the 1.0 mg/L set point, the PLC will send a signal to the blower VFD to either increase or decrease frequency of power to increase or decrease the air flow rate respectively.

Specifications for the sludge blowers are provided in Appendix F.

5.12.2 Pump Cycle Settings

The rotary lobe transfer pumps will have sufficient pumping capacity to transfer the maximum volume of supernatant in a reasonable amount of time. The transfer pump capacity shall be 121 gpm at 45 ft TDH, equivalent to pumping 30,000 gallons in 4 hours. The transfer pumps will only be able to run in manual mode.

Specifications for the rotary lobe transfer pump are provided in Appendix B.

5.13 Treated Effluent Pump Station

Following UV disinfection, treated effluent from each treatment train will flow through a 4-inch HDPE pipe to a 13,200-gallon effluent concrete tank. Each treatment train will have its own designated line to the effluent tank. An effluent tank is required to collect and pump the effluent over a ridge to a downstream manhole. This manhole is SMH4 located approximately 287 ft away.

The effluent tank will consist of two (2) duty/stand-by submersible effluent pumps, associated piping, guide rails, shut off valves, check valves, controls, and access ladder. It will also have three (3) concrete risers, each with a hinged and lockable aluminum access hatch. The effluent pumps will each have a rated pumping capacity of 950 gpm at 22 ft TDH. The pumps will be installed with isolation valves, check valves, and associated piping and will connect to a 10-inch PVC pipe and transition to a 10-inch gravity pipe that will allow effluent to drain to the existing outfall. The existing outfall is located along the Maritje Kill. A vermin proof screen is installed at the end of the outfall pipe outfall. Note that turbulence from pumping and the gravity flow in the discharge piping is expected to maintain a DO of 7.0 mg/L.

5.13.1 Controls

The controls for the effluent tank will be designed to alternate the duty and standby pumps on every successive pumping cycle. In the event of a pump failure, the remaining functional pump will take over all pumping cycles until the failed pump is repaired or replaced.

The operation of the effluent pumps will be controlled by a pressure transducer and four (4) float switches used as secondary back up should the pressure transducer fail. The pressure transducer will control the start, stop, and alarm levels in the effluent tank. The frequency of power can be changed by the operator to increase/decrease pump run times. The function of each controller is described below:

- Effluent Tank Pressure Transducer: This pressure transducer will display the wastewater level in the effluent tank as a percentage. There will also be a low-low, stop, start, and high-high level settings programmed into the PLC which will control the operation of the effluent pumps. The operator can adjust the power being supplied to the effluent pump VFD's to increase or decrease pump run times.
- Effluent Tank Low-Low Level Float: Should the pressure transducer fail, this float will stop the duty and/or standby pump and will activate an audio/visual alarm signal when the float switch is in the extended position (open circuit).
- Effluent Tank Low Level Float: Should the pressure transducer fail, this float will stop the duty lift pump when the float switch is in the extended position (open circuit).
- Effluent Tank High Level Float: Should the pressure transducer fail, this float will start the duty lift pump when the float switch is tilted (closed circuit).
- Effluent Tank High-High Level Float: This float will activate an audio/visual alarm signal and alternate to the standby effluent pump when the float switch is tilted (closed circuit). The floats will maintain control of the effluent pumps until the pressure transducer is repaired or replaced.

5.13.2 Pump Cycle Settings

The effluent pumps are sized to start less than 6 times per hour during average day flow conditions and run continuously for peak hourly flow conditions based on the expected flows of the full buildout. The PLC will record the effluent pump cycles and run times to monitor pump usage. The effluent pumps will have a maximum pumping capacity of 950 gpm at 35 feet of total dynamic head (TDH). The operator will be able to adjust the VFDs and pressure transducer start/stop set points based on actual flow conditions.

5.14 Effluent Flow Metering

A GF Signet 2551 insertion-style magmeter flow sensor with a 4-20 mA signal output for remote flow monitoring will be installed on the common discharge pipe header between the permeate pumps and the UV units in each MBR building. The flowmeter will record instantaneous flows processed by the MBR train and record the total flow per day per cycle. The plant PLC will have the ability to monitor and track flows and totalize and log the flows from the flowmeter. Cut sheets for the Signet 2551 magmeter are included in Appendix I.

5.15 Odor Control

An activated carbon air filtration system as manufactured by Carbtrol Corporation will be provided to remove hydrogen sulfide, VOCs and other odors associated with sewer gases vented from the equalization tank, aeration tanks, MBR tanks and sludge tank.

Air requirements for the WWP at full buildout are as follows:

EQ tank		60 cfm
Aeration train	353 cfm x 3 trains =	1,060 cfm
MBR	432 cfm x 3 trains =	1,300 cfm
Sludge tank		38 cfm
Total:		2,458 cfm

The Carbtrol Corp. odor control air filtration system model G-23 is a skid-mounted forced ventilation system consisting of an FRP adsorber vessel, activated catalytic carbon media, centrifugal blower, manual flow control valve, control panel, sample ports, drain valve and differential pressure gauge.

The G-23 system is a deep bed up-flow carbon filter with flow capacity of 1,400 CFM designed for high removal efficiency of hydrogen sulfide, VOCs and other sewer gases. The G-23 system contains 1,700 lbs of activated catalytic carbon.

Carbon air filtration system will consist of two (2) G-23 units proposed to be housed inside the back portion of the Laboratory/Maintenance building. Treated filtered air from the units will be piped and directed to the outside.

All vent piping will consist of corrosion-resistant PVC piping. Carbon media will be replaced as needed when spent. If replacement of media becomes costly, an inline dehumidifier will be installed prior to the carbon filters to remove moisture.

Cut sheets for the Odor Control system are included in Appendix M.

5.16 Belt Filter Press

During the initial phase of the development with the 1st treatment train in place, waste liquid sludge from the WWTP processes will be pumped and hauled off-site for proper disposal and treatment according to DEC regulations. Once the second treatment train is in place, off-site disposal of waste liquid sludge will no longer be practical and viable.

At this stage, the installation of a belt filter press is recommended to dewater the waste liquid sludge from the WWTP processes. The belt filter press is proposed to be installed in a heated and insulated pre-fabricated steel building with approximate dimensions of 40' x 50' feet adjoining the plant headworks. The building will have a clear interior vertical height of 25 feet and gabled roof.

The dewatering facility will be provided with two (2) belt filter press units in a duty/standby arrangement to provide full mechanical redundancy. The belt filter press units are proposed to be EMO combined unit Omega model cc180 as manufactured by Aqualitec Corporation based in California. Each belt press has a belt width of 1.8 meter (6 feet) and is capable of processing up to 3,612 gallons of sludge per hour or 28,900 gpd. The Omega belt filter press consists of a gravity belt thickener and a belt filter press combined into a single operating enclosed unit. The belt filter press is designed for continuous mechanical dewatering operation.

The belt filter press installation will include a discharge hopper, a screw-type conveyor belt, a chute, a floor or skid-mounted control panel, a skid-mounted chemical feed pump system for the injection of polymer and an adjoining space for the placement of two (2) roll-off containers for the storage of dewatered sludge. The building will be provided with two (2) roll-up doors large enough to accommodate the passage of trucks to load and off load the roll-off containers. Dewatered sludge will be disposed of off-site according to DEC regulations.

Decant pump station will be repurposed to convey waste liquid sludge from the sludge tank to the belt press building. Wash water from the sludge dewatering process will be returned by gravity to the EQ tank at the head of the plant. Proper operation of the belt press requires an appropriate source of water to the wash spray bars. Each belt filter press requires a flow of 70 gpm of wash water for the spray bars. Initially, potable water will be used as a source of water to the belt filter press. Future plan will include the installation of a small submersible effluent pump in the treated effluent pump station to provide non-potable water for operation of the belt press units.

The belt filter press building will be provided with its own dedicated air filtration system. Air filtration system will consist of Pure Air Filtration model VTS-7201 self-contained compact vertical airflow unit with a rated air flow capacity of 8,000 cfm including skid-mounted drawn-through blower and exhaust stack. Media will consist of high grade activated carbon impregnated with acid gas neutralizing compound and proprietary reagent capable of high removal efficiency for hydrogen sulfide. The self-contained unit is designed for outdoor installation.

Cut sheets for the belt filter press, pre-fabricated steel building and air filtration system are included in Appendix N.

5.17 Standby Power

A dedicated on-site standby generator equipped with an automatic transfer switch will provide backup power to ensure continuous operation of the sewage treatment plant in the event of a power outage. The standby generator will have sufficient capacity to power all pumps and ancillary equipment including control panels.

The standby generator will be powered by a diesel engine. The diesel- powered generator will be provided with a 767-gallon fuel subbase tank with enough capacity to run the generator for 24 hours continuously at full loads. The subbase tank is a dual wall tank with secondary containment and provided with a leak detection alarm.

A 350 kW Kohler model 350REOZJ standby generator is proposed to be provided. The generator will be housed in a sound-attenuated acoustically designed weather protective enclosure with a low noise critical grade exhaust silencer. The generator will be equipped with the following features and accessories: run-off-auto switch, running time meter, critical-grade exhaust silencer, block heater, automatic battery charger, generator alarm status panel, oil pressure gauge, high temperature and low oil pressure shutdown. An automatic transfer switch will be provided.

The generator provides contacts for interconnection with the central control panel. The central control panel will notify the operator with a generator fault alarm and message. The generator has an LCD screen with detailed info on faults.

Standby equipment will be regularly exercised at full loads. Cut-sheets of the Kohler model 350REOZJ standby generator are provided in Appendix O.

5.18 Site Protection

The WWTP will only be accessible to the operators via a locked access gate. All of the WWTP buildings will be locked and are inaccessible through other means as there are no windows or other exterior features that provide a means of entrance. All buried tanks shall be secured with a lockable cover. The generator panels shall also be locked.

5.19 Water Service Connection

Water service connection to the treatment plant site consists of a 1-inch curb stop, 1-inch type K copper service line and a curb box. The curb box will is installed on the shoulder of the main roadway along the edge of paved access drive to the wastewater treatment plant.

A 1-inch water meter and 1-inch reduced pressure zone (RPZ) assembly is installed in an aboveground insulated metal enclosure near the access gate to the WWTP site. The enclosure is of aluminum fabrication with 1 1/2-inch thick insulation such as Safe-T-Cover model 200SN-AL or approved equivalent. The enclosure is mounted on a concrete pad. The enclosure is provided with heat trace cables to maintain an interior temperature of 40°F with an outside temperature of -30°F. The meter will be provided by the Dutchess County Water and Wastewater Authority.

A 2-inch CTS HDPE water service line will be extended from the meter enclosure to supply water to the buildings on the WWTP site.

A ¾" or 1" CTS HDPE potable water service line will be provided to each MBR building, screening building and laboratory building for makeup water if needed and for cleaning or rinsing of equipment. A ¾-inch or 1-inch Watts reduced pressure zone (RPZ) model LF009M2-QT will be installed on the potable water connection for cross-connection control inside each treatment building, belt press facility and laboratory. Cut sheets for the RPZ are provided in Appendix D.

6.0 MASS BALANCE

A mass balance of the flows and concentrations was completed for full buildout of the development. Flow diagram and a mass balance are provided in Appendix P.

7.0 TESTING

Upon substantial completion of all sanitary sewer gravity lines, or at times when it is prudent to conduct performance testing, sections of gravity sewer mains (manhole-to-manhole) shall be tested by conducting 24-hour hydrostatic exfiltration test or low-pressure air test per ASTM F1417. All sanitary concrete manholes shall be subjected to a 24-hour hydrostatic test or vacuum test per ASTM C1244. Deflection testing shall be conducted on all flexible sewer pipe section no sooner than 30 days after installation.

Hydrostatic tests shall be performed in the presence of an Engineer on below grade concrete tanks and wet wells. Structures shall be completely plugged and filled with water and allowed to stand for two hours prior to a reading. After two hours, a reading should be taken and the structure shall be allowed to stand for 24 hours. The water level drop shall be noted after 24 hours. Leakage shall not exceed 0.6 gal/ft manhole diameter/ft manhole depth. Any leaks shall be repaired and retested subject to the Engineer's approval.

8.0 BACKFLOW PREVENTION DEVICE

The degree of hazard is based upon the guidelines set forth in the Public Water Supply Guide Cross-Connection Control (1/81) as prepared by the Bureau of Public Water Supply New York State Department of Health. According to Section 6 of this document, a sewage treatment plant is classified as a hazardous facility.

A hazardous facility should be protected by a reduced pressure zone (RPZ) backflow prevention as recommended in the cross connection guideline. The RPZ assembly with atmospheric vent shall be a 1" Watts Lead-Free Series LF009M2-QT with quarter turn ball valves or approved equal. Assembly is provided with quarter turn ball valves on inlet side and outlet side, and four test cocks. Assembly is rated for a working pressure of 150 psi. RPZ shall be provided with Watts air gap model 909AGAC.

RPZ shall conform to ASSE Standard 1013, AWWA C-511 and USC specifications manual for Cross Connection Control. This assembly is listed as an acceptable device in the State Department of Health, Environmental Health Manual PWS-14. Cut-sheets are provided in Appendix D.

9.0 OPERATION AND MAINTENANCE

The operation, monitoring and maintenance of the on-site wastewater treatment plant will be performed by and under the direct supervision of a New York State licensed wastewater operator contracted by the owner of the facilities.

The minimum wastewater operator certification grades required to operate this WWTP facility will be determined by the NYSDEC based on its design flow, type of treatment and operational complexity. Using the NYSDEC WWTP Facility Scoring worksheet (form FOAS 100-4/95) to rate this proposed facility, we determined that the Chief Operator and the Assistant/Shift Operator will need to hold a grade 2A and grade 1A certification, respectively. The worksheet is included in Appendix Q.

Prior to completion of the construction of the wastewater treatment plant facility, the Contractor should assemble and compile an Operation and Maintenance (O&M) Manual, complete with list of major equipment suppliers and copies of approved shop drawings, installation manuals, operation and maintenance manuals for major equipment and components.

10.0 CODES AND STANDARDS

The proposed sanitary sewer facilities have been designed in accordance with applicable standards and guidelines including Recommended Standards for Wastewater Facilities (a.k.a. Ten States Standards) and NYSDEC Design Standards for Intermediate-Sized Wastewater Treatment Systems.

All electrical design shall be in compliance with the National Electrical Code (NFPA 70) and any applicable NFPA requirements. The electrical equipment and installation inside the MBR

container shall meet UL and NEC requirements. The electrical installation inside the MBR container will be UL certified by a UL inspector. Electrical panels will be provided with required NEC clearances. Note that the MBR tanks and aeration tank located inside the MBR container are actually sealed (no open water surface) and vented to the outside.

Figures:

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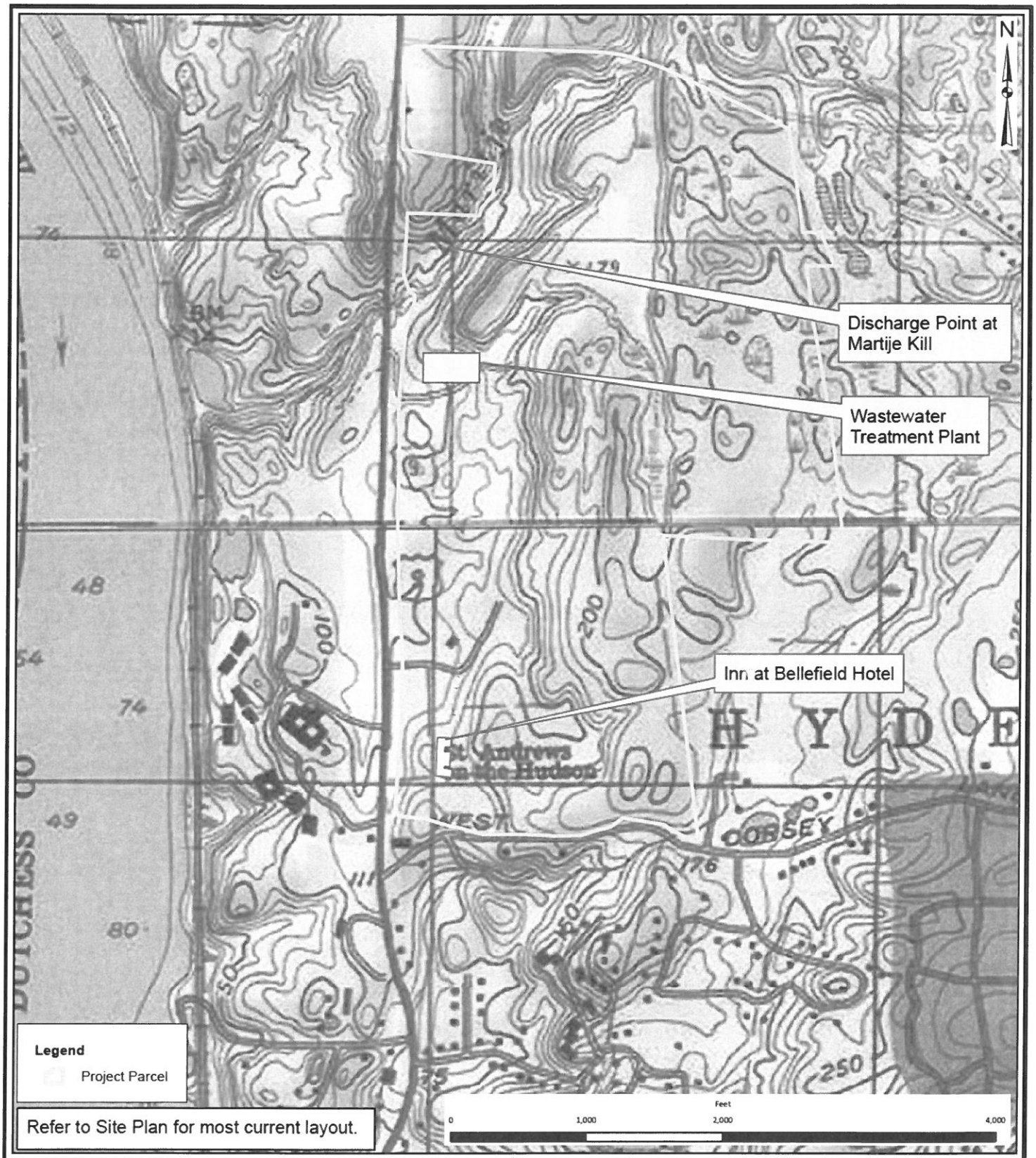

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Phone: (518) 812-0513

Inn at Bellefield

Figure 1
USGS Location Map
3760 Route 9, Town of Hyde Park - Dutchess County, NY

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Project:	81235.02
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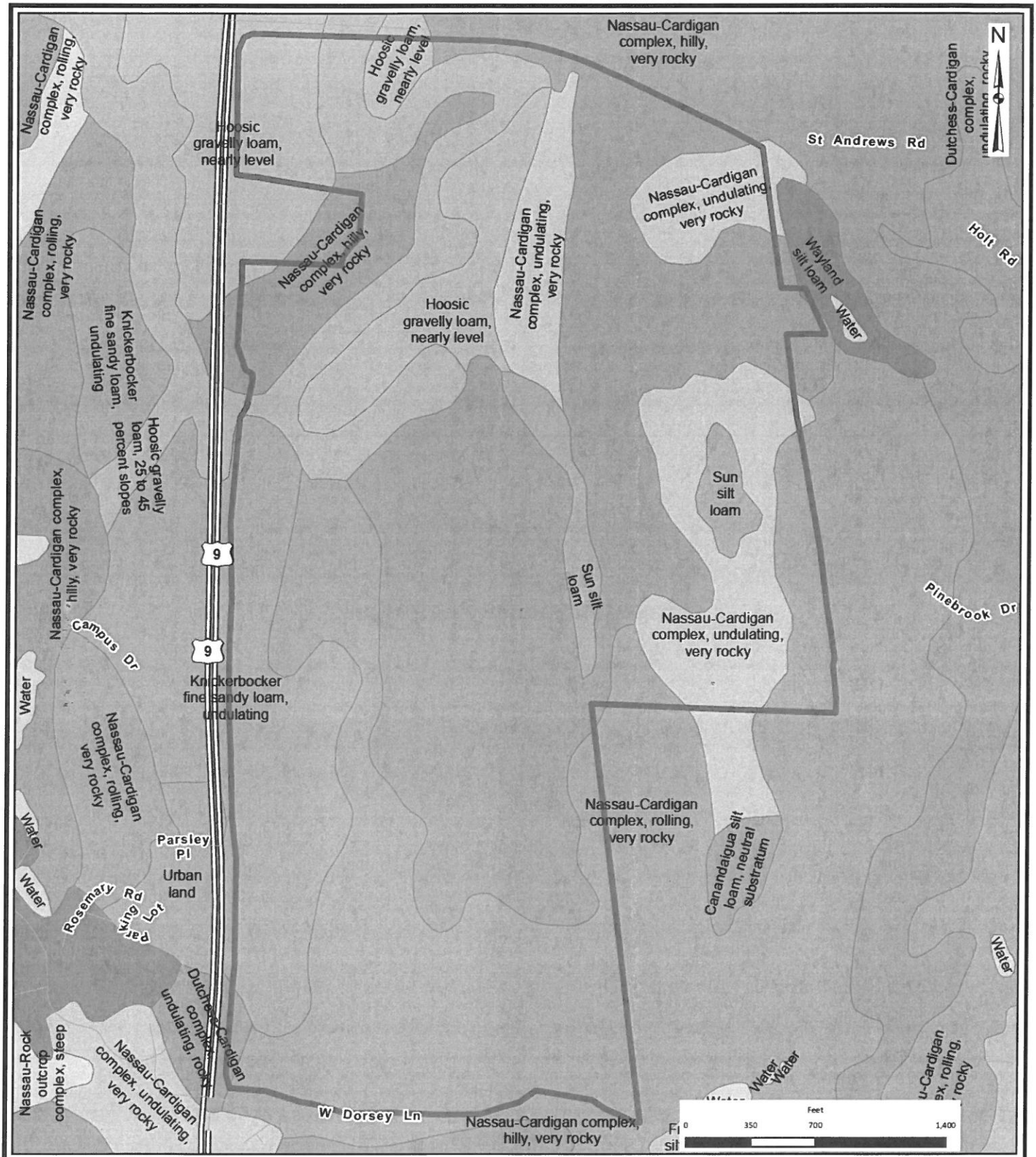

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T-Rex Hyde Park Owner

Figure 2
Soils Map

3760 Route 9
Town of Hyde Park, Dutchess County, New York
Source: Dutchess County 2010 Tax Parcel Data; USGS Soils Survey of Dutchess County 2004

Drawn:	STF
Date:	5/5/2016
Scale:	1 inch equals 700 feet
Project:	81235.01
Figure:	2

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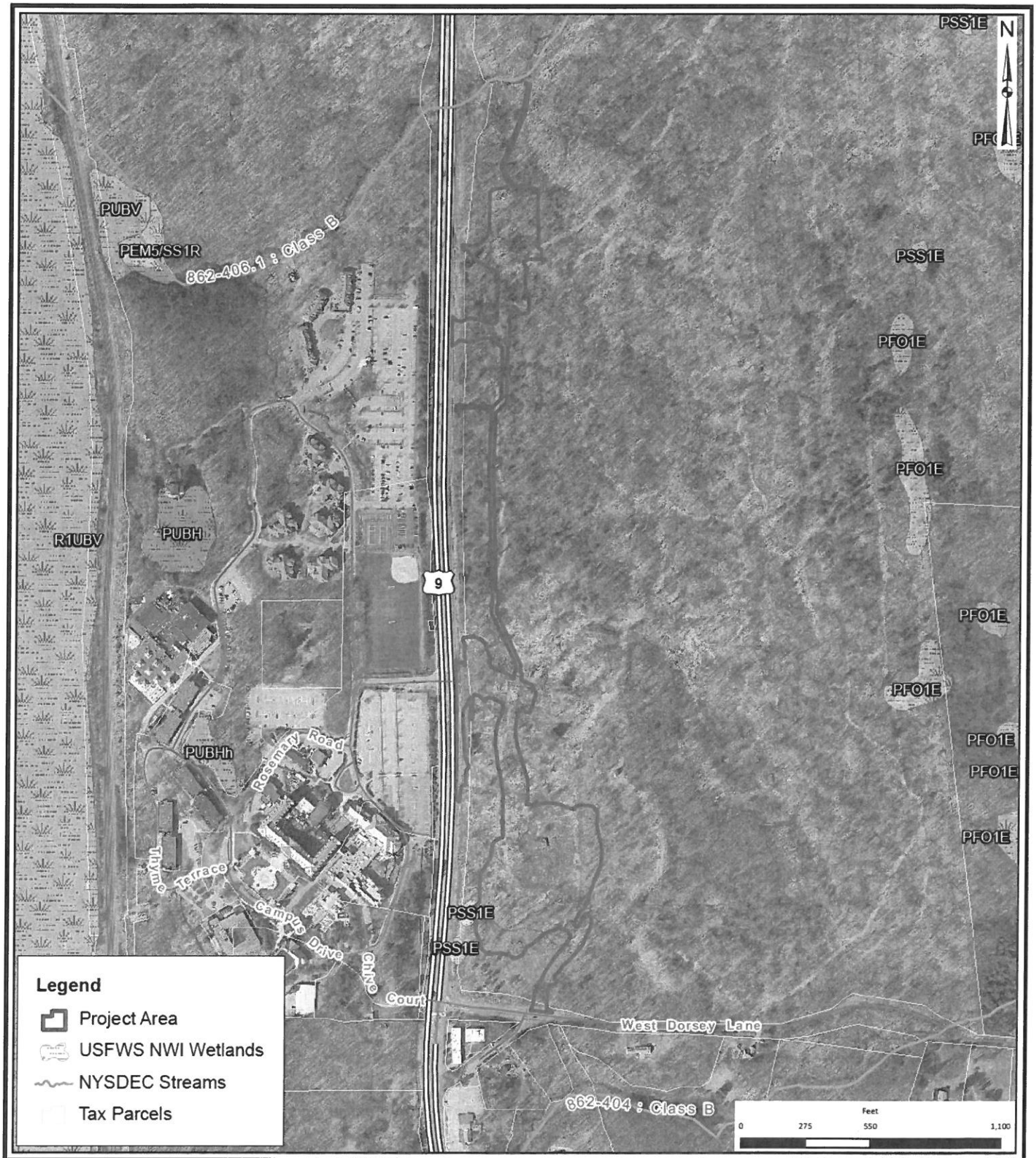

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St. Andrews Sub-Phase 1A Final Development Plan
Inn at Bellefield

Figure 3
Wetland and Streams Map

3760 Route 9, Town of Hyde Park - Dutchess County, NY

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Date:	12/6/2017
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Project:	81235.02
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Appendix A:
Bellefield at Historic Hyde Park
Projected Wastewater Flows

Project Number: 81235.09

The Chazen Companies
May 13, 2021
Revised February 23, 2022

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TABLE 1- BELLEFIELD AT HISTORIC HYDE PARK PROPOSED DEVELOPMENT - HYDE PARK, NY
PROJECTED WASTEWATER FLOWS AT BUILDOUT[1]

Type of Use		Unit	Unit Qty	Hydraulic Loading Rate[2] (gpd/unit)	Water Saving Credit [3] (%)	Hydraulic Loading Rate w/ Credit (gpd/unit)	Average Daily Wastewater Flow (gpd)	
Residential	**558 units**							**146,190 gpd**
Single Family Home		4-Bedroom	50	440 [4]	---	440	22,000	
Village Home		3-Bedroom	45	330 [4]	---	330	14,850	
Townhome		3-Bedroom	105	330 [4]	---	330	34,650	
Townhome		2-Bedroom	105	220 [4]	---	220	23,100	
Duplex Home		3-Bedroom	82	330 [4]	---	330	27,060	
Brownstone Flat		2-Bedroom	33	220 [4]	---	220	7,260	
Apartment (above retail)		1-Bedroom	119	110 [4]	---	110	13,090	
Live/Work Unit		2-Bedroom	19	220 [4]	---	220	4,180	
Office	**207,910 sf**							**7,488 gpd**
Office [5]	207,910 sf	employee	624	15	20%	12	7,488	
Retail & Restaurant	**393,735 sf**							**79,519 gpd**
Retail	338,735 sf	sf	338,735	0.1	20%	0.08	27,099	
Employees - Retail [6]		employee	847	15	20%	12	10,164	
Restaurants [7]	30,000 sf	seat	1,125	35	20%	28	31,500	
Movie Theater [8]	25,000 sf	seat	2,500	5	20%	4	10,000	
Employees - Movie Theater [6]		employee	63	15	20%	12	756	
Hotel & Conference Center	**260,000 sf**							**51,278 gpd**
Inn at Bellefield	105,000 sf	---	---	---	---	---	21,464	
Boutique Hotel	125,000 sf	sleeping unit	75	110 [4]	---	110	8,250	
Hotel Restaurant		seat	75	35	20%	28	2,100	
Conference Center/Banquet Hall [9]	15,000 sf	seat	1,500	10	20%	8	12,000	
Employees - Conference Center [6]		employee	38	15	20%	12	456	
Health Club and Spa [10]	15,000 sf	patron	438	20	20%	16	7,008	
Community Building Space	**14,250 sf**							**3,256 gpd**
Club House [11]	3,500 sf	seat	140	20	20%	16	2,240	
Community Center [12]	10,750 sf	occupant	215	5	20%	4	860	
Employees - Community Center [13]		employee	13	15	20%	12	156	
Education Facilities	**130,000 sf**							**14,340 gpd**
Classroom [14]	115,000 sf	student	1,725	10	20%	8	13,800	
Office/Admin [5]	15,000 sf	employee	45	15	20%	12	540	
Out-of-District User(s)								**39,000 gpd**
Allowance for Out-of-District User(s)							39,000	
							Avg Daily Flow:	**341,071 gpd**
								237 gpm
						Max Day Peak Factor:	**2.0**	
							Max Daily Flow:	**682,142 gpd**
								474 gpm
						Hourly Peak Factor:	**4.0**	
							Peak Hourly Flow:	**1,364,283 gpd**
								947 gpm

Notes:

1. Projected wastewater flows assume full buildout and maximum occupancy of proposed facilities
2. Hydraulic Loading Rates from Table B-3 of NYS Design Standards for Wastewater Treatment Systems (2014) unless otherwise noted below
3. NYSDEC allows for up to 20% reduction in flows for installations equipped with certified water-saving plumbing fixtures
4. Unit rate of 110 gpd/bedroom or sleeping unit includes the 20% reduction for use of water-saving post 1994 plumbing fixtures
5. Assume 3.0 employees per 1,000 square feet of office space per Development Impact Assessment Handbook, Urban Land Institute 1994
6. Assumed 2.5 employees/1,000 sf of retail floor space per Development Impact Assessment Handbook, Urban Land Institute 1994
7. Assume 60% of square footage is dining room space and average 16 square feet per patron for full service/fine dining, per industry rule of thumb
8. Assume 10 square feet per seat, per industry rule of thumb
9. Assume 10 square feet per person for conference center/banquet hall, per industry rule of thumb
10. Assume 12 square feet per member and 35% of member population uses facility in a given day, per Hearline Fitness Systems (2018)
11. Assumed 25 sf of gross floor space per seat and rate of 20 gpd/seat for Lounge/Bar per Table B-3 of 2014 NYSDEC Standard
12. Assumed 50 sf of gross floor space/occupant and rate of 5 gpd/patron for Library/Museum per Table B-3 of NYSDEC Standard
13. Assumed 1.25 employees per 1,000 sf of community center gross floor space
14. Assume 15 students per 1,000 square foot classroom, per Minimum Classroom Size and Number of Students per Classroom, University of Georgia School Design and Planning Laboratory (2009)

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TABLE 4- BELLEFIELD AT HISTORIC HYDE PARK PROPOSED DEVELOPMENT - HYDE PARK, NY
PROJECTED WASTEWATER FLOWS AT BUILDOUT - AMENDED DEVELOPMENT PROGRAM[1]

NEIGHBORHOOD	Type of Use		Unit	Unit Qty	Hydraulic Loading Rate[2] (gpd/unit)	Water Saving Credit[3] (%)	Hydraulic Loading Rate w/ Credit (gpd/unit)	Average Daily Wastewater Flow (gpd)	
The Village	**Residential**	**533,824 sf**							**108,700 gpd**
	Condominium Apartment	1,594 sf/unit	2-Bedroom	60	220 [4]	---	220	13,200	
	Rental Loft Apartment (above retail)	1,246 sf/unit	1-Bedroom	120	110 [4]	---	110	13,200	
	Rental Apartment	1,116 sf/unit	1-Bedroom	252	110 [4]	---	110	27,720	
	Townhouse	1,858 sf/unit	2-Bedroom	4	220 [4]	---	220	880	
	Non-Residential	**336,578 sf**							
	Community Building [12]	25,250 sf	occupant	285	5	20%	4	1,140	
	Retail	155,000 sf	sf	155,000	0.1	20%	0.08	12,400	
	Employees - Retail [6]		employee	388	15	20%	12	4,656	
	Sales Office [5]	15,000 sf	employee	45	15	20%	12	540	
	Restaurant [7]	10,000 sf	seat	375	35	20%	28	10,500	
	Agricultural Education Center [14]	25,000 sf	student	375	10	20%	8	3,000	
	Inn at Bellefield	106,328 sf	---	---	---	---	---	21,464	
The Terrace	**Residential**	**377,700 sf**							**48,090 gpd**
	Townhouse	1,858 sf/unit	2-Bedroom	150	220 [4]	---	220	33,000	
	Cottage	2,200 sf/unit	3-Bedroom	45	330 [4]	---	330	14,850	
	Non-Residential	**3,000 sf**							
	Community Building [12]	3,000 sf	occupant	60	5	20%	4	240	
The Ridge	**Residential**	**245,030 sf**							**36,100 gpd**
	Single Family Estate Home	3,000 sf/unit	4-Bedroom	30	440 [4]	---	440	13,200	
	Cottage	2,200 sf/unit	3-Bedroom	30	330 [4]	---	330	9,900	
	Patio Home	1,535 sf/unit	2-Bedroom	58	220 [4]	---	220	12,760	
	Non-Residential	**3,000 sf**							
	Community Building [12]	3,000 sf	occupant	60	5	20%	4	240	
The Crescent	**Residential**	**151,188 sf**							**105,954 gpd**
	Condominium Apartment	1,594 sf/unit	2-Bedroom	69	220 [4]	---	220	15,180	
	Patio Home	1,535 sf/unit	2-Bedroom	22	220 [4]	---	220	4,840	
	Townhouse	1,858 sf/unit	2-Bedroom	4	220 [4]	---	220	880	
	Non-Residential	**395,000 sf**							
	Hotel	204,400 sf	sleeping unit	300	110 [4]	---	110	33,000	
	Hotel Villas	25,600 sf	sleeping unit	32	110 [4]	---	110	3,520	
	Spa and Wellness Center [10]	15,000 sf	patron	438	20	20%	16	7,008	
	Conference Center/Banquet Hall [9]	30,000 sf	seat	3,000	10	20%	8	24,000	
	Employees - Conference Center [6]		employee	75	15	20%	12	900	
	Event Barn [9]	15,000 sf	occupant	1,500	5	20%	4	6,000	
	Employees - Event Barn [6]		employee	38	15	20%	12	456	
	CIA Classroom [14]	97,500 sf	student	1,238	10	20%	8	9,900	
	CIA Office/Admin [5]	7,500 sf	employee	23	15	20%	12	270	
St. Andrews	**Non-Residential**	**83,000 sf**							**14,800 gpd**
	Retail	50,000 sf	sf	50,000	0.1	20%	0.08	4,000	
	Employees - Retail [6]		employee	125	15	20%	12	1,500	
	Office [5]	25,000 sf	employee	75	15	20%	12	900	
	Restaurant [7]	8,000 sf	seat	300	35	20%	28	8,400	
Out-of-District User(s)									**28,000 gpd**
	Allowance for Out-of-District User(s)							28,000	
								Avg Daily Flow:	**341,644 gpd**
									237 gpm
							Max Day Peak Factor:	**2.0**	
								Max Daily Flow:	**683,288 gpd**
									475 gpm
							Hourly Peak Factor:	**4.0**	
								Peak Hourly Flow:	**1,366,576 gpd**
									949 gpm

Notes:

1. Projected wastewater flows assume full buildout and maximum occupancy of proposed facilities
2. Hydraulic Loading Rates from Table B-3 of NYS Design Standards for Wastewater Treatment Systems (2014) unless otherwise noted below
3. NYSDEC allows for up to 20% reduction in flows for installations equipped with certified water-saving plumbing fixtures
4. Unit rate of 110 gpd/bedroom or sleeping unit includes the 20% reduction for use of water-saving post 1994 plumbing fixtures
5. Assume 3.0 employees per 1,000 square feet of office space per Development Impact Assessment Handbook, Urban Land Institute 1994
6. Assumed 2.5 employees/1,000 sf of retail floor space per Development Impact Assessment Handbook, Urban Land Institute 1994
7. Assume 60% of square footage is dining room space and average 16 square feet per patron for full service/fine dining, per industry rule of thumb
8. Assume 10 square feet per seat, per industry rule of thumb
9. Assume 10 square feet per person for conference center/banquet hall, per industry rule of thumb
10. Assume 12 square feet per member and 35% of member population uses facility in a given day, per Hearline Fitness Systems (2018)
11. Assumed 25 sf of gross floor space per seat and rate of 20 gpd/seat for Lounge/Bar per Table B-3 of 2014 NYSDEC Standard
12. Assumed 50 sf of gross floor space/occupant and rate of 5 gpd/patron for Library/Museum per Table B-3 of NYSDEC Standard
13. Assumed 1.25 employees per 1,000 sf of community center gross floor space
14. Assume 15 students per 1,000 square foot classroom, per Minimum Classroom Size and Number of Students per Classroom, University of Georgia School Design and Planning Laboratory (2009)

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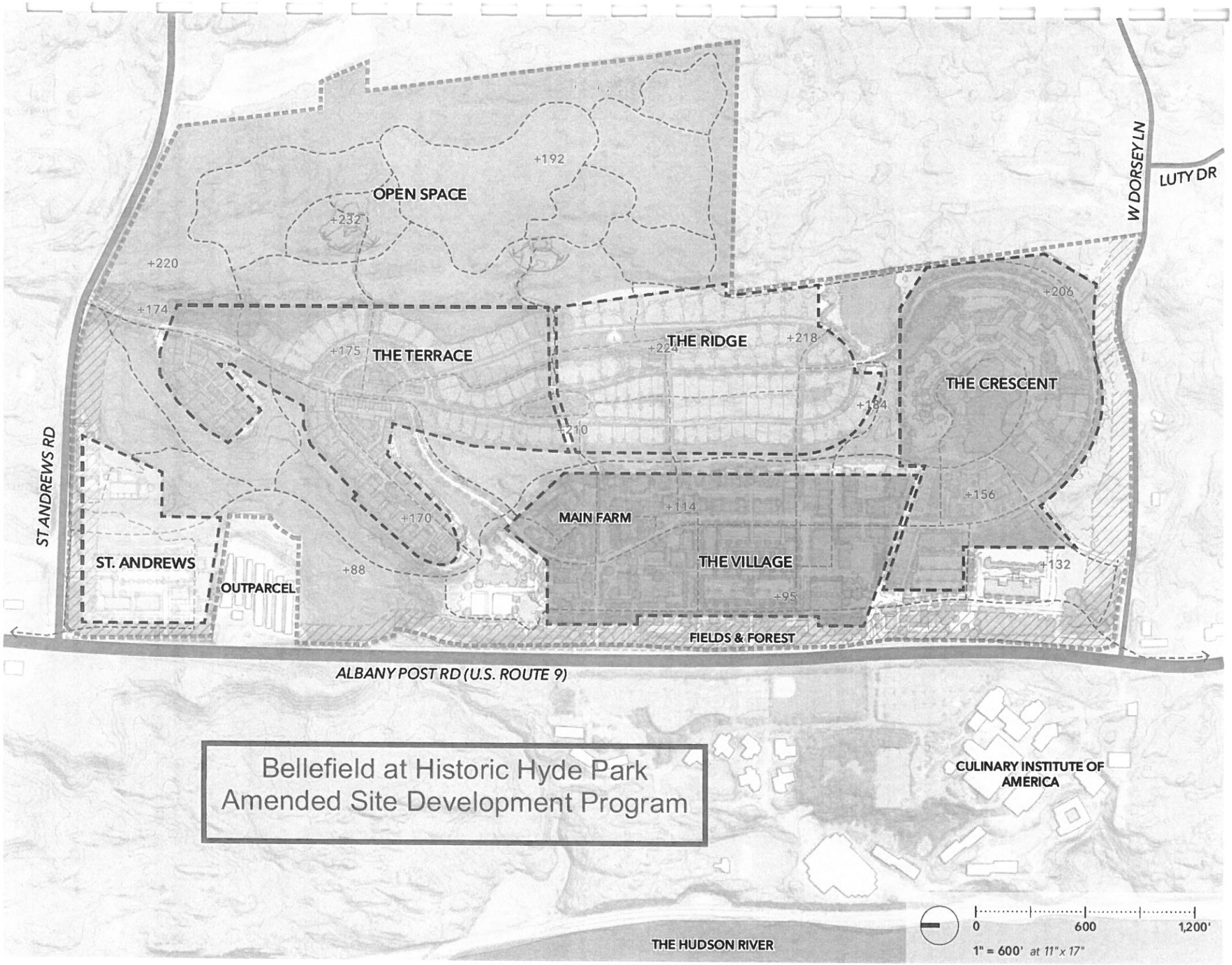

Bellefield at Historic Hyde Park
Amended Site Development Program

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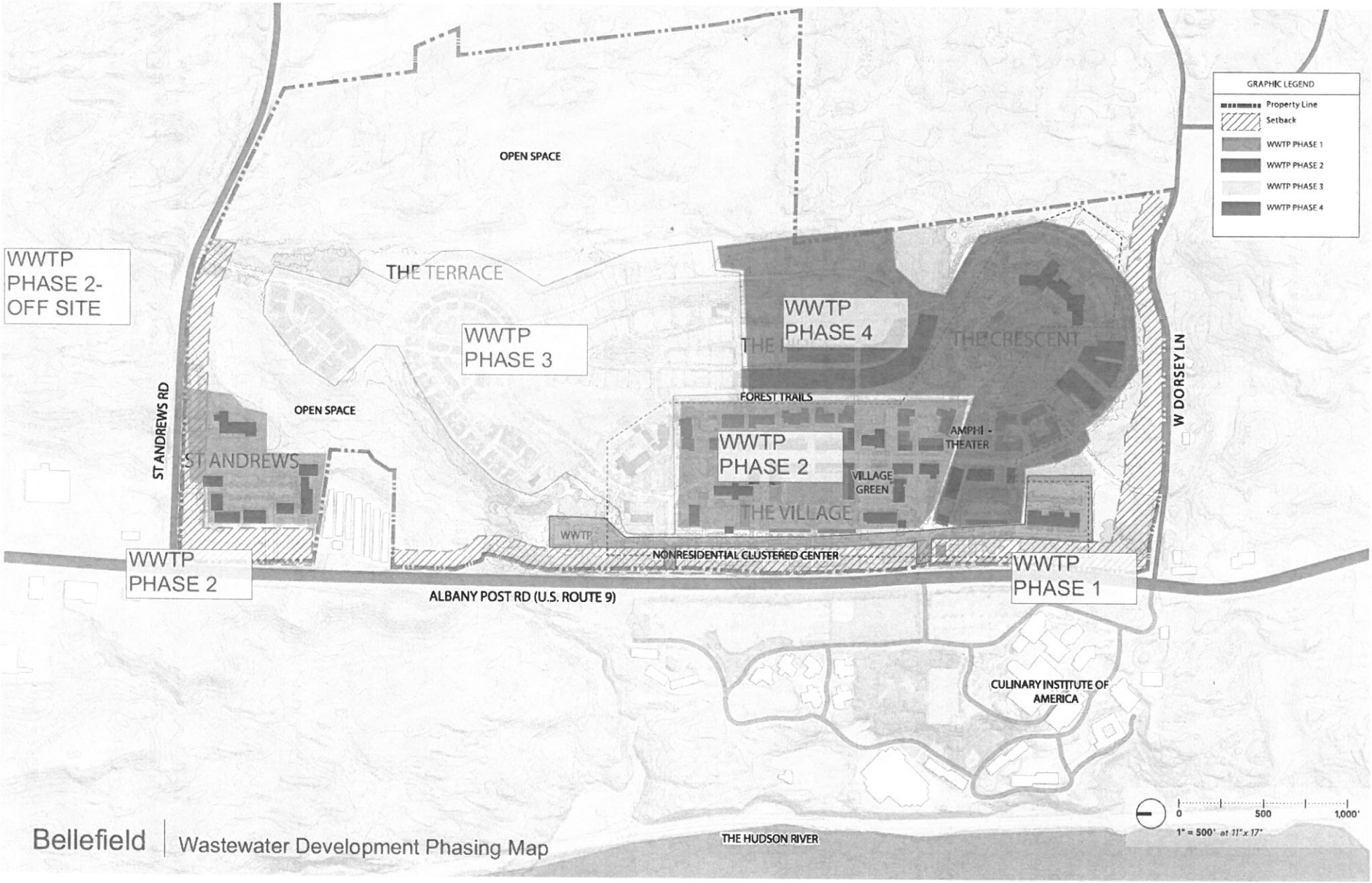
GRAPHIC LEGEND
Property Line
Setback
WWTP PHASE 1
WWTP PHASE 2
WWTP PHASE 3
WWTP PHASE 4
WWTP PHASE 2- OFF SITE
OPEN SPACE
THE TERRACE
WWTP PHASE 3
WWTP PHASE 4
THE CRESCENT
W DORSEY LN
ST ANDREWS RD
OPEN SPACE
FOREST TRAILS
AMPHI - THEATER
ST ANDREWS
WWTP PHASE 2
VILLAGE GREEN
THE VILLAGE
WWTP
NONRESIDENTIAL CLUSTERED CENTER
WWTP PHASE 2
WWTP PHASE 1
ALBANY POST RD (U.S. ROUTE 9)
CULINARY INSTITUTE OF AMERICA
0
500
1,000'
1" = 500' at 11"x 17"
THE HUDSON RIVER
Bellefield
Wastewater Development Phasing Map

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Appendix B:
WWTP – Pump & Valves – Manufacturer's Cut Sheets

Project Number: 81235.09

The Chazen Companies
May 13, 2021
Revised February 23, 2022

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Data sheet

Influent Lift Pumps (Typ of 2)

KSB

Customer item no.:Lift Pump 1 & 2
Communication dated: 02/11/2017
Doc. no.: Submersible Pump
Quantity: 1

Number: ES 5460654
Item no.: 100
Date: 02/11/2017

KRTD 150-253/76XEG-S

Version no.: 1

Operating data

Requested flow rate	950.00 US GPM	Actual flow rate	1056.25 US GPM
Requested developed head	14.00 ft	Actual developed head	18.54 ft
Pumped medium	Sludge Sewage sludge, general up to 2% bone dry Not containing chemical and mechanical substances which affect the materials	Efficiency	75.9 %
		Power absorbed	6.60 HP
		Pump speed of rotation	1174 rpm
		Max. power on curve	7.23 HP
		Shutoff head	40.15 ft
		Design	Single system 1 x 100 %
Ambient air temperature	68.0 °F		
Fluid temperature	68.0 °F		
Fluid density	63.114708 lb/ft³		
Fluid viscosity	0.0044 in²/s	Performance test	Yes

Design

Design	Close-coupled submersible	Material code	SIC/SIC/NBR
Orientation	Vertical	Impeller type	Single vane mixed flow (D)
Suction flange pump drilled according to(DN1)	unmachined	Wear ring	Wear plate
		Impeller diameter	10.00 in
Discharge flange pump drilled according to(DN2)	EN 1092-2 / DN 150 / PN 16	Free passage size	3.94 in
		Direction of rotation from drive	Clockwise
Shaft seal	2 mech. seals in tandem arrangement with oil reservoir	Ex protection	Explosion protection to NEC Class1, Div 1, Gr.C, D T3
Manufacturer	KSB		
Type	MG		

Driver, accessories

Driver type	Electric motor	Temperature classes aggregate	T3
Model (make)	KSB		
Motor const. type	KSB Sub. motor	Temperature sensor	Bimetal switch / PTC
NEMA code letter	G	Motor winding	460 V
Frequency	60 Hz	Number of poles	6
Rated voltage	460 V	Starting mode	Direct-on-line starting
Rated power P2	10.00 HP	Connection mode	Delta
Available reserve	51.57 %	Motor cooling method	Surface cooling
Rated current	13.9 A	Motor version	X
Starting current ratio	5.5	Cable design	Rubber hose
Insulation class	H according IEC 34-1	Cable entry	Sealed along entire length
Type of protection	XP/I/1/CD	Power cable	AWG 15-12
Motor enclosure	IP68	Number of power cables	1
Cos phi at 4/4 load	0.80	Moisture sensor	With
Motor efficiency at 4/4 load	84.3 %	Cable length	49.21 ft
Motor service factor	1.15		

Customer item no.:Lift Pump 1 & 2
Communication dated: 02/11/2017
Doc. no.: Submersible Pump
Quantity: 1

Number: ES 5460654
Item no.: 100
Date: 02/11/2017

KRTD 150-253/76XEG-S

Version no.: 1

Materials G

Notes
General criteria for a water analysis: pH-value >= 7; chloride content (Cl) <=250 mg/kg. Chlorine (Cl2) <=0.6 mg/kg.

Pump casing (101)	Cast iron A 48 Class 35 B	Impeller (230)	Cast iron A 48 Class 35 B
Wear Plate (135.1)	Cast iron A 48 Class 35 B	Bearing bracket (330)	Cast iron A 48 Class 35 B
Discharge cover (163)	Cast iron A 48 Class 35 B	O-Ring (412)	Nitrile rubber NBR
Shaft (210)	Chrome steel A 276 Type 410 T	Motor housing (811)	Cast iron A 48 Class 35 B
		Motor cable (824)	Chloroprene rubber
		Screw (900)	Stainless steel A 193 B8M

Packaging

Packaging category	B1 Wooden or plywood case, cover provided with polyproylene cellular sheet, outdoor storage up to 3 months	Packaging for storage	Indoor
		Packaging for country	United States of America
		Outdoor storage at -40°C to +50°C for up to 3 months. Packet must be covered. No corrosion protection, only transport protection.	
Packaging for transport	Ship		
IPPC Standard ISPM 15	Yes		

Nameplates

Nameplates language	International	Duplicate nameplate	With

Certifications

Hydraulic performance test		Test participation	Non-witnessed
Acceptance standard	Hydraulic Inst. B	Quantity, non-witnessed	1
Quantity meas. points Q-H	7	Quantity, witnessed	0
Certificate	Inspection cert. 3.1 to EN 10204		

Customer item no.:Lift Pump 1 & 2
Communication dated: 02/11/2017
Doc. no.: Submersible Pump
Quantity: 1

Number: ES 5460654
Item no.: 100
Date: 02/11/2017

KRTD 150-253/76XEG-S

Version no.: 1

Installation parts

Installation type	stationary 2 guide rail	Type	Chain
Scope of supply	Pump with installation parts For guide rail arrangements, the guide rails are not included in KSB's scope of supply.	Material	CrNiMo steel 1.4404
		Length	32.81 ft
		Max. load	882 lbm
		Lifting Bail	With
Installation depth	31.17 ft		
Material concept	G		

Duckfoot bend

Size	DN 150
Flange design	ASME
Duckfoot bend size (DN2 / DN3)	DN 150 Drilled according to ASME
Material	Cast iron A 48 Class 35 B
Mounting type	Composite anchor bolts
Foundation rail	Without

Claw

Design	straight
Size	DN 150
Intermediate bracket	Yes

Lifting chain / -rope

Coating

KSB coating code	A1 to AA-0080-06-01 / 1	Final coating	2-component epoxy resin high solid
Surface preparation	Free from dirt, grease, rust		
Primer	Zinc phosphate synthetic resin	Color	Ultramarine blue (RAL 5002) KSB-blue
		Total film thickness approx.	0.0059 in

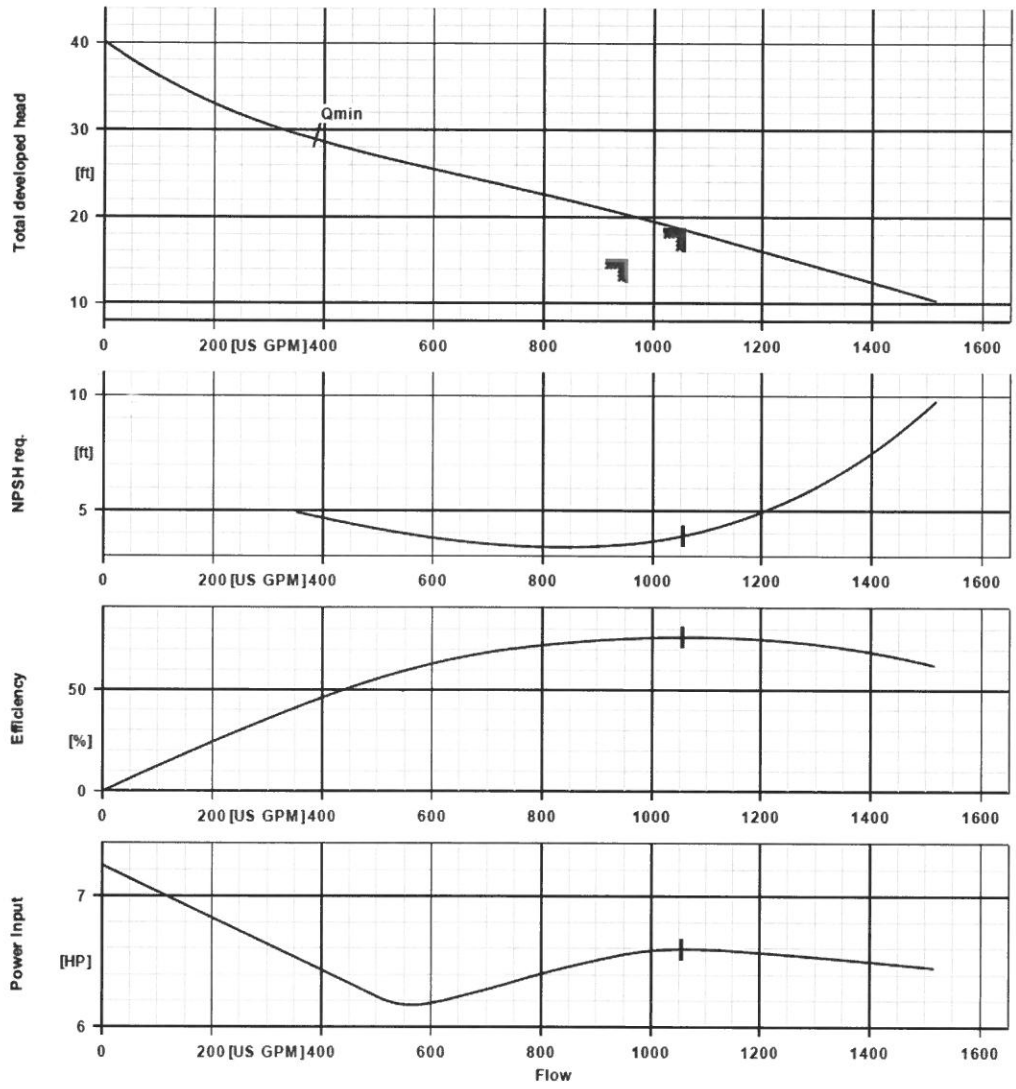
Performance curve

Customer item no.:Lift Pump 1 & 2
Communication dated: 02/11/2017
Doc. no.: Submersible Pump
Quantity: 1

Number: ES 5460654
Item no.:100
Date: 02/11/2017

KRTD 150-253/76XEG-S

Version no.: 1



Curve data

Speed of rotation	1174 rpm	Efficiency	75.9 %
Fluid density	63.114708 lb/ft³	Power absorbed	6.60 HP
Viscosity	0.0044 in²/s	NPSH req. 3%	3.94 ft
Flow rate	1056.25 US GPM	Curve number	K43422s
Requested flow rate	950.00 US GPM	Effective impeller diameter	10.00 in
Total developed head	18.54 ft	Acceptance standard	Hydraulic Inst. B
Requested developed head	14.00 ft		

Motor data sheet

Customer item no.:Lift Pump 1 & 2
Communication dated: 02/11/2017
Doc. no.: Submersible Pump
Quantity: 1

Number: ES 5460654
Item no.:100
Date: 02/11/2017

KRTD 150-253/76XEG-S

Version no.: 1

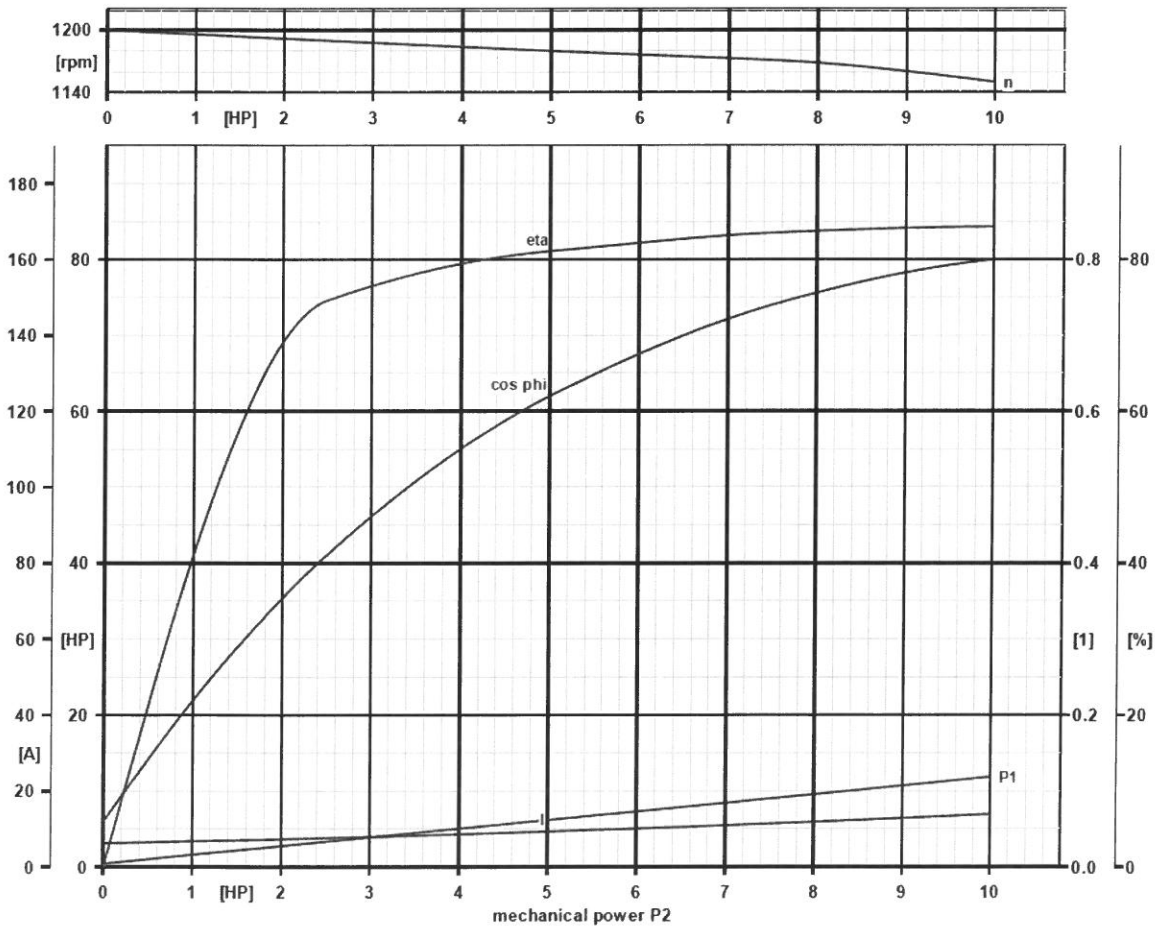
Motor data

Motor manufacturer	KSB	Rated speed	1150 rpm
Motor size	7E	Starting current ratio	5.5
Motor construction type	KSB Sub. motor	Starting mode	Direct-on-line starting
Motor material	Grey cast iron EN-GJL-250	Power cable	AWG 15-12
Efficiency class	not classified	Number of power cables	1
Rated voltage	460 V	Power cable Ø min.	0.65 in
Frequency	60 Hz	Power cable Ø max.	0.69 in
Motor power	10.00 HP	Cable standard	NEC
Rated current	13.9 A	Switching frequency	20.00 1/h

Curve data

The no-load point is not a guarantee point within the meaning of IEC 60034

Load	0.0 %	24.9 %	50.0 %	74.9 %	100.0 %
P2	0.00 HP	2.49 HP	5.00 HP	7.50 HP	10.00 HP
n	1200 rpm	1190 rpm	1180 rpm	1171 rpm	1150 rpm
P1	0.42 HP	3.35 HP	6.17 HP	8.98 HP	11.87 HP
I	6.2 A	7.7 A	9.3 A	11.4 A	13.9 A
Eta	0.0 %	74.6 %	81.1 %	83.5 %	84.3 %
cos phi	0.06	0.41	0.62	0.74	0.80



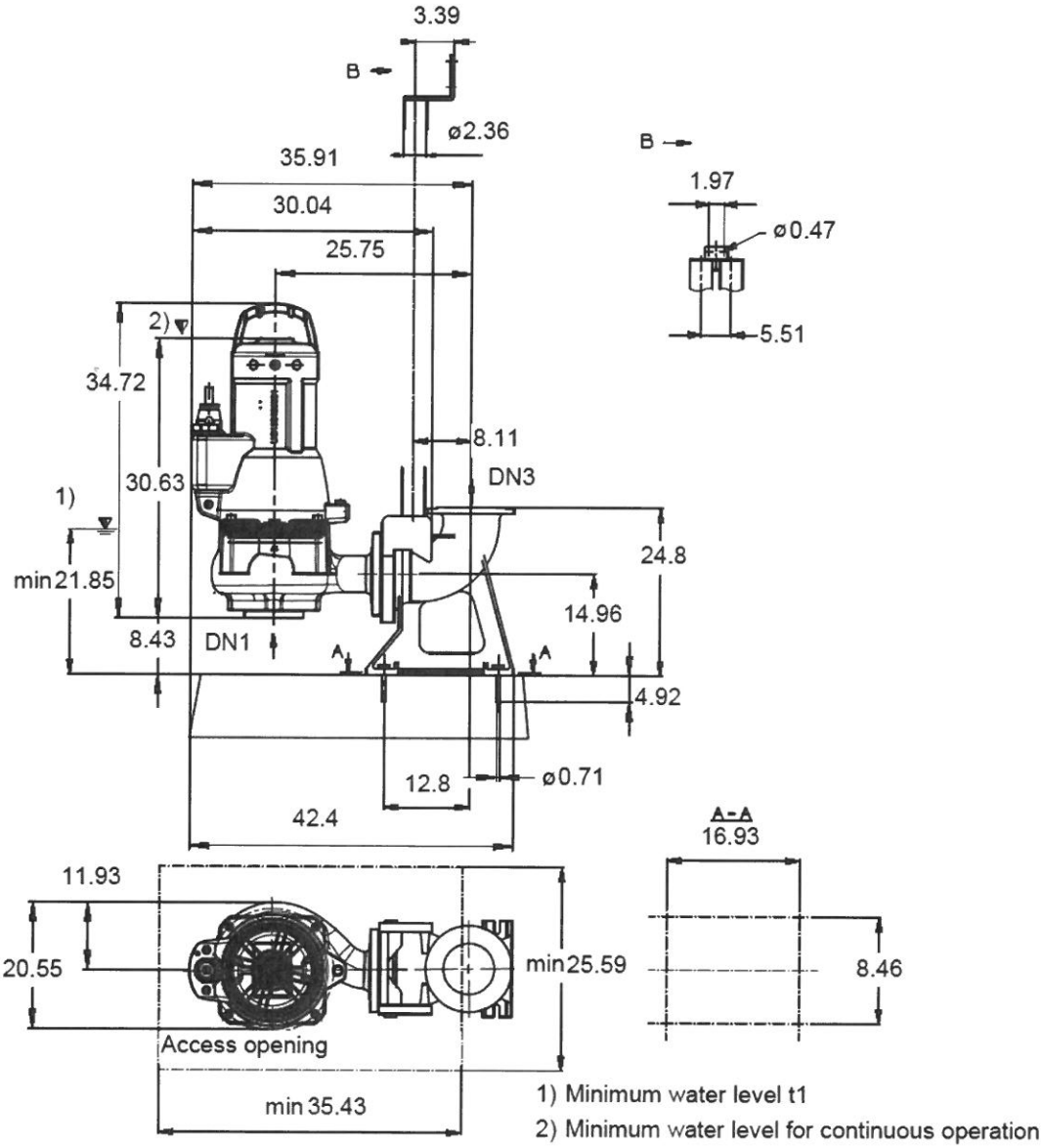
Installation plan

Customer item no.:Lift Pump 1 & 2
Communication dated: 02/11/2017
Doc. no.: Submersible Pump
Quantity: 1

Number: ES 5460654
Item no.:100
Date: 02/11/2017

KRTD 150-253/76XEG-S

Version no.: 1



1) Minimum water level t1
2) Minimum water level for continuous operation

Installation plan

Customer item no.:Lift Pump 1 & 2
Communication dated: 02/11/2017
Doc. no.: Submersible Pump
Quantity: 1

Number: ES 5460654
Item no.:100
Date: 02/11/2017

KRTD 150-253/76XEG-S

Version no.: 1

Drawing is not to scale

Dimensions in in

Motor

Motor manufacturer	KSB
Motor size	7E
Motor power	10.00 HP
Number of poles	6
Speed of rotation	1150 rpm
Motor enclosure	IP68

Connections

Suction flange pump drilled according to(DN1)	unmachined
Duckfoot bend size (DN2 / DN3)	DN 150 Drilled according to ASME

Weight net

Pump, Motor, Cable	470 lbm
Claw / Foot	49 lbm
Total	518 lbm

Connect pipes without stress or strain!

Dimensional tolerances for shaft axis height:	DIN 747
Dimensions without tolerances, middle tolerances to:	ISO 2768-m
Connection dimensions for pumps:	EN735
Dimensions without tolerances - welded parts:	ISO 13920-B
Dimensions without tolerances - gray cast iron parts:	ISO 8062-CT9

Data sheet

EQ Pumps
(Typ of 2)

KSB

Customer item no.:EQ Pump 1 & 2
Communication dated: 02/11/2017
Doc. no.: Submersible Pump
Quantity: 1

Number: ES 5460654
Item no.: 200
Date: 02/11/2017

KRTK 100-400/406XG-S

Version no.: 1

Operating data

Requested flow rate	950.00 US GPM	Actual flow rate	950.00 US GPM
Requested developed head	109.00 ft	Actual developed head	109.00 ft
Pumped medium	Wastewater, municipal untreated Not containing chemical and mechanical substances which affect the materials	Efficiency	71.2 %
		Power absorbed	37.69 HP
		Pump speed of rotation	1185 rpm
		Max. power on curve	43.21 HP
		Shutoff head	139.04 ft
Ambient air temperature	68.0 °F	Design	Single system 1 x 100 %
Fluid temperature	68.0 °F		
Fluid density	64.300840 lb/ft³		
Fluid viscosity	0.0015 in²/s	Performance test	Yes

Design

Design	Close-coupled submersible	Material code	SIC/SIC/NBR
Orientation	Vertical	Impeller type	Multivane radial flow impeller (K)
Suction flange pump drilled according to(DN1)	unmachined	Wear ring	Casing/impeller wear ring
Discharge flange pump drilled according to(DN2)	EN 1092-2 / DN 100 / PN 16	Impeller diameter	16.06 in
		Free passage size	2.99 in
Shaft seal	2 mech. seals in tandem arrangement with oil reservoir	Direction of rotation from drive	Clockwise
		Ex protection	Explosion protection to NEC Class1, Div 1, Gr.C, D T3
Manufacturer	KSB		
Type	MG		

Driver, accessories

Driver type	Electric motor	Temperature sensor	Bimetal switch / PTC
Model (make)	KSB	Motor winding	460 V
Motor const. type	KSB Sub. motor	Number of poles	6
NEMA code letter	E	Starting mode	Direct-on-line starting
Frequency	60 Hz	Connection mode	Delta
Rated voltage	460 V	Motor cooling method	Surface cooling
Rated power P2	49.99 HP	Motor version	X
Available reserve	32.64 %	Cable design	Rubber hose
Rated current	69.0 A	Cable entry	Sealed along entire length
Starting current ratio	4.4	Power cable	AWG 7-4
Insulation class	F to IEC 34-1	Number of power cables	2
Type of protection	XP/I/1/CD	Control cable	AWG 15-12
Motor enclosure	IP68	Number of control cables	1
Cos phi at 4/4 load	0.76	Moisture sensor	With
Motor efficiency at 4/4 load	89.7 %	Cable length	49.21 ft
Motor service factor	1.15		
Temperature classes aggregate	T3		

Customer item no.:EQ Pump 1 & 2
Communication dated: 02/11/2017
Doc. no.: Submersible Pump
Quantity: 1

Number: ES 5460654
Item no.: 200
Date: 02/11/2017

KRTK 100-400/406XG-S

Version no.: 1

Materials G

Pump casing (101)	Cast iron A 48 Class 35 B	Casing wear ring (502.1)	Cast iron A 48 Class 35 B
Discharge cover (163)	Cast iron A 48 Class 35 B	Impeller wear ring (503)	Wear resistant duplex stainless steel
Shaft (210)	Chrome steel A 276 Type 410 T	Motor housing (811)	Cast iron A 48 Class 35 B
Impeller (230)	Cast iron A 48 Class 35 B	Motor cable (824)	Chloroprene rubber
O-Ring (412)	Nitrile rubber NBR	Screw (900)	Stainless steel A 193 B8M

Packaging

Packaging category	B1 Wooden or plywood case, cover provided with polyproylene cellular sheet, outdoor storage up to 3 months	Packaging for storage	Indoor
		Packaging for country	United States of America
		Outdoor storage at -40°C to +50°C for up to 3 months. Packet must be covered. No corrosion protection, only transport protection.	
Packaging for transport	Ship		
IPPC Standard ISPM 15	Yes		

Nameplates

Nameplates language	International	Duplicate nameplate	With

Certifications

		Test participation	Non-witnessed
Hydraulic performance test		Quantity, non-witnessed	1
Acceptance standard	Hydraulic Inst. A	Quantity, witnessed	0
Quantity meas. points Q-H	7		
Certificate	Inspection cert. 3.1 to EN 10204		

Customer item no.:EQ Pump 1 & 2
Communication dated: 02/11/2017
Doc. no.: Submersible Pump
Quantity: 1

Number: ES 5460654
Item no.: 200
Date: 02/11/2017

KRTK 100-400/406XG-S

Version no.: 1

Installation parts

Installation type	stationary 2 guide rail	Type	Chain
Scope of supply	Pump with installation parts For guide rail arrangements, the guide rails are not included in KSB's scope of supply.	Material Length Max. load	CrNiMo steel 1.4404 32.81 ft 1874 lbm
Installation depth	31.17 ft		
Material concept	G		

Duckfoot bend

Size	DN 100 / 150
Flange design	ASME
Duckfoot bend size (DN2 / DN3)	DN 100 / 150 Drilled according to ASME
Material	Cast iron A 48 Class 35 B
Mounting type	Composite anchor bolts
Foundation rail	Without

Claw

Design	straight
Size	DN 100
Intermediate bracket	Yes

Lifting chain / -rope

Coating

KSB coating code	A1 to AA-0080-06-01 / 1	Final coating	2-component epoxy resin high solid
Surface preparation	Free from dirt, grease, rust		
Primer	Zinc phosphate synthetic resin	Color	Ultramarine blue (RAL 5002) KSB-blue
		Total film thickness approx.	0.0059 in

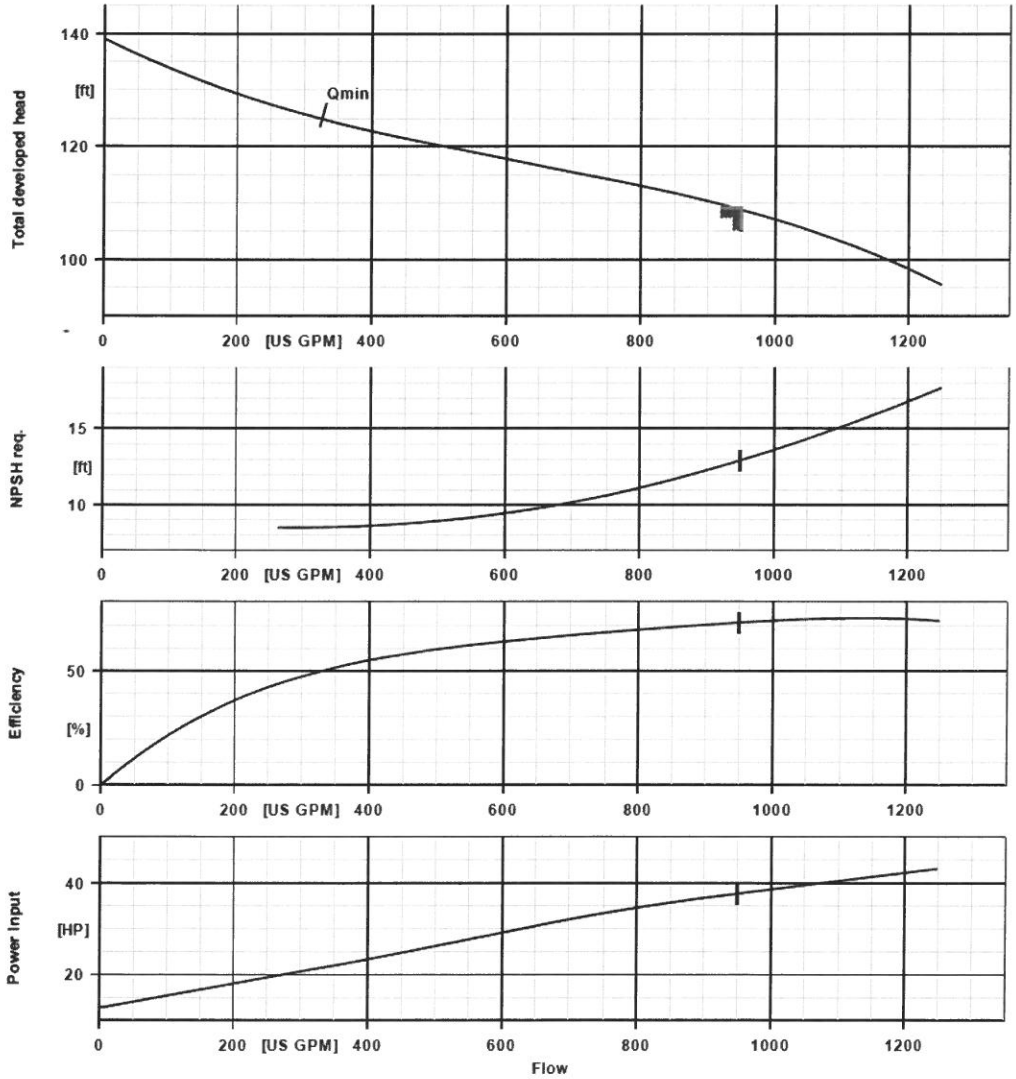
Performance curve

Customer item no.:EQ Pump 1 & 2
Communication dated: 02/11/2017
Doc. no.: Submersible Pump
Quantity: 1

Number: ES 5460654
Item no.:200
Date: 02/11/2017

KRTK 100-400/406XG-S

Version no.: 1



Curve data

Speed of rotation	1185 rpm	Efficiency	71.2 %
Fluid density	64.300840 lb/ft³	Power absorbed	37.69 HP
Viscosity	0.0015 in²/s	NPSH req. 3%	12.89 ft
Flow rate	950.00 US GPM	Curve number	K43199s
Requested flow rate	950.00 US GPM	Effective impeller diameter	16.06 in
Total developed head	109.00 ft	Acceptance standard	Hydraulic Inst. A
Requested developed head	109.00 ft		

Motor data sheet

Customer item no.:EQ Pump 1 & 2
Communication dated: 02/11/2017
Doc. no.: Submersible Pump
Quantity: 1

Number: ES 5460654
Item no.:200
Date: 02/11/2017

KRTK 100-400/406XG-S

Version no.: 1

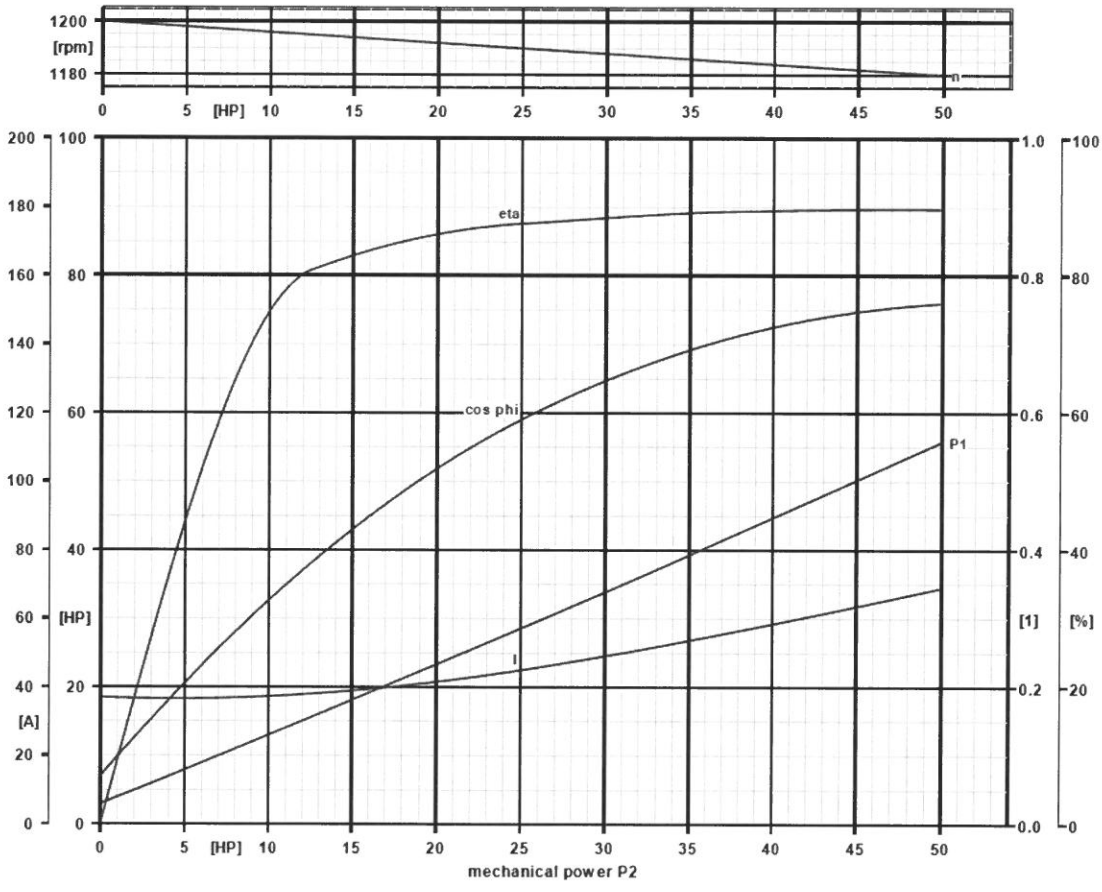
Motor data

Motor manufacturer	KSB	Starting mode	Direct-on-line starting
Motor size	40	Power cable	AWG 7-4
Motor construction type	KSB Sub. motor	Number of power cables	2
Motor material	Grey cast iron EN-GJL-250	Power cable Ø min.	0.72 in
Efficiency class	not classified	Power cable Ø max.	0.77 in
Rated voltage	460 V	Control cable	AWG 15-12
Frequency	60 Hz	Number of control cables	1
Motor power	49.99 HP	Ctrl. cable diameter, min.	0.65 in
Rated current	69.0 A	Ctrl. cable diameter, max.	0.69 in
Rated speed	1180 rpm	Cable standard	NEC
Starting current ratio	4.4	Switching frequency	10.00 1/h

Curve data

The no-load point is not a guarantee point within the meaning of IEC 60034

Load	0.0 %	25.0 %	50.0 %	75.0 %	100.0 %
P2	0.00 HP	12.50 HP	25.00 HP	37.49 HP	49.99 HP
n	1200 rpm	1195 rpm	1190 rpm	1185 rpm	1180 rpm
P1	2.95 HP	15.56 HP	28.56 HP	41.97 HP	55.79 HP
I	37.0 A	38.0 A	45.0 A	56.0 A	69.0 A
Eta	0.0 %	80.8 %	87.6 %	89.4 %	89.7 %
cos phi	0.07	0.38	0.59	0.71	0.76



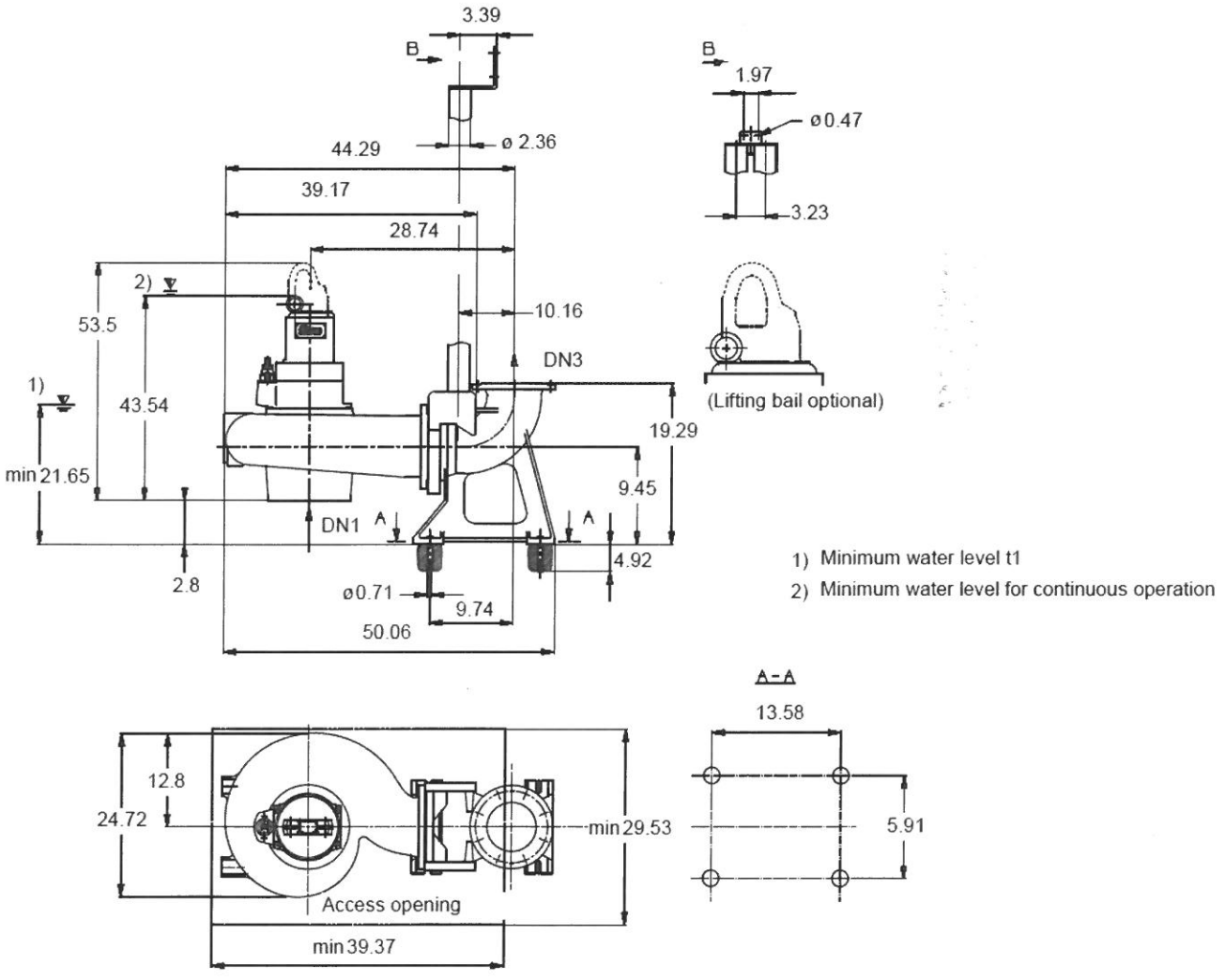
Installation plan

Customer item no.:EQ Pump 1 & 2
Communication dated: 02/11/2017
Doc. no.: Submersible Pump
Quantity: 1

Number: ES 5460654
Item no.:200
Date: 02/11/2017
Page: 6 / 7

KRTK 100-400/406XG-S

Version no.: 1



1) Minimum water level t1
2) Minimum water level for continuous operation

Drawing is not to scale

Dimensions in in

Installation plan

Customer item no.:EQ Pump 1 & 2
Communication dated: 02/11/2017
Doc. no.: Submersible Pump
Quantity: 1

Number: ES 5460654
Item no.:200
Date: 02/11/2017

KRTK 100-400/406XG-S

Version no.: 1

Motor

Motor manufacturer	KSB
Motor size	40
Motor power	49.99 HP
Number of poles	6
Speed of rotation	1180 rpm
Motor enclosure	IP68

Connections

Suction flange pump drilled according to(DN1)	unmachined
Duckfoot bend size (DN2 / DN3)	DN 100 / 150 Drilled according to ASME

Weight net

Pump, Motor, Cable	1431 lbm
Claw / Foot	32 lbm
Total	1463 lbm

Connect pipes without stress or strain!

Dimensional tolerances for shaft axis height:	DIN 747
Dimensions without tolerances, middle tolerances to:	ISO 2768-m
Connection dimensions for pumps:	EN735
Dimensions without tolerances - welded parts:	ISO 13920-B
Dimensions without tolerances - gray cast iron parts:	ISO 8062-CT9

StreamGo - SYSTEM HEAD CALCULATION

Project Number						
Project Name	Bellfield					
Pumping System	EQ Pumps					
		SI Units		Imperical Units		
Fluid Characteristics:	Temperature	20	Celsius	67.99712023	Fahrenheit	
	Kinematic Viscosity	1.0023E-06	m2/s	0.000010789	ft2/s	
Pipe Information:	Material	HDPE		HDPE		
	Roughness, e	0.000001524	in	0.00006	in	
	Hydraulic Diameter, D Pumping station m	0.22047	m	0.7231416	ft	
	Effective Length, L	48.8	m	160.064	ft	
Flow:	Flowrate (pumping capacity)	0.0599	m3/s	2.115069	ft3/s	949.415 gpm
	Velocity (0.8 to 2.5 m/s for PS)	1.569850015	m/s	5.152383628	ft/s	
	Gravity	9.81	m/s2	32.17	ft/s2	
	Reynolds #	345310.6184		345342.751	(fully turbulent flow if > 2000)	
	Swamee-Jain Friction Factor	0.014091145		0.014091145		
Total Dynamic Head	Static Head	3.9	m	12.792	ft	5.547653 psi
	Equipment Losses	4.921	m	16.14088	ft	7 psi
	Pressure Head at Terminal End	22.496	m	73.78688	ft	32 psi
	Friction Head Loss (Darcy Weisbach)	0.392354014	m	1.286921166	ft	0.558114 psi
	Minor Losses	Hloss = KV^2(2g)				

Fitting	K Value	#	Hloss(m)
Check Valve	2	3	0.753648033
Ball Valve	0.05	5	0.031402001
Gate/Knife Valve	0.18	0	0
22.5 Elbow	0.1	0	0
45 Elbow	0.4	0	0
90 Elbow	0.3	13	0.489871222
Reducer		0	0
Basket	10.13	0	0
Contraction		0	0
Expansion	0.23	0	0
Tee (through)	0.2	2	0.050243202
Tee (into)	1	2	0.251216011
Coupler		0	0
Sharp Entrance	0.5	0	0
Bellmouth Entrance	0.05	0	0

	Minor Head Loss	1.57638047	m	5.170527941	ft	2.242362 psi
	Total Dynamic Head	**33.28573448**	**m**	**109.1772091**	**ft**	**47.34813 psi**

GRUNDFOS

Company name: Grundfos Canada
Created by:
Phone:

Date: 11/2/2017

Tender Text

MBR Feed Pumps
(Individual Treatment Train)

Product photo could vary from the actual product

Product No.: 99030214
SLV.40.A40.75.4.61R.C

Controls:

Moisture sensor:	with moisture sensors
Water-in-oil sensor:	without water-in-oil sensor

Liquid:

Pumped liquid:	Water
Maximum liquid temperature:	104 °F
Liquid temperature during operation:	68 °F
Density:	62.4 lb/ft³
Kinematic viscosity:	1 cSt

Technical:

Actual calculated flow:	413 US gpm
Resulting head of the pump:	27.66 ft
Type of impeller:	Super Vortex
Maximum particle size:	3 15/16 in
Primary shaft seal:	SIC/SIC
Secondary shaft seal:	CARBON/CERAMICS
Approvals on nameplate:	CSA
Curve tolerance:	ANSI/HI11.6:2012 3B2

Materials:

Pump housing:	EN-GJL-250
Impeller:	EN-GJL-250
Motor:	EN-GJL-250

Installation:

Maximum ambient temperature:	104 °F
Flange standard:	ANSI
Pump inlet:	100
Pump outlet:	100
Pressure stage:	PN 10
Maximum installation depth:	65.62 ft
Frame range:	C

Electrical data:

Power input - P1:	6.4 kW
Rated power - P2:	7.5 HP
Main frequency:	60 Hz
Rated voltage:	3 x 230/460 V
Voltage tolerance:	+10/-10 %
Max starts per. hour:	20
Rated current:	19.2/10.1 A
Starting current:	120 A
Cos phi - power factor:	0.87
Cos phi - p.f. at 3/4 load:	0.84

GRUNDFOS

Company name: Grundfos Canada
Created by:
Phone:

Date: 11/2/2017

Cos phi - p.f. at 1/2 load:	0.77
Rated speed:	1750 rpm
Motor efficiency at full load:	88.9 %
Motor efficiency at 3/4 load:	89.65 %
Motor efficiency at 1/2 load:	89.2 %
Number of poles:	4
Start. method:	star/delta
Enclosure class (IEC 34-5):	IP68
Insulation class (IEC 85):	H
Explosion proof:	no
Length of cable:	49 ft
Cable type:	SEOOW 600V

Others:

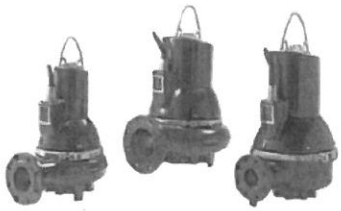
Net weight:	311 lb

GRUNDFOS

Company name: Grundfos Canada
Created by:
Phone:

Date: 11/2/2017

Position	Count	Description
	1	**SLV.40.A40.75.4.61R.C**



Product photo could vary from the actual product

Product No.: 99030214

Non-self-priming, single-stage, centrifugal pump designed for handling wastewater, process water and unscreened raw sewage.

The pump is designed for intermittent and continous operations in submerged installation. The efficient SuperVortex impeller provides passage of long fibres and solids up to 3 15/16 in and is suitable for wastewater with a dry matter content of up to 5 %.

A unique stainless-steel clamp assembling system enables quick and easy disassembly of the pump from the motor unit for service and inspection. No special tools are required. Pipework connection is via a ANSI flange.

Further product details

Typical application is transfer of liquid, such as:

- large quantities of drainage and surface water
- domestic wastewater with discharge from toilets
- wastewater from commercial buildings without discharge from toilets
- sludge-containing industrial wastewater.

The pump is ideal for pumping of the above liquids from for instance:

- municipal network pumping stations
- public buildings
- blocks of flats
- factories/industry.

The pump is suitable for both temporary and permanent installation either as free-standing on ring stand or on an auto-coupling system.

Pump

The pump housing, motor top and impeller are made of cast iron (EN-GJL-250).

All surfaces of the cast iron parts are protected with cataphoresis coating. The surface of the cast iron pump parts is afterwards painted with environmental friendly powder coating (type NCS 9000N (black), gloss code 30, thickness 100 µm) which ensures high impact and corrosion protection. The final pump is assembled from already painted parts which ensures that no rust or scale can be formed in grooves between parts, etc.

The SuperVortex impeller is a symmetrical multivane winglet impeller. The design ensures a flow entirely outside the impeller providing limited contact between the impeller and the pumped liquid. This ensures that long fibres, rags and more passes freely through the pump without getting caught and without causing clogging or jamming.

The shaft seal consists of two mechanical seals that ensure a reliable sealing between the pumped liquid and motor. The shaft seals are incorporated in a single-unit cartridge shaft seal system that is easy to replace in the field without use of special tools.

The combination of the primary and secondary seals in a cartridge shaft seal system results in a shorter assembly length compared to conventional shaft seals.

- Primary seal: Silicon carbide/silicon carbide (SiC/SiC)
- Secondary seal: Carbon/Ceramics

The shaft seal is bidirectional, meaning it operates correctly in case of backflow through the pump.

GRUNDFOS

Company name: Grundfos Canada
Created by:
Phone:

Date: 11/2/2017

The pump is approved according to CSA.

Motor

The motor is a watertight, totally encapsulated motor supplied with a 49 ft power cable. The stainless steel plug is fastened with a union nut. This nut and the O-rings provide sealing against ingress of the liquid.

The plug is polyurethane-embedded, ensuring a watertight and durable seal around the leads of the cable. This prevents the ingress of water into the motor through the cable in case of cable breakage or adverse handling in connection with installation or service.

A compact motor construction with a short shaft reduces vibrations, resulting in an increased efficiency and lifetime of the shaft seal and ball bearings.

The motor features built-in thermal protection to protect the motor against overheating and ensure the reliability.

The pump is equipped with the following sensor(s):

- A digital moisture switch that is fitted in the motor chamber monitors whether water enters the motor chamber. If moisture is detected in the motor chamber, the switch will trip and send a warning to the sensor module.

The pump is designed for speed-controlled operation to keep the energy consumption at a minimum. To avoid the risk of sedimentation in the pipes, we recommend that you operate the speed-controlled pump within a speed range of 30 % to 100 % and at a flow rate above 1 m/s.

Controls:

Moisture sensor:	with moisture sensors
Water-in-oil sensor:	without water-in-oil sensor

Liquid:

Pumped liquid:	Water
Maximum liquid temperature:	104 °F
Liquid temperature during operation:	68 °F
Density:	62.4 lb/ft³
Kinematic viscosity:	1 cSt

Technical:

Actual calculated flow:	413 US gpm
Resulting head of the pump:	27.66 ft
Type of impeller:	Super Vortex
Maximum particle size:	3 15/16 in
Primary shaft seal:	SIC/SIC
Secondary shaft seal:	CARBON/CERAMICS
Approvals on nameplate:	CSA
Curve tolerance:	ANSI/HI11.6:2012 3B2

Materials:

Pump housing:	EN-GJL-250
Impeller:	EN-GJL-250
Motor:	EN-GJL-250

Installation:

Maximum ambient temperature:	104 °F
Flange standard:	ANSI
Pump inlet:	100
Pump outlet:	100
Pressure stage:	PN 10
Maximum installation depth:	65.62 ft
Frame range:	C

Electrical data:

Power input - P1:	6.4 kW
Rated power - P2:	7.5 HP
Main frequency:	60 Hz
Rated voltage:	3 x 230/460 V
Voltage tolerance:	+10/-10 %
Max starts per. hour:	20

GRUNDFOS

Company name: Grundfos Canada
Created by:
Phone:

Date: 11/2/2017

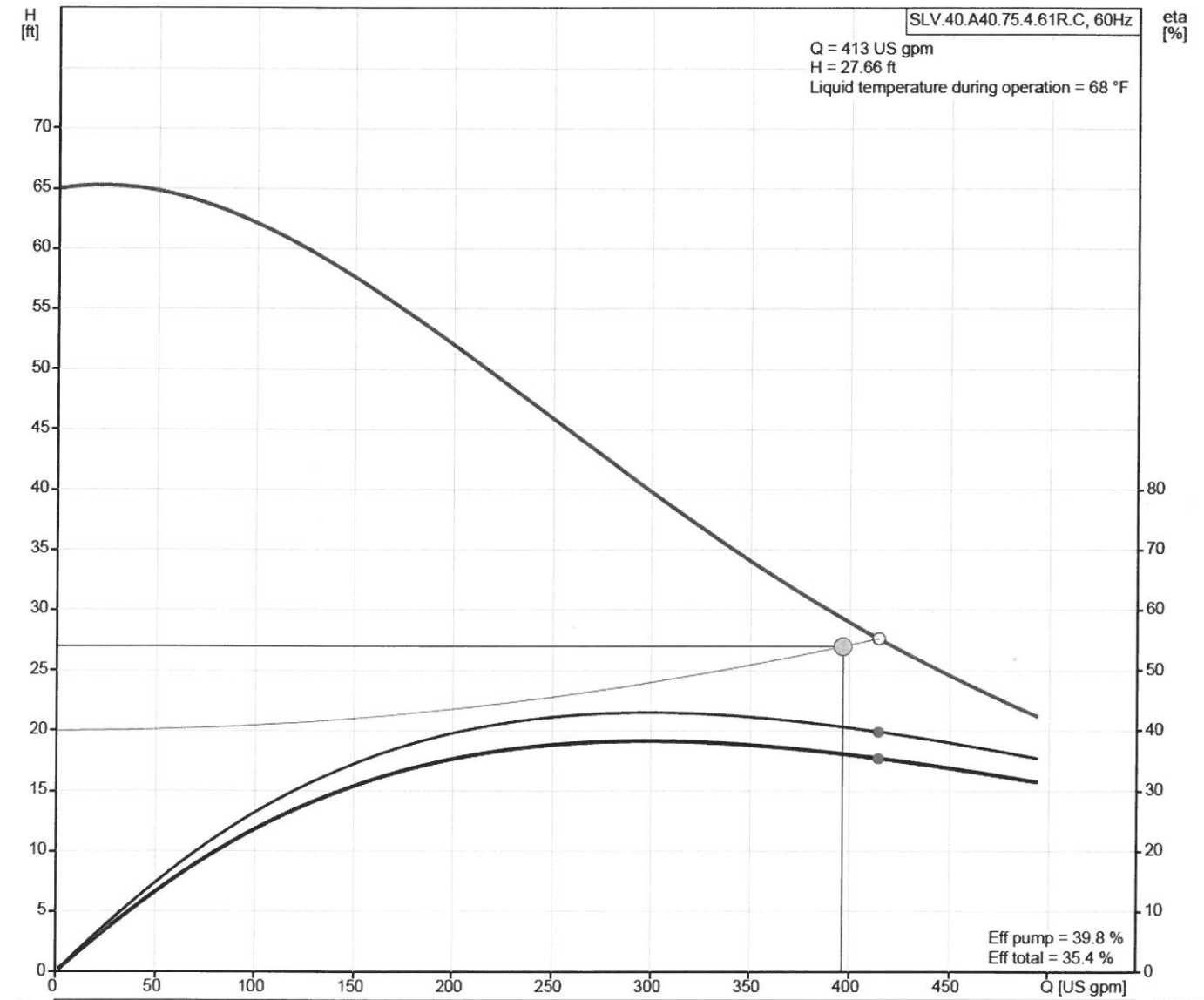
Position	Count	Description	
		Rated current:	19.2/10.1 A
		Starting current:	120 A
		Cos phi - power factor:	0.87
		Cos phi - p.f. at 3/4 load:	0.84
		Cos phi - p.f. at 1/2 load:	0.77
		Rated speed:	1750 rpm
		Motor efficiency at full load:	88.9 %
		Motor efficiency at 3/4 load:	89.65 %
		Motor efficiency at 1/2 load:	89.2 %
		Number of poles:	4
		Start. method:	star/delta
		Enclosure class (IEC 34-5):	IP68
		Insulation class (IEC 85):	H
		Explosion proof:	no
		Length of cable:	49 ft
		Cable type:	SEOOW 600V
		Others:	
		Net weight:	311 lb

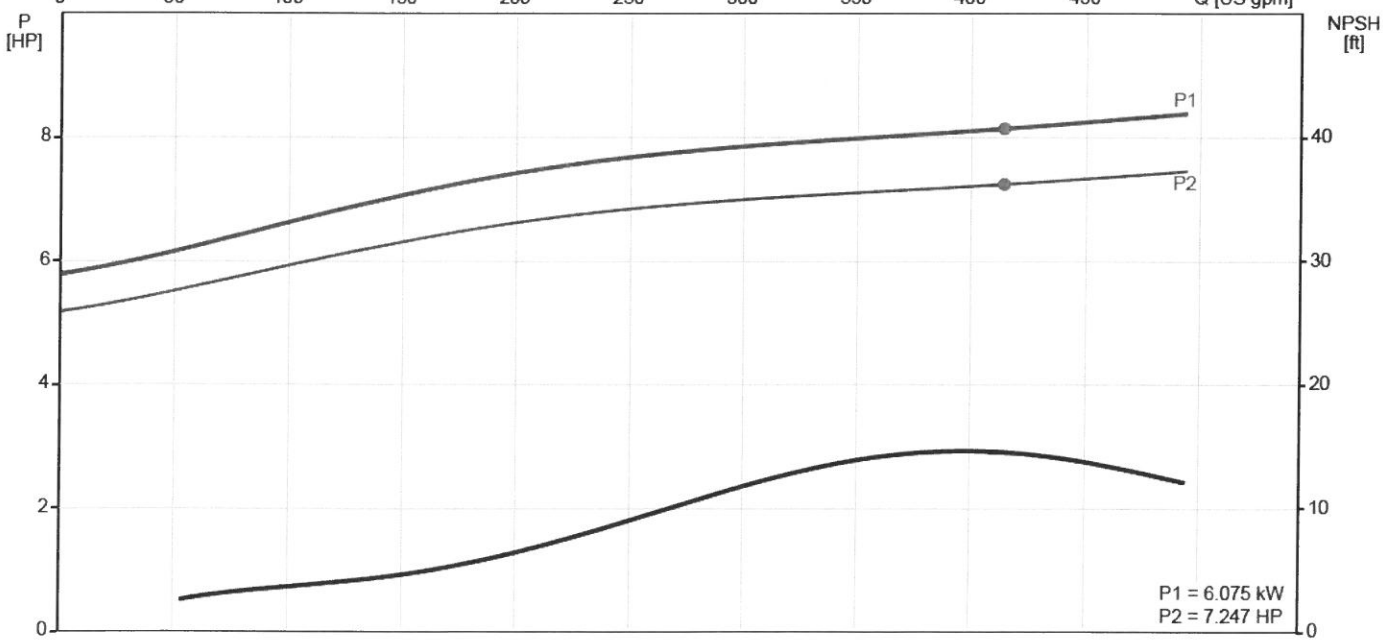
GRUNDFOS

Company name: Grundfos Canada
Created by:
Phone:

Date: 11/2/2017

99030214 SLV.40.A40.75.4.61R.C 60 Hz



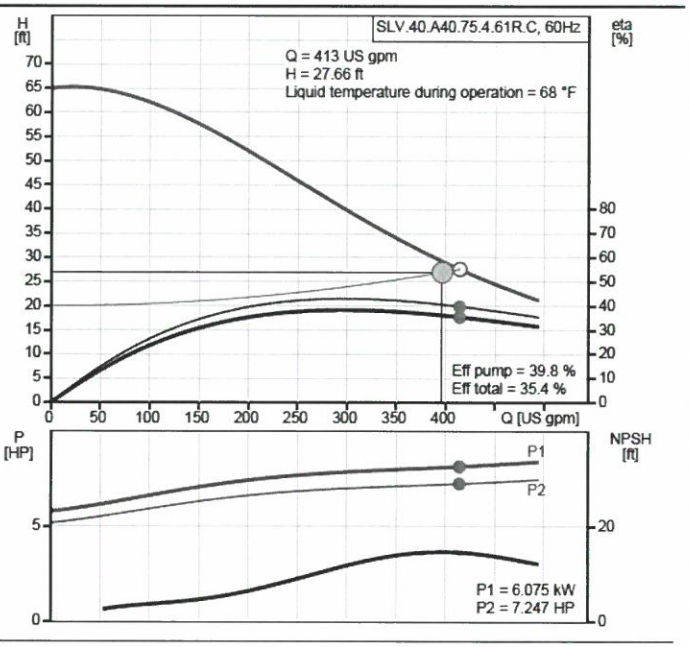


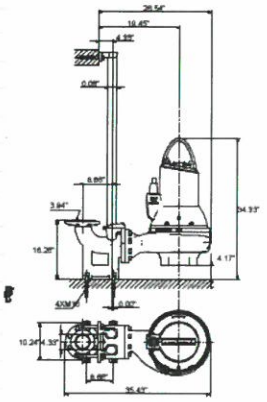
GRUNDFOS

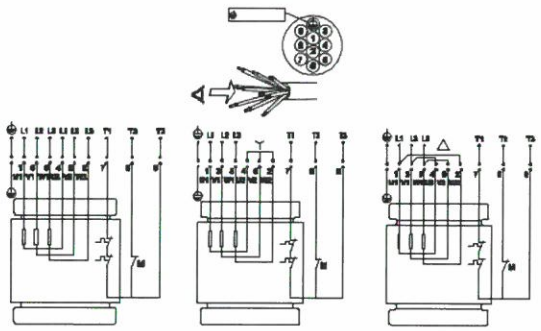
Company name: Grundfos Canada
Created by:
Phone:

Date: 11/2/2017

Description	Value
General information:	
Product name:	SLV.40.A40.75.4.61R.C
Product No.:	99030214
EAN:	5712605417378
Technical:	
Actual calculated flow:	413 US gpm
Max flow:	493 US gpm
Resulting head of the pump:	27.66 ft
Head max:	63.98 ft
Type of impeller:	Super Vortex
Maximum particle size:	3 15/16 in
Primary shaft seal:	SIC/SIC
Secondary shaft seal:	CARBON/CERAMICS
Approvals on nameplate:	CSA
Curve tolerance:	ANSI/HI11.6:2012 3B2
Cooling jacket:	without cooling jacket
Materials:	
Pump housing:	EN-GJL-250
Impeller:	EN-GJL-250
Motor:	EN-GJL-250
Installation:	
Maximum ambient temperature:	104 °F
Flange standard:	ANSI
Pump inlet:	100
Pump outlet:	100
Pressure stage:	PN 10
Maximum installation depth:	65.62 ft
Inst dry/wet:	SUBMERGED
Installation:	VERTICAL
Frame range:	C
Liquid:	
Pumped liquid:	Water
Maximum liquid temperature:	104 °F
Liquid temperature during operation:	68 °F
Density:	62.4 lb/ft³
Kinematic viscosity:	1 cSt
Electrical data:	
Power input - P1:	6.4 kW
Rated power - P2:	7.5 HP
Main frequency:	60 Hz
Rated voltage:	3 x 230/460 V
Voltage tolerance:	+10/-10 %
Max starts per. hour:	20
Rated current:	19.2/10.1 A
Starting current:	120 A
Cos phi - power factor:	0.87
Cos phi - p.f. at 3/4 load:	0.84
Cos phi - p.f. at 1/2 load:	0.77
Rated speed:	1750 rpm
Motor efficiency at full load:	88.9 %
Motor efficiency at 3/4 load:	89.65 %
Motor efficiency at 1/2 load:	89.2 %
Number of poles:	4
Start. method:	star/delta
Enclosure class (IEC 34-5):	IP68
Insulation class (IEC 85):	H
Explosion proof:	no
Motor protection:	THERMAL SWITCH
Length of cable:	49 ft
Cable type:	SEOOW 600V







GRUNDFOS

Company name: Grundfos Canada
Created by:
Phone:

Date: 11/2/2017

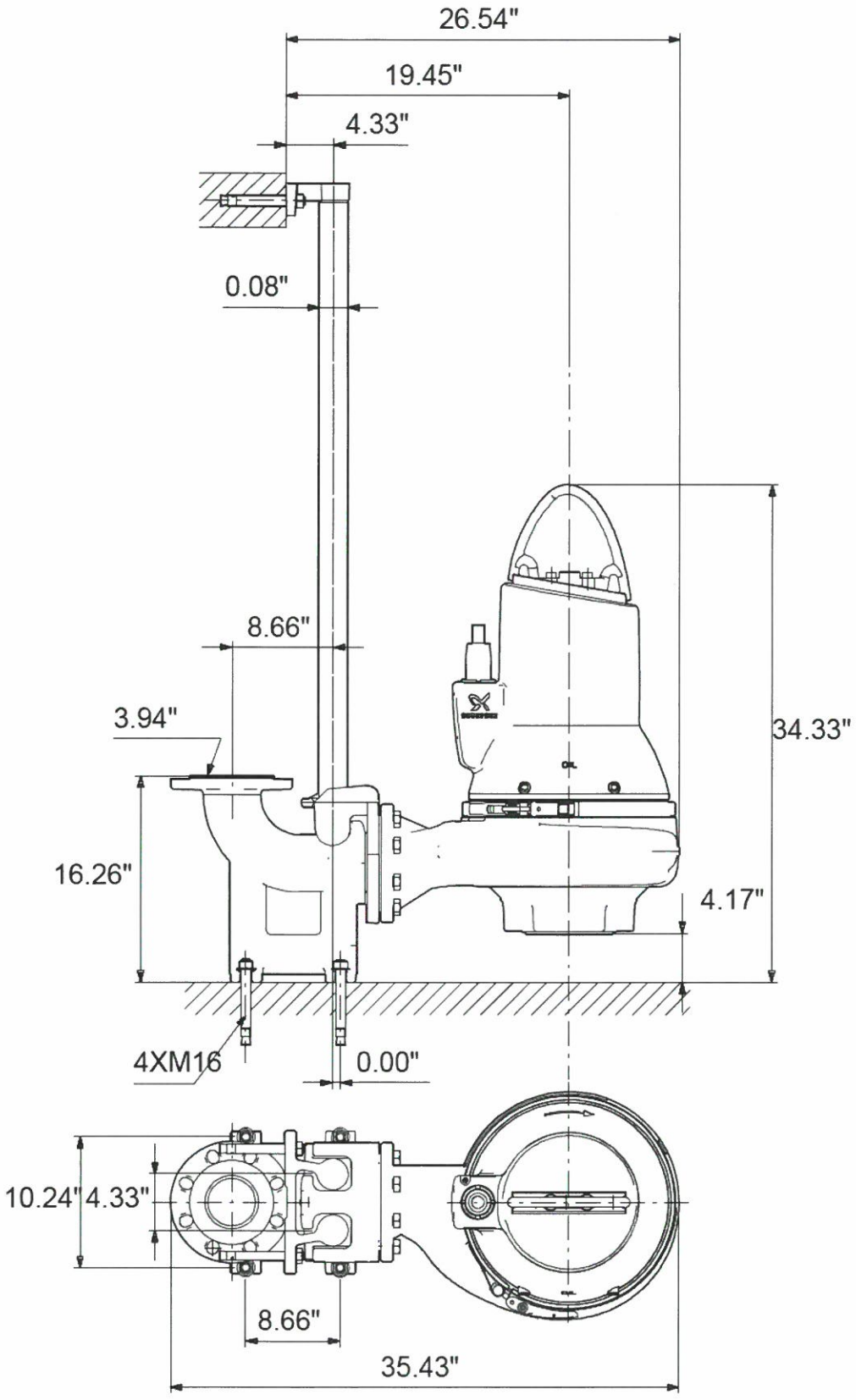
Description	Value
Controls:	
Additional I/O:	N
Moisture sensor:	with moisture sensors
Water-in-oil sensor:	without water-in-oil sensor
Others:	
Net weight:	311 lb

GRUNDFOS

Company name: Grundfos Canada
Created by:
Phone:

Date: 11/2/2017

99030214 SLV.40.A40.75.4.61R.C 60 Hz



Note! All units are in [mm] unless otherwise stated.
Disclaimer: This simplified dimensional drawing does not show all details.

MBR Permeate Pumps
(Individual Treatment Train)

Performance curve

PL 300 Lobe Type A

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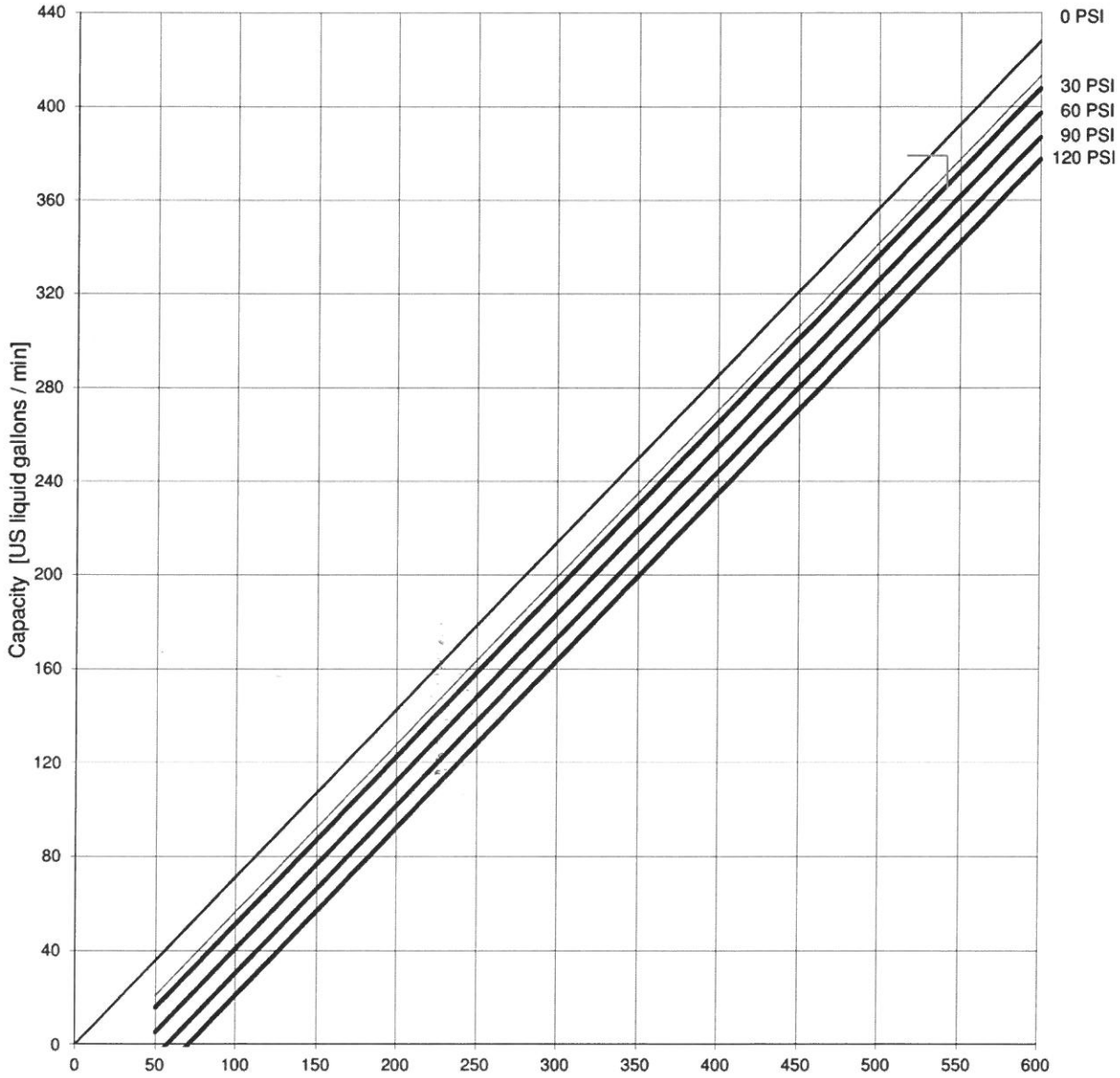
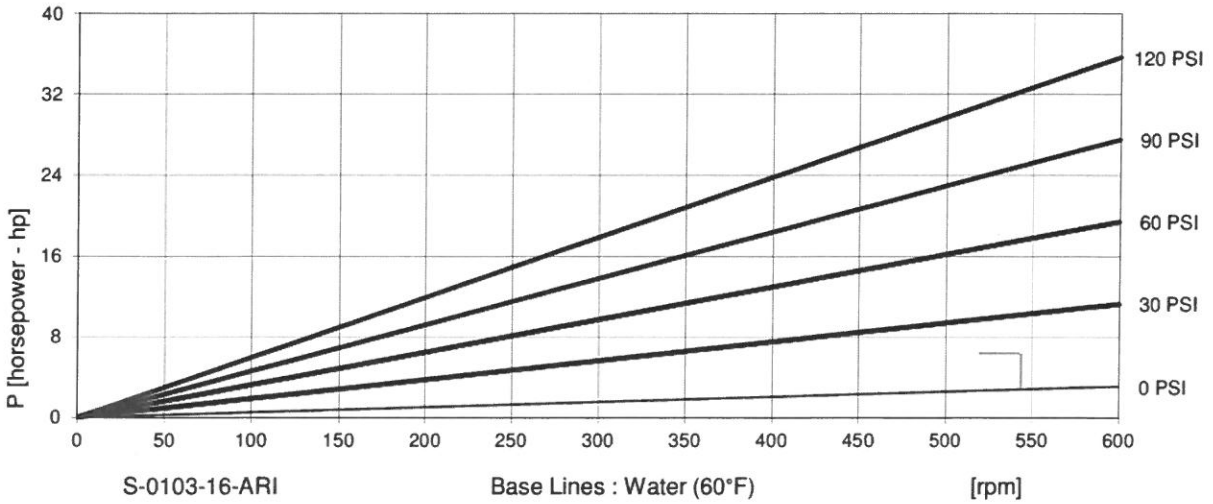
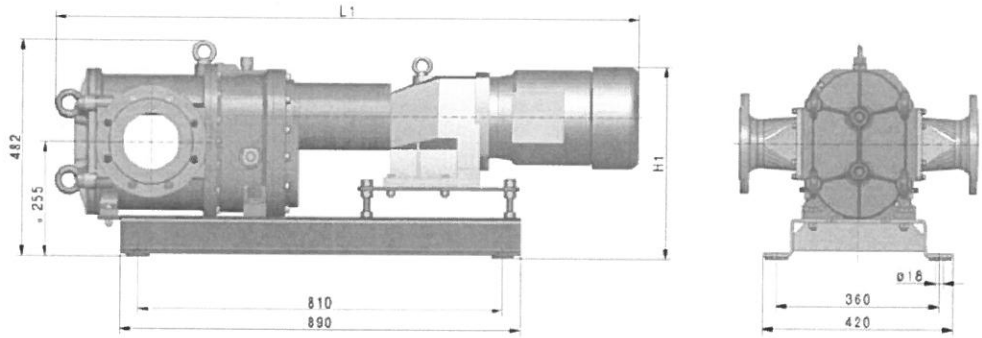




S-0103-16-ARI Base Lines : Water (60°F) [rpm]

printed in 16.03.2017 by Boerger LLC - USA



Standard unit in mm / inches (approx.)

Drive [kW]	Size PL 100 Weight	Dimensions L1	[kg]	PL 200 Weight	Dimensions L1	[kg]
1.1 kW	165 kg	1,100 mm	414 mm	—	—	—
1.5 HP	**364 lbs**	**43.31 inch**	**16.30 inch**	—	—	—
2.2 kW	176 kg	1,150 mm	414 mm	190 kg	1,190 mm	414 mm
3 HP	**388 lbs**	**45.28 inch**	**16.30 inch**	**419 lbs**	**46.85 inch**	**16.30 inch**
3 kW	180 kg	1,150 mm	414 mm	194 kg	1,190 mm	414 mm
4 HP	**397 lbs**	**45.28 inch**	**16.30 inch**	**428 lbs**	**46.85 inch**	**16.30 inch**
4 kW	192 kg	1,176 mm	426 mm	206 kg	1,216 mm	426 mm
5 HP	**423 lbs**	**46.30 inch**	**16.77 inch**	**454 lbs**	**47.87 inch**	**16.77 inch**
5.5 kW	213 kg	1,233 mm	453 mm	227 kg	1,273 mm	426 mm
7.5 HP	**470 lbs**	**48.54 inch**	**17.83 inch**	**500 lbs**	**50.12 inch**	**16.77 inch**
7.5 kW	226 kg	1,295 mm	453 mm	240 kg	1,335 mm	453 mm
10 HP	**498 lbs**	**50.98 inch**	**17.83 inch**	**529 lbs**	**52.56 inch**	**17.83 inch**
9.2 kW	242 kg	1,295 mm	453 mm	256 kg	1,335 mm	453 mm
15 HP	**534 lbs**	**50.98 inch**	**17.83 inch**	**564 lbs**	**52.56 inch**	**17.83 inch**
11 kW	281 kg	1,420 mm	453 mm	295 kg	1,460 mm	453 mm
15 HP	**619 lbs**	**55.91 inch**	**17.83 inch**	**650 lbs**	**57.48 inch**	**17.83 inch**
15 kW	344 kg	1,467 mm	481 mm	359 kg	1,507 mm	481 mm
20 HP	**758 lbs**	**57.76 inch**	**18.94 inch**	**791 lbs**	**59.33 inch**	**18.94 inch**

Drive	Size PL 300 Weight	Dimensions L1	H1	PL 400 Weight	Dimensions L1	H1
3 kW	208 kg	1,245 mm	414 mm	228 kg	1,274 mm	415 mm
4 HP	**459 lbs**	**49.02 inch**	**16.30 inch**	**503 lbs**	**50.16 inch**	**16.34 inch**
4 kW	220 kg	1,271 mm	426 mm	240 kg	1,291 mm	426 mm
5 HP	**485 lbs**	**50.04 inch**	**16.77 inch**	**529 lbs**	**50.83 inch**	**16.77 inch**
5.5 kW	241 kg	1,328 mm	426 mm	261 kg	1,348 mm	426 mm
7.5 HP	**531 lbs**	**52.28 inch**	**16.77 inch**	**575 lbs**	**53.07 inch**	**16.77 inch**
7.5 kW	254 kg	1,390 mm	453 mm	274 kg	1,410 mm	453 mm
10 HP	**560 lbs**	**54.72 inch**	**17.83 inch**	**604 lbs**	**55.51 inch**	**17.83 inch**
9.2 kW	270 kg	1,390 mm	453 mm	290 kg	1,410 mm	453 mm
15 HP	**595 lbs**	**54.72 inch**	**17.83 inch**	**639 lbs**	**55.51 inch**	**17.83 inch**
11 kW	309 kg	1,515 mm	453 mm	329 kg	1,535 mm	453 mm
15 HP	**681 lbs**	**59.65 inch**	**17.83 inch**	**725 lbs**	**60.43 inch**	**17.83 inch**
15 kW	372 kg	1,562 mm	481 mm	392 kg	1,582 mm	481 mm
20 HP	**820 lbs**	**61.50 inch**	**18.94 inch**	**864 lbs**	**62.28 inch**	**18.94 inch**

Production-related deviations in individual dimensions within an acceptable tolerance cannot be ruled out.
Requests for dimensions regarding a specific order are welcome.

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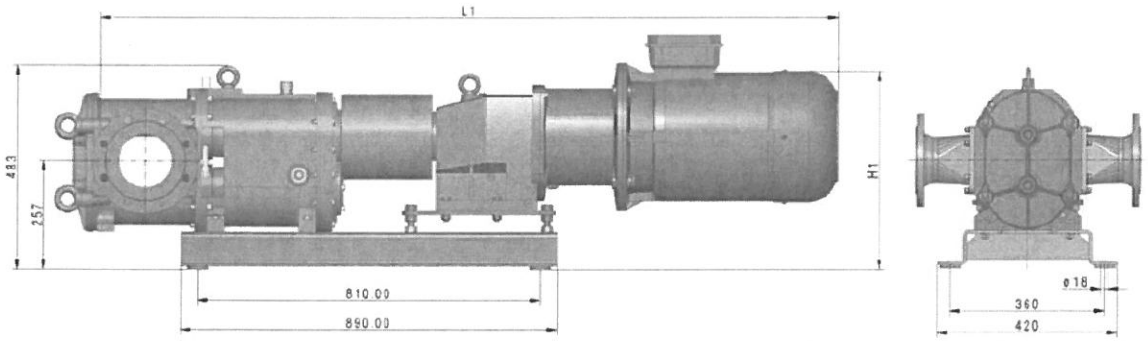

Standard unit in mm / inches (approx.)

Drive	Size Protect PL 100			Protect PL 200			Protect PL 300		
	Weight	Dimensions		Weight	Dimensions		Weight	Dimensions	
		L1	H1		L1	H1		L1	H1
1.1 kW	206 kg	1236 mm	414 mm	—	—	—	—	—	—
1.5 HP	**454 lbs**	**48.66 inch**	**16.30 inch**	—	—	—	—	—	—
2.2 kW	217 kg	1286 mm	414 mm	231 kg	1381 mm	414 mm	—	—	—
3 HP	**478 lbs**	**50.63 inch**	**16.30 inch**	**509 lbs**	**54.37 inch**	**16.30 inch**	—	—	—
3 kW	221 kg	1286 mm	414 mm	235 kg	1381 mm	414 mm	249 kg	1491 mm	414 mm
4 HP	**487 lbs**	**50.63 inch**	**16.30 inch**	**518 lbs**	**54.37 inch**	**16.30 inch**	**549 lbs**	**58.70 inch**	**16.30 inch**
4 kW	233 kg	1312 mm	426 mm	247 kg	1407 mm	426 mm	261 kg	1517 mm	426 mm
5 HP	**514 lbs**	**51.65 inch**	**16.77 inch**	**545 lbs**	**55.39 inch**	**16.77 inch**	**575 lbs**	**59.72 inch**	**16.77 inch**
5.5 kW	254 kg	1369 mm	453 mm	268 kg	1464 mm	426 mm	282 kg	1574 mm	426 mm
7.5 HP	**560 lbs**	**53.90 inch**	**17.83 inch**	**591 lbs**	**57.64 inch**	**16.77 inch**	**622 lbs**	**61.97 inch**	**16.77 inch**
7.5 kW	267 kg	1431 mm	453 mm	281 kg	1526 mm	453 mm	295 kg	1636 mm	453 mm
10 HP	**589 lbs**	**56.34 inch**	**17.83 inch**	**619 lbs**	**60.08 inch**	**17.83 inch**	**650 lbs**	**64.41 inch**	**17.83 inch**
9.2 kW	283 kg	1431 mm	453 mm	297 kg	1526 mm	453 mm	311 kg	1636 mm	453 mm
15 HP	**624 lbs**	**56.34 inch**	**17.83 inch**	**655 lbs**	**60.08 inch**	**17.83 inch**	**686 lbs**	**64.41 inch**	**17.83 inch**
11 kW	322 kg	1556 mm	453 mm	336 kg	1651 mm	453 mm	350 kg	1761 mm	453 mm
15 HP	**710 lbs**	**61.26 inch**	**17.83 inch**	**741 lbs**	**65.00 inch**	**17.83 inch**	**772 lbs**	**69.33 inch**	**17.83 inch**
15 kW	385 kg	1603 mm	481 mm	400 kg	1698 mm	481 mm	413 kg	1808 mm	481 mm
20 HP	**849 lbs**	**63.11 inch**	**18.94 inch**	**882 lbs**	**66.85 inch**	**18.94 inch**	**911 lbs**	**71.18 inch**	**18.94 inch**

Production-related deviations in individual dimensions within an acceptable tolerance cannot be ruled out.
Requests for dimensions regarding a specific order are welcome.

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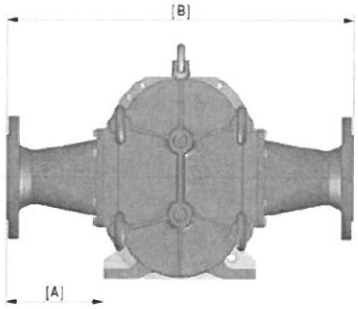


Design 1 | Short. straight pipe connectors with connection flange and O-ring seal, in mm / inches (approx.)

		Size							
		PL 100				PL 200			
Nominal diameter:	Standard:	DIN/DIN EN		ANSI/ASME		DIN/DIN EN		ANSI/ASME	
	Dimension:	A	B	A	B	A	B	A	B
DN 25	mm	93	436	—	—	—	—	—	—
1"	inch	**3.66**	**17.17**	—	—	—	—	—	—
DN 32	mm	167	584	—	—	—	—	—	—
1¼"	inch	**6.57**	**22.99**	—	—	—	—	—	—
DN 40	mm	160	570	180	610	—	—	—	—
1½"	inch	**6.30**	**22.44**	**7.09**	**24.02**	—	—	—	—
DN 50	mm	176	602	195	640	156	562	175	600
2"	inch	**6.93**	**23.70**	**7.68**	**25.20**	**6.14**	**22.13**	**6.89**	**23.62**
DN 65	mm	141	532	166	582	176	602	201	652
2½"	inch	**5.55**	**20.94**	**6.54**	**22.91**	**6.93**	**23.70**	**7.91**	**25.67**
DN 80	mm	146	542	166	582	156	562	175	600
3"	inch	**5.75**	**21.34**	**6.54**	**22.91**	**6.14**	**22.13**	**6.89**	**23.62**
DN 100	mm	146	542	170	590	136	522	160	570
4"	inch	**5.75**	**21.34**	**6.69**	**23.23**	**5.35**	**20.55**	**6.30**	**22.44**
DN 125	mm	176	602	210	670	151	552	185	620
5"	inch	**6.93**	**23.70**	**8.27**	**26.38**	**5.94**	**21.73**	**7.28**	**24.41**
DN 150	mm	176	602	210	670	181	612	215	680
6"	inch	**6.93**	**23.70**	**8.27**	**26.38**	**7.13**	**24.09**	**8.46**	**26.77**
DN 200	mm	236	722	276	802	251	752	291	832
8"	inch	**9.29**	**28.43**	**10.87**	**31.57**	**9.88**	**29.61**	**11.46**	**32.76**
DN 250	mm	—	—	—	—	251	752	—	—
10"	inch	—	—	—	—	**9.88**	**29.61**	—	—

		Size							
		PL 300				PL 400			
Nominal diameter:	Standard:	DIN/DIN EN		ANSI/ASME		DIN/DIN EN		ANSI/ASME	
	Dimension:	A	B	A	B	A	B	A	B
DN 50	mm	—	—	240	730	—	—	—	—
2"	inch	—	—	**9.45**	**28.74**	—	—	—	—
DN 65	mm	200	650	225	700	—	—	—	—
2½"	inch	**7.87**	**25.59**	**8.86**	**27.56**	—	—	—	—
DN 80	mm	236	722	256	762	200	650	—	—
3"	inch	**9.29**	**28.43**	**10.08**	**30.00**	**7.87**	**25.59**	—	—
DN 100	mm	201	652	225	700	221	692	245	740
4"	inch	**7.91**	**25.67**	**8.86**	**27.56**	**8.70**	**27.24**	**9.65**	**29.13**
DN 125	mm	161	572	195	640	188	626	222	694
5"	inch	**6.34**	**22.52**	**7.68**	**25.20**	**7.40**	**24.65**	**8.74**	**27.32**
DN 150	mm	166	582	200	650	191	632	225	700
→ 6"	inch	**6.54**	**22.91**	**7.87**	**25.59**	**7.52**	**24.88**	**8.86**	**27.56**
DN 200	mm	196	642	236	722	221	692	261	772
8"	inch	**7.72**	**25.28**	**9.29**	**28.43**	**8.70**	**27.24**	**10.28**	**30.39**
DN 250	mm	295	840	329	908	—	—	—	—
10"	inch	**11.61**	**33.07**	**12.95**	**35.75**	—	—	—	—

Production-related deviations in individual dimensions within an acceptable tolerance cannot be ruled out.
Requests for dimensions regarding a specific order are welcome.

StreamGO - SYSTEM HEAD CALCULATION

Project Number						
Project Name	Bellefield					
Pumping System	Permeate Pump					
		SI Units		Imperical Units		
Fluid Characteristics:	Temperature	20	Celsius	67.99712023	Fahrenheit	
	Kinematic Viscosity	1.0023E-06	m2/s	0.000010789	ft2/s	
Pipe Information:	Material	PVC		PVC		
	Roughness, e	0.000001524	m	0.00006	in	
	Hydraulic Diameter, D	0.0922	m	0.302416	ft	
	Effective Length, L	74	m	242.72	ft	
Flow:	Flowrate (pumping capacity)	0.02399	m3/s	0.8470869	ft3/s	380.2415 gpm
	Velocity	3.594998795	m/s	11.79909721	ft/s	
78.21860544	Gravity	9.81	m/s2	32.17	ft/s2	
	Reynolds #	330698.2828		330729.0557	(fully turbulent flow if > 2000)	
	Swamee-Jain Friction Factor	0.01431978		0.01431978		
Total Dynamic Head	Static Head	3.5	m	11.48	ft	4.978663 psi
	Equipment Losses	2.812	m	9.22336	ft	4 psi
	Pressure Head at Terminal End	0	m	0	ft	0 psi
	Friction Head Loss (Darcy Weisbach)	7.581930564	m	24.86873225	ft	10.78511 psi
	Minor Losses	Hloss = KV^2(2g)				

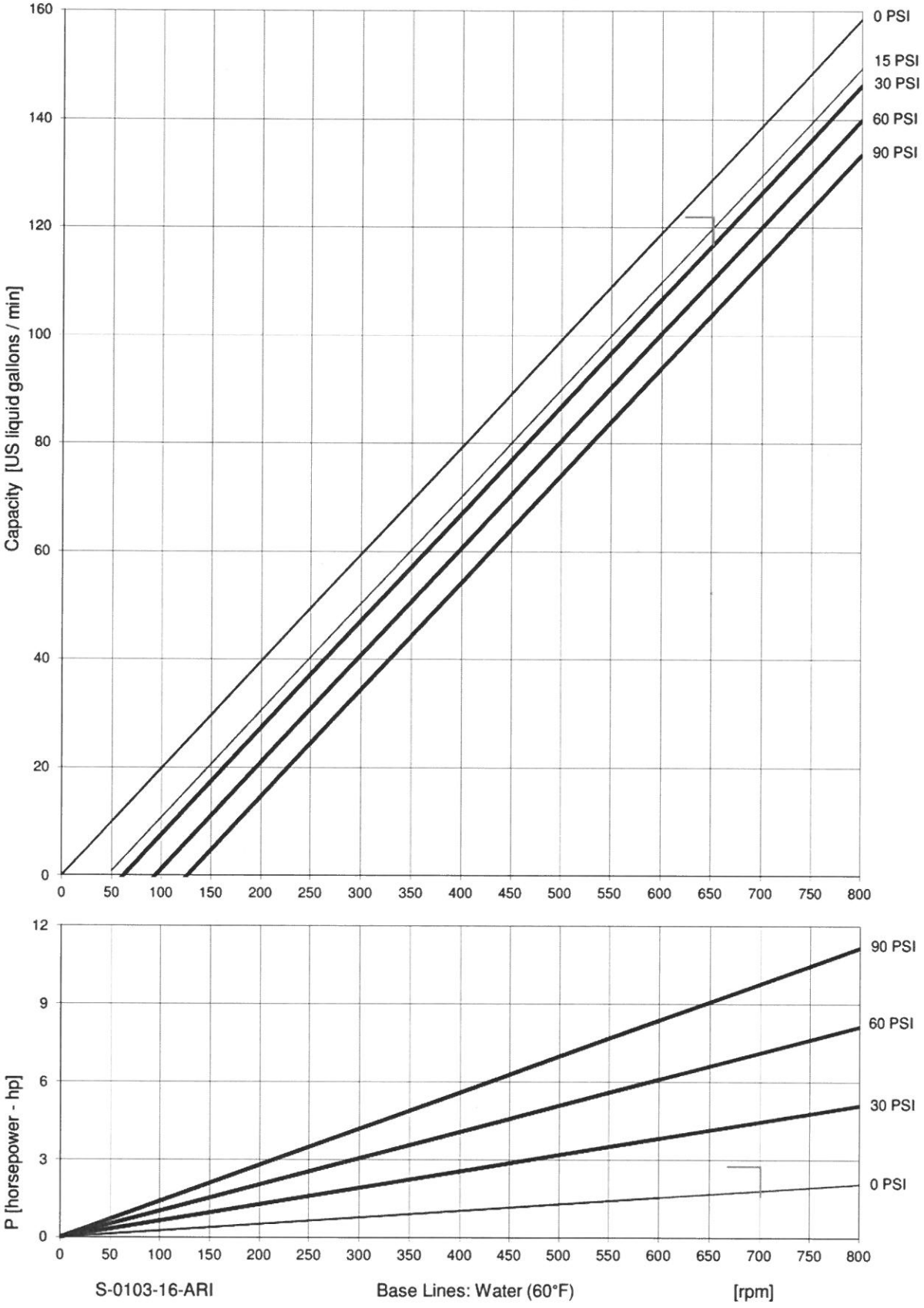
Fitting	K Value	#	Hloss(m)
Check Valve	3.26	1	2.147415558
Ball Valve	0.05	4	0.131743286
Gate/Knife Valve	0.18	0	0
22.5 Elbow	0.1	0	0
45 Elbow	0.4	0	0
90 Elbow	0.51	16	5.375126059
Reducer		0	0
Butterfly valve	0.77	1	0.50721165
Contraction		0	0
Expansion	0.23	0	0
Tee (through)	0.34	2	0.447927172
Tee (into)	1.02	2	1.343781515
Coupler		0	0
Sharp Entrance	0.5	0	0
Bellmouth Entrance	0.05	0	0

	Minor Head Loss	9.95320524	m	32.64651319	ft	14.15819 psi
	Total Dynamic Head	**23.8471358**	**m**	**78.21860544**	**ft**	**33.92196 psi**

Sludge Decant Pumps

Performance curve

AL 75 Lobe Type A



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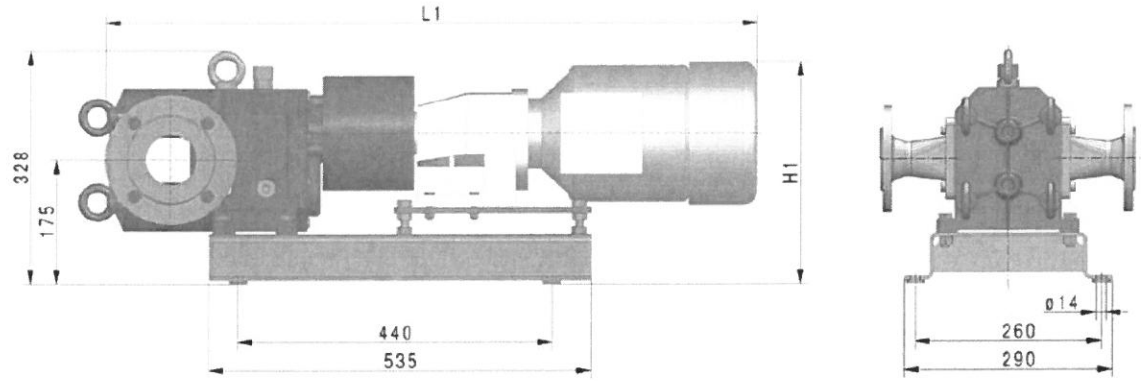

Standard unit in mm / inches (approx.)

Drive	Size AL 25			AL 50			AL 75		
	Weight	Dimensions		Weight	Dimensions		Weight	Dimensions	
		L1	H1		L1	H1		L1	H1
1.1 kW	70 kg	780 mm	224 mm	75 kg	818 mm	224 mm	85 kg	950 mm	305 mm
1.5 HP	**154 lbs**	**30.71 inch**	**8.82 inch**	**165 lbs**	**32.20 inch**	**8.82 inch**	**187 lbs**	**37.40 inch**	**12.01 inch**
1.5 kW	81 kg	780 mm	224 mm	87 kg	818 mm	224 mm	97 kg	950 mm	305 mm
2 HP	**179 lbs**	**30.71 inch**	**8.82 inch**	**192 lbs**	**32.20 inch**	**8.82 inch**	**214 lbs**	**37.40 inch**	**12.01 inch**
2.2 kW	94 kg	878 mm	245 mm	99 kg	945 mm	245 mm	109 kg	980 mm	315 mm
3 HP	**208 lbs**	**34.57 inch**	**9.65 inch**	**218 lbs**	**37.20 inch**	**9.65 inch**	**240 lbs**	**38.58 inch**	**12.40 inch**
3 kW	98 kg	907 mm	245 mm	103 kg	945 mm	245 mm	113 kg	1,010 mm	315 mm
4 HP	**216 lbs**	**35.71 inch**	**9.65 inch**	**227 lbs**	**37.20 inch**	**9.65 inch**	**249 lbs**	**39.76 inch**	**12.40 inch**
4 kW	110 kg	930 mm	257 mm	115 kg	968 mm	257 mm	125 kg	1,056 mm	326 mm
5 HP	**243 lbs**	**36.61 inch**	**10.12 inch**	**254 lbs**	**38.11 inch**	**10.12 inch**	**276 lbs**	**41.57 inch**	**12.83 inch**
5.5 kW	131 kg	1,021 mm	276 mm	136 kg	1,059 mm	276 mm	150 kg	1,110 mm	395 mm
7.5 HP	**289 lbs**	**40.20 inch**	**10.87 inch**	**300 lbs**	**41.69 inch**	**10.87 inch**	**331 lbs**	**43.70 inch**	**15.55 inch**
7.5 kW	136 kg	1,059 mm	276 mm	150 kg	1,097 mm	276 mm	—	—	—
10 HP	**300 lbs**	**41.69 inch**	**10.87 inch**	**331 lbs**	**43.19 inch**	**10.87 inch**	—	—	—

Production-related deviations in individual dimensions within an acceptable tolerance cannot be ruled out.
Requests for dimensions regarding a specific order are welcome.

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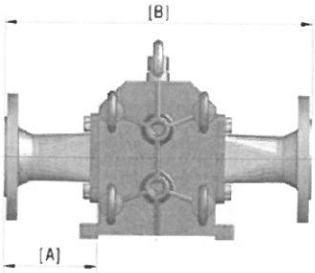


Design 1 | Short, straight pipe connectors with connection flange and gasket, in mm / inches (approx.)

Nominal diameter:	Standard:	Size AL 25 DIN/DIN EN		AL 25 ANSI/ASME		AL 50 DIN/DIN EN		AL 50 ANSI/ASME		AL 75 DIN/DIN EN		AL 75 ANSI/ASME	
	Dimension:	A	B	A	B	A	B	A	B	A	B	A	B
DN 25	mm	96	346	114	378	152	458	—	—	—	—	186	526
1"	inch	**3,78**	**13.62**	**4.49**	**14.88**	**5.98**	**18.03**	—	—	—	—	**7.32**	**20.71**
DN 32	mm	96	346	113	380	139	432	156	466	—	—	—	—
1¼"	inch	**3.78**	**13.62**	**4.45**	**14.96**	**5.47**	**17.01**	**6.14**	**18.35**	—	—	—	—
DN 40	mm	101	356	121	396	126	406	146	446	172	498	—	—
1½"	inch	**3.98**	**14.02**	**4.76**	**15.59**	**4.96**	**15.98**	**5.75**	**17.56**	**6.77**	**19.61**	—	—
DN 50	mm	116	386	135	424	121	396	140	434	171	496	191	536
2"	inch	**4.57**	**15.20**	**5.31**	**16.69**	**4.76**	**15.59**	**5.51**	**17.09**	**6.73**	**19.53**	**7.52**	**21.10**
DN 65	mm	111	376	135	424	121	396	146	446	141	436	165	484
2½"	inch	**4.37**	**14.80**	**5.31**	**16.69**	**4.76**	**15.59**	**5.75**	**17.56**	**5.55**	**17.17**	**6.50**	**19.06**
DN 80	mm	141	436	161	476	136	426	156	466	131	416	151	436
3"	inch	**5.55**	**17.17**	**6.34**	**18.74**	**5.35**	**16.77**	**6.14**	**18.35**	**5.16**	**16.38**	**5.94**	**17.17**
DN 100	mm	204	562	228	610	141	436	165	484	141	436	165	484
4"	inch	**8.03**	**22.13**	**8.98**	**24.02**	**5.55**	**17.17**	**6.50**	**19.06**	**5.55**	**17.17**	**6.50**	**19.06**
DN 125	mm	—	—	—	—	—	—	275	704	—	—	—	—
5"	inch	—	—	—	—	—	—	**10.83**	**27.72**	—	—	—	—

Production-related deviations in individual dimensions within an acceptable tolerance cannot be ruled out.
Requests for dimensions regarding a specific order are welcome.

Treated Effluent Pumps

(Typ of 2)

StreamGo - SYSTEM HEAD CALCULATION
Project Number
Project Name Bellefield
Pumping System Effluent Pump

		SI Units		Imperical Units		
Fluid Characteristics:	Temperature	20	Celsius	67.99712023	Fahrenheit	
	Kinematic Viscosity	1.0023E-06	m2/s	0.000010789	ft2/s	
Pipe Information:	Material	PVC		PVC		
	Roughness, e	0.000001524	m	0.00006	in	
	Hydraulic Diameter, D	0.22047	m	0.7231416	ft	
	Effective Length, L	3	m	9.84	ft	
Flow:	Flowrate (pumping capacity)	0.06	m3/s	2.1186	ft3/s	951 gpm
	Velocity	1.5724708	m/s	5.16098527	ft/s	
	Gravity	9.81	m/s2	32.17	ft/s2	
	Reynolds #	345887.0969		345919.2832	(fully turbulent flow if > 2000)	
	Swamee-Jain Friction Factor	0.014086917		0.014086917		
Total Dynamic Head	Static Head	6.1	m	20.008	ft	8.677098 psi
	Equipment Losses	0	m	0	ft	0 psi
	Pressure Head at Terminal End	0	m	0	ft	0 psi
	Friction Head Loss (Darcy Weisbach)	0.024193464	m	0.079354561	ft	0.034415 psi

Minor Losses Hloss = KV^2(2g)

Fitting	K Value	#	Hloss(m)
Check Valve	3.26	1	0.410850458
Ball Valve	0.04	1	0.00504111
Gate/Knife Valve	0.18	0	0
22.5 Elbow	0.1	0	0
45 Elbow	0.4	0	0
90 Elbow	0.42	1	0.052931654
Reducer		0	0
Increaser		0	0
Contraction		0	0
Expansion	0.23	0	0
Tee (through)	0.28	0	0
Tee (into)	0.84	1	0.105863308
Coupler		0	0
Sharp Entrance	0.5	0	0
Bellmouth Entrance	0.05	0	0

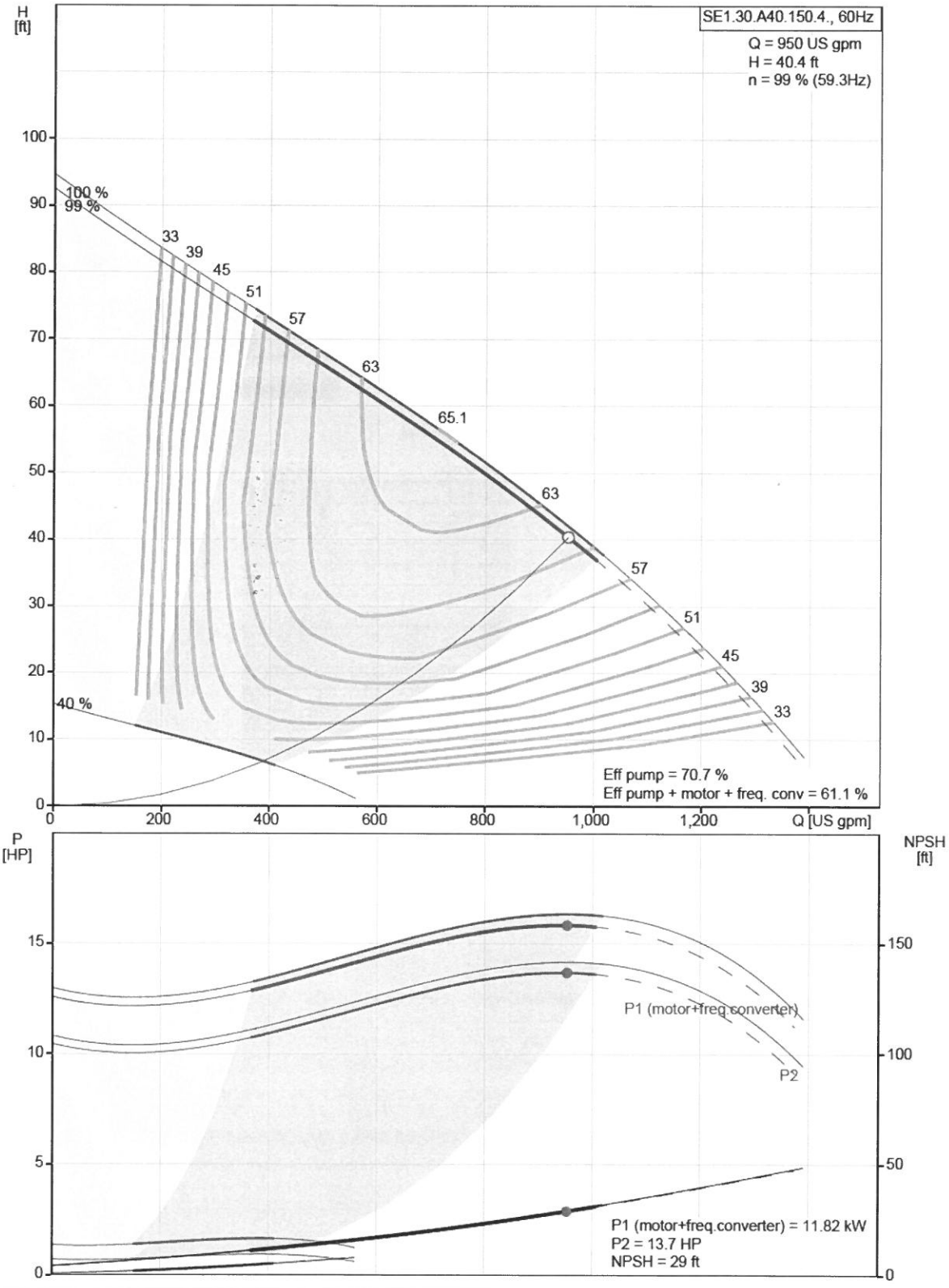
Minor Head Loss	0.574686531	m	1.884971821 ft	0.817477 psi
Total Dynamic Head	**6.698879994**	**m**	**21.97232638 ft**	**9.52899 psi**

GRUNDFOS

Company name:
Created by:
Phone:

Date: 3/6/2020

99193092 SE1.30.A40.150.4.52H.C.EX.61R 60 Hz



Specifications

Product name	SE1.30.A40.150.4.52H.C.EX.61R
Product No.	99193092
EAN	5712608442124
Price	

Technical

Maximum flow	1010 US gpm
Max flow	1010 US gpm
Head max	75.46 ft
Type of impeller	S-TUBE
Maximum particle size	3 1/8 in
Primary shaft seal	SIC-SIC
Secondary shaft seal	SIC-CARBON
Curve tolerance	ANSI/HI11.6:2017 3B
Cooling jacket	with cooling jacket

Materials

Pump housing	Cast iron
	EN 1561 EN-GJL-250
	ASTM ASTM A48 35B
Impeller	Cast iron
	EN 1561 EN-GJL-250
	ASTM ASTM A48 35B
Motor	Cast iron
	EN 1561 EN-GJL-250
	ASTM ASTM A48 35B

Installation

Maximum ambient temperature	104 °F

Flange standard	ANSI
Pump inlet	6 inch
Pump outlet	4 inch
Pressure stage	PN 10
Maximum installation depth	65.6 ft
Inst dry/wet	D/S
Auto-coupling	97626238
Inst vertical	96308238
Base stand	96102314
Frame range	52

Liquid

Liquid temperature range	32 .. 104 °F
Density	62.29 lb/ft³

Electrical data

Power input - P1	12.4 kW
Rated power - P2	15 HP
Main frequency	60 Hz
Rated voltage	3 x 230/460 V
Voltage tolerance	+10/-10 %
Max starts per. hour	20
Rated current	37/19 A
Maximum current consumption	37 A
Starting current	279/192 A
Rated current at no load	12.3 A
Rated speed	1782 rpm
Motor efficiency at full load	89 %
Motor efficiency at 3/4 load	87 %
Motor efficiency at 1/2 load	84 %
Number of poles	4
Start. method	direct-on-line
Enclosure class (IEC 34-5)	IP68

Enclosure class (IEC 34-5)	IP68
Insulation class (IEC 85)	H
Explosion proof	yes
Motor protection	KLIXON
Length of cable	49.2 ft
Cable type	S1BN8-F
Cable size	7X6 + 5X1,5
Cable resistance	3.30 mOhm/m
Winding resistance	0.235 Ohm
Cos phi 1/1	0.86
Cos phi 1/2	0.74
Cos phi 3/4	0.80

Controls

Moisture sensor	with moisture sensors

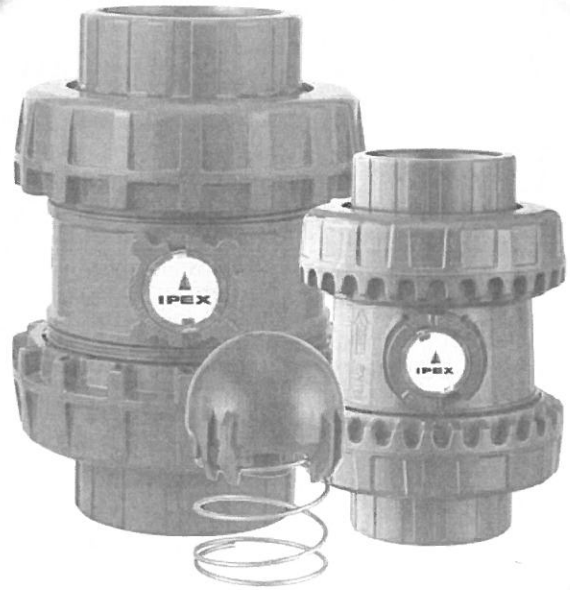
Others

Net weight	767 lb

IPEX SSE TRUE UNION SPRING ASSISTED CHECK VALVES

SSE easyfit

NEW PRODUCT SHOWCASE



The IPEX EasyFit SSE Series Spring Assisted Check Valves represent the latest innovation in thermoplastic valve manufacturing technology. The all new SSE complements our SXE ball check valves, which introduce an advanced method of installation, providing trouble free service for industrial, OEM and water service applications. The internal profile of the SSE, combined with the spring assisted contoured ball, gives the advantage of trouble-free vertical and horizontal installations, even if only very low backpressure is available. The innovative SSE EasyFit design features a custom labelling system, and the optional EasyFit multifunctional handle allows for union nut rotational control and safe blocked carrier tightening.

SSE Spring Assisted Check Valves are part of our complete system of IPEX pipe, valves and fittings, engineered and manufactured to our strict quality, performance and dimensional standards.

VALVE AVAILABILITY	SSE
Body Material	PVC
Size Range	1/2" through 4"
Pressure	232 psi
Seals	EPDM or Fluoropolymer (FPM)
Spring Material	1/2" to 4" 316 Stainless Steel (SS), 1-1/4" to 4" PTFE Encapsulated 316SS 1/2" to 2" Hastelloy
End Connections	Socket (IPS), Threaded (FNPT)
APPLICATIONS	
Acid Products Handling for Refineries, Metal Works, Etc.	✓
Alum and Ferric Chloride Handling	✓
Aquariums and Aquatic animal life support systems	✓
Bleach, Dye and Acid Lines	✓
Brine and Seawater Systems	✓
Chlorine injection, chlorine dioxide and chloralkali plant piping	✓
Acid Products Handling for Refineries, Metal Works, etc.	✓
Pharmaceutical	✓
Plant chemical distribution lines	✓
Plant water supply and distribution	✓
Swimming Pools	✓
Wash water recovery systems	✓
Water and wastewater treatment	✓
And many more!	

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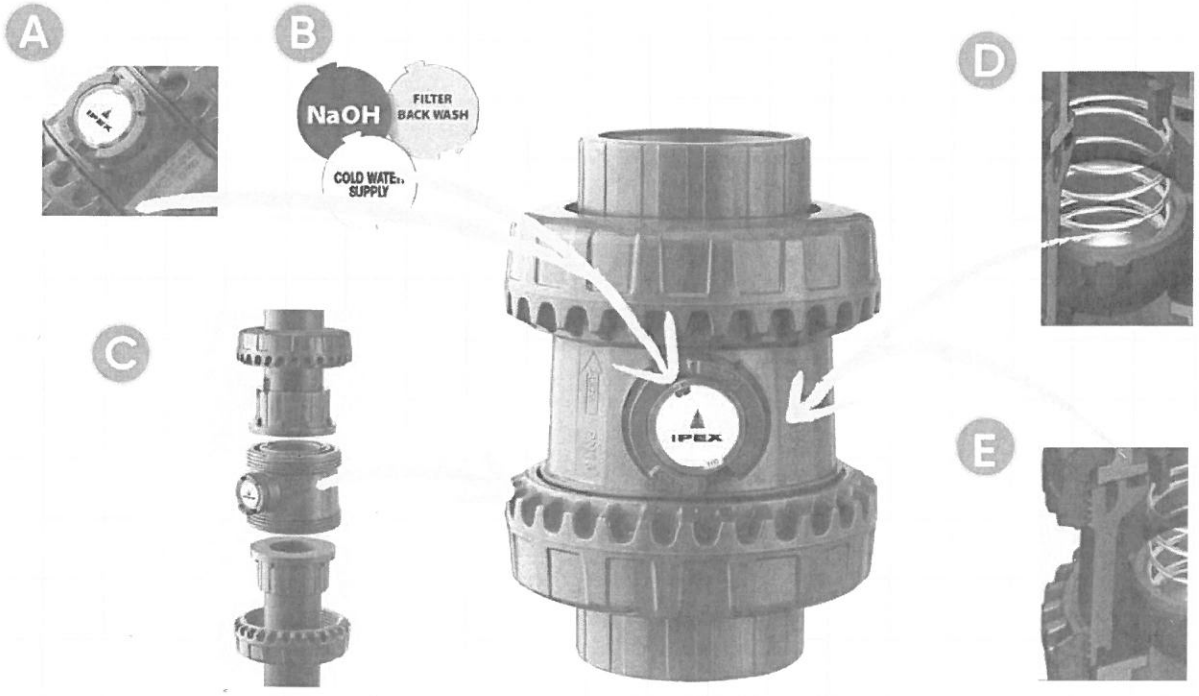
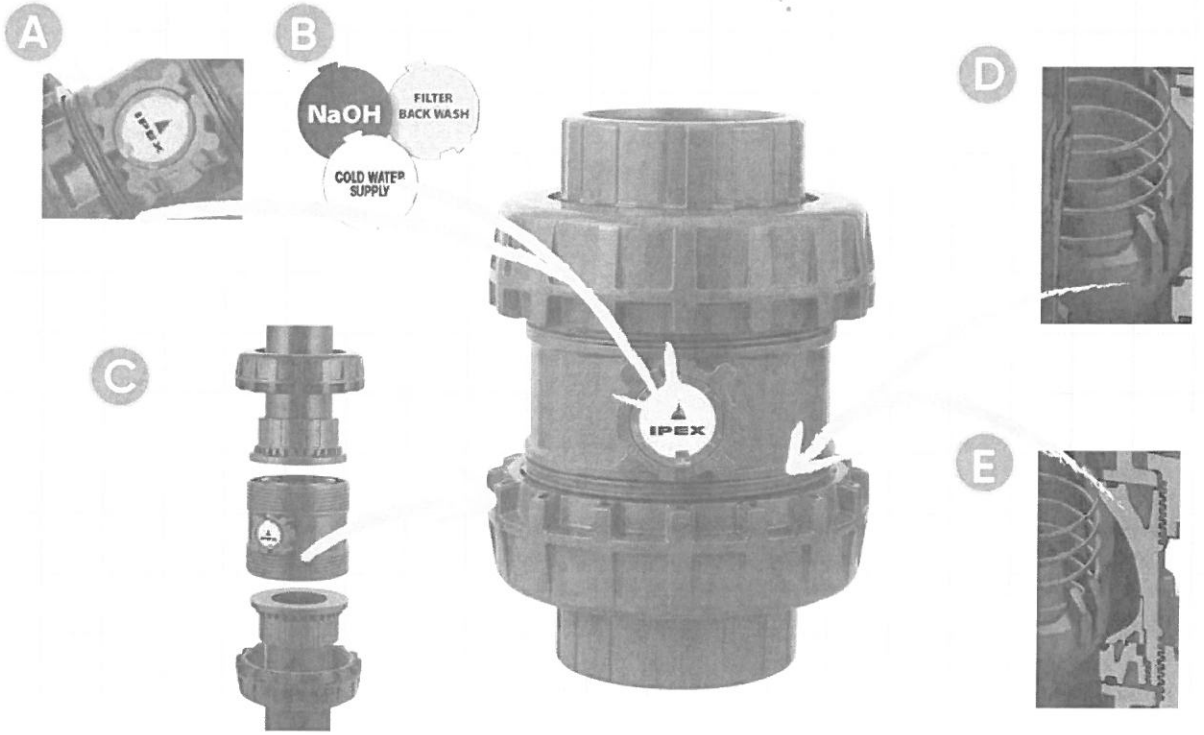
1/2" – 2" SSE



2-1/2" – 4" SSE



A TRANSPARENT PLUG WITH TAG HOLDER

The SSE valve body has a molded module that contains a transparent PVC service plug and white tag holder, IPEX branded on one side.

B EASYFIT CUSTOM LABELLING SYSTEM

The EasyFit Custom Labelling System is a complete product line created to customize individual EasyFit valves. This can be used to identify chemical service, tag number or pipeline contents.

C TRUE UNION DESIGN

The SSE true union design allows for simple installation and removal without disturbing the rest of the pipe assembly. The SSE lay length is identical to an SXE ball check valve and VXE ball valve, and all valves share the same union nuts and end connectors. This means that the SSE can replace an existing SXE ball check valve or VXE ball valve.

D SPRING ASSISTED CONTOURED BALL

The SSE spring assisted contoured ball is available in 316SS, PTFE encapsulated 316SS, and Hastelloy, providing maximum reliability in a wide range of applications – from water to aggressive acids.

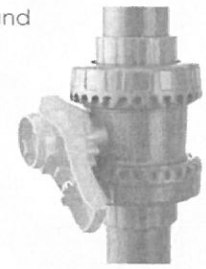
E IDEAL FOR HORIZONTAL AND VERTICAL INSTALLATIONS

The spring assisted contoured ball provides trouble-free performance even when low back pressure is present. It is also ideal in applications where strong vibrations or pulsating fluids exist.

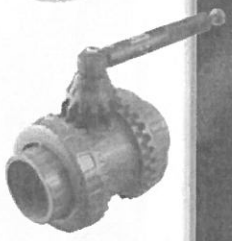
1/2" – 2" SSE

EASYFIT UNION NUT GEAR TIGHTENING

The optional EasyFit multifunctional handle can be turned upside down and repositioned on the top of the valve after pulling out the service plug. Pawls of the nut gear are easily engaged and it is possible to tighten or un-tighten the union nuts simply by rotating the handle.



EASYFIT TORQUE WRENCH



The optional EasyFit torque wrench can be used to precisely adjust the tightening torque of the SSE union nuts as per the manufacturers specifications. The use of the torque wrench is recommended to minimize mechanical stresses on thermoplastic threads caused by over-tightening. This tool will help prevent fluid leakage, optimize ball valve operation and minimize wear on the elastomeric seals.

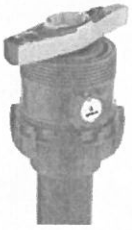
2-1/2" – 2" SSE

EASYFIT UNION NUT GEAR TIGHTENING

The optional EasyFit multifunctional handle can be converted into a wrench key using the tool insert housed inside the handle body. The tool is extremely rugged, light and ergonomic, and is designed to engage the external profile of the SSE union nuts eliminating the possibility of damage and over-tightening.

SAFE BLOCKED CARRIER ADJUSTMENT

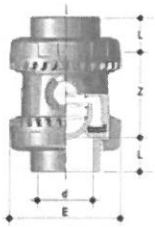
The EasyFit multifunctional handle can be used to dismount, install or adjust the safe blocked carrier into the valve body. There is no need for additional tools.

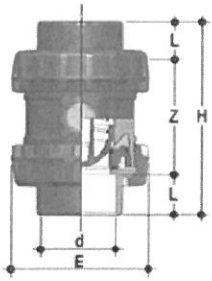


Dimensions

SSE IPS Socket (inches)

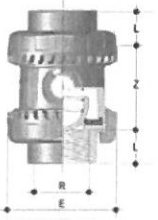
Size	d	L	Z	H	E
1/2	0.84	0.89	2.01	3.78	2.13
3/4	1.05	1.00	2.13	4.13	2.48
1	1.315	1.13	2.34	4.61	2.83
1-1/4	1.66	1.26	2.83	5.35	3.35
1-1/2	1.9	1.38	3.03	5.79	3.94
2	2.375	1.50	3.84	6.85	4.65
2-1/2	2.875	1.75	4.8	8.31	6.18
3	3.5	1.89	5.98	9.76	6.85
4	4.5	2.26	6.61	11.14	8.35

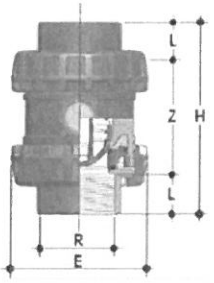




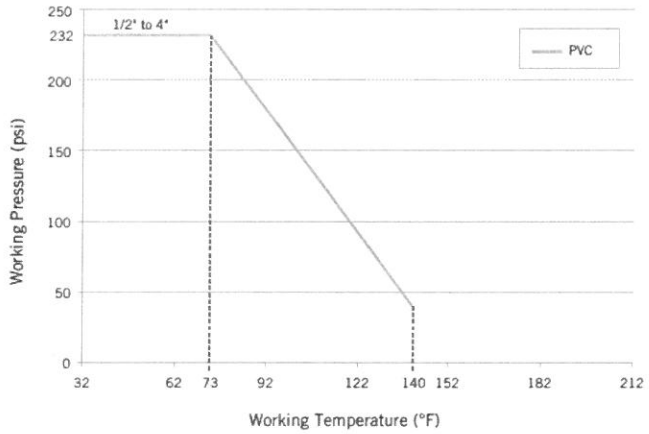
SSE NPT Female (inches)

Size	d	L	Z	H	E
1/2	1/2-NPT	0.70	2.14	3.54	2.13
3/4	3/4-NPT	0.71	2.24	3.66	2.48
1	1-NPT	0.89	2.55	4.33	2.83
1-1/4	1-1/4-NPT	0.99	3.02	5.00	3.35
1-1/2	1-1/2-NPT	0.97	3.21	5.16	3.94
2	2-NPT	1.17	4.01	6.34	4.65
2-1/2	2-1/2-NPT	1.31	5.69	8.31	6.18
3	3-NPT	1.4	6.97	9.76	6.85
4	4-NPT	1.48	8.18	11.14	8.35





Pressure & Temperature Ratings



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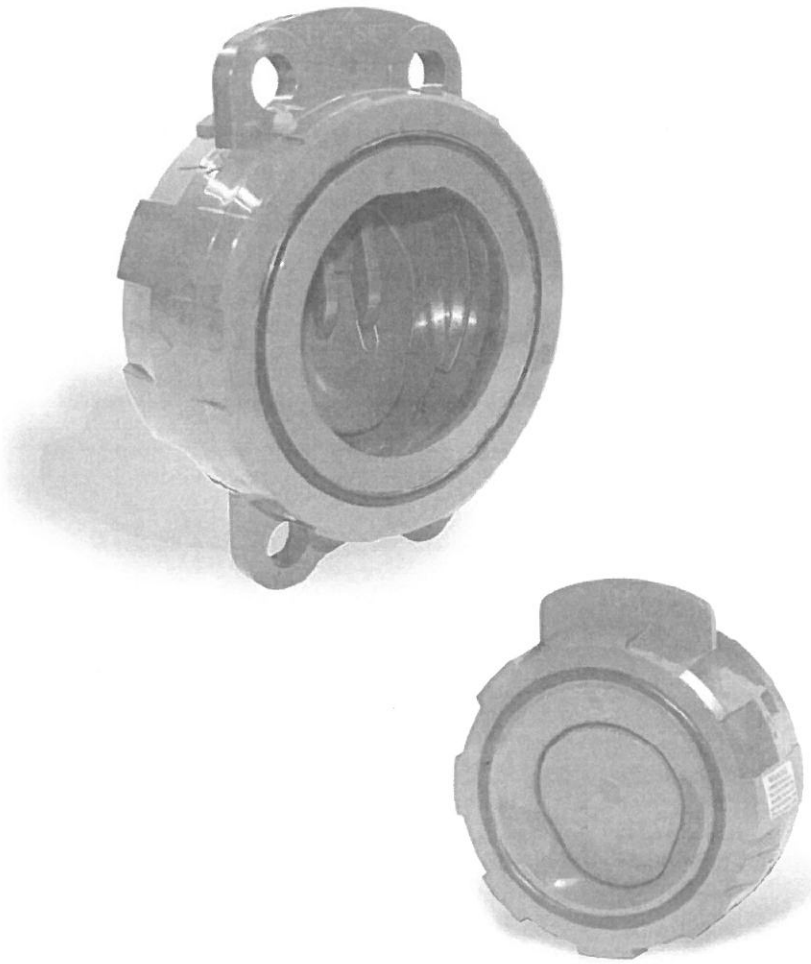
HAYWARD®



WCV Series Full Pattern Wafer Check Valves

2" TO 8" PVC AND CVPC

KEY FEATURES

- Robust Full Pattern Body
- Available in PVC and CPVC
- No Special Spacers or Flanges Required
- High Cv Rating, Saves on Energy and Pump Wear
- FPM or EPDM Gasket and Face Seal
- One-Piece Disc and Shaft Design
- Designed for ANSI150 and PN10 Flanges*
- Contoured Inlet Port for Reduced Head Loss
- Lower Closing Pressure than Swing Check Valves
- Integral Bolt Eyes for Ease of Installation for Large Sizes (4" - 8")
- Can be Installed in Vertical or Horizontal Position
- Pressure Rated to 150 PSI/PN10 in All Sizes

OPTIONS

- 316 Stainless Steel or Hastelloy® Disc Spring

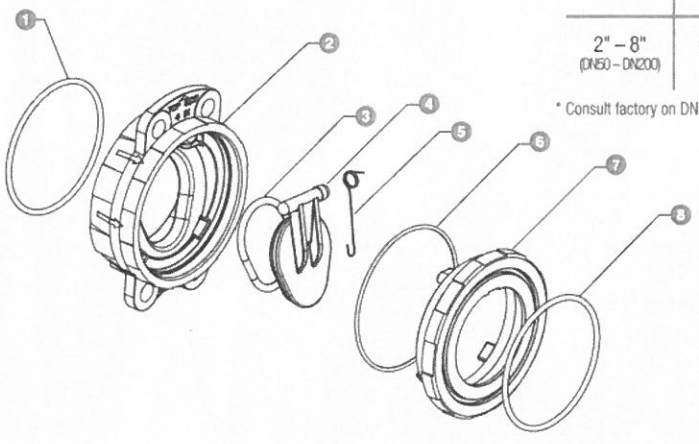
MATERIALS

- PVC per ASTM D1784 Cell Class 12454
- CPVC per ASTM D1784 Cell Class 23447
- FPM and EPDM Gasket and Disc Seals

* Patent No. 8,887,757

TECHNICAL INFORMATION

EXPLODED VIEW



SELECTION CHART

SIZE	MATERIAL	END CONNECTION	O-RING	SPRING	PRESSURE RATING
2" – 8" (DN50 – DN200)	PVC and CPVC	Wafer	FPM or EPDM	316 SS, Hastelloy®	150 PSI @ 70°F 10 Bar @ 21°C Non-Shock

* Consult factory on DN100 Size

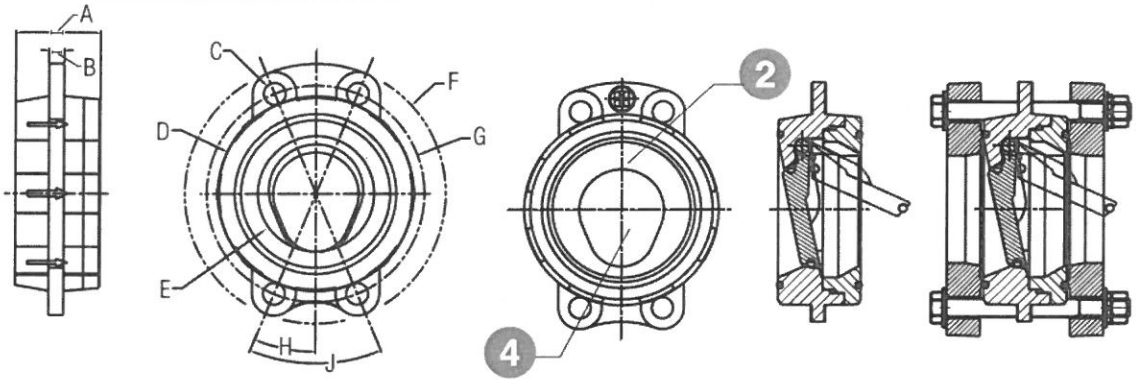
"Patented" Pat. No.: 8,887,757

WCV Series
Full Pattern Wafer Check Valves
2" TO 8" PVC AND CVPC

TECHNICAL INFORMATION, *CONTINUED*

PARTS LIST

1. Face Seal O-Ring
2. Body
3. Wafer Disc O-Ring
4. Wafer Disc
5. Wafer Disc Spring
6. Body O-Ring
7. Body
8. Face Seal O-Ring

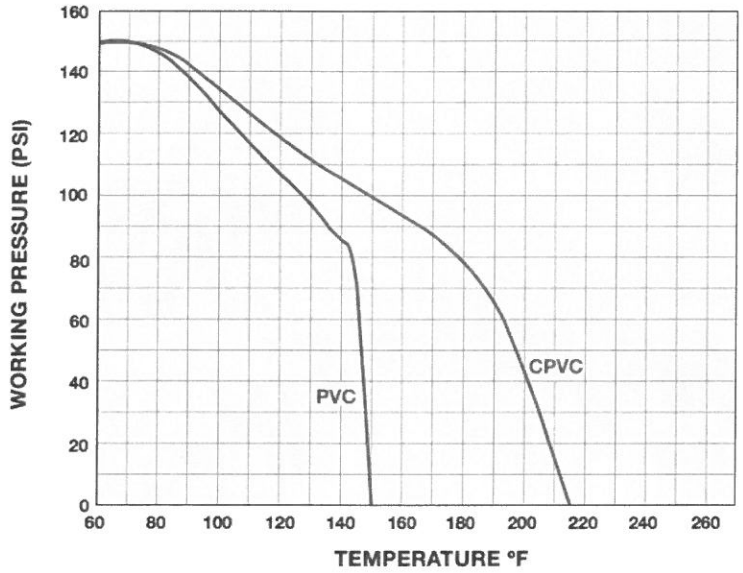


DIMENSIONS

SIZE in / DN	A in / mm	B in / mm	C in / mm	D in / mm	E in / mm	F in / mm	G in / mm	H in / mm	J in / mm
2 / 50	1.80 / 45	.25 / 6	—	4.00 / 101	2.03 / 51	5.25 / 133	—	—	—
2-1/2 / 65	2.30 / 58	.25 / 6	—	4.75 / 120	2.43 / 61	6.00 / 152	—	—	—
3 / 80	2.40 / 61	.25 / 6	—	5.25 / 133	3.00 / 76	6.50 / 165	—	—	—
4 / 100	2.90 / 73	.50 / 12	.75 / 19	6.75 / 171	4.00 / 101	9.00 / 228	.75 / 190	22.50 / 572	45.00 / 1143
6 / 150	3.00 / 76	.50 / 12	.88 / 22	8.63 / 219	5.77 / 146	11.13 / 282	9.50 / 241	22.50 / 572	45.00 / 1143
8 / 200	4.93 / 125	.75 / 19	.95 / 24	10.88 / 276	7.63 / 193	13.38 / 339	11.75 / 298	22.50 / 572	45.00 / 1143

Pressure Rating for ALL Sizes – 150 PSI @ 70°F Non-Shock
Consult Hayward for DN100 Wafer Check Dimension
***Sealing Pressure of 3psi (with or without spring)

OPERATING TEMPERATURE/PRESSURE



Cv VALUES

SIZE in / DN	Cv VALUES
2 / 50	93
2-1/2 / 65	144
3 / 80	87
4 / 100	346
6 / 150	848
8 / 200	1643

PRESSURE LOSS CALCULATION FORMULA

$$\Delta P = \left[\frac{Q}{Cv}\right]^2$$

ΔP = Pressure Drop
Q = Flow in GPM
Cv = Flow Coefficient

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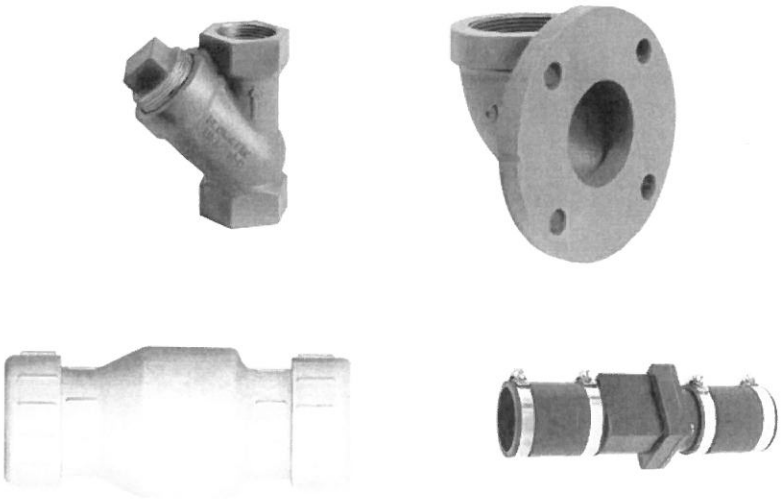
Visit us at: haywardflowcontrol.com

TECHNICAL BROCHURE
BCPCV1 R8



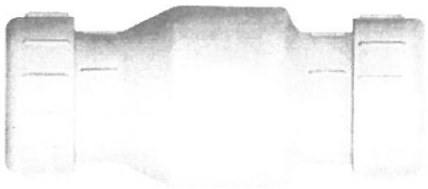
CHECK VALVES / FITTINGS

CAST IRON / PLASTIC CHECK VALVES / SHORT RADIUS ELBOWS
EFFLUENT AND SEWAGE

CentriPro
a xylem brand

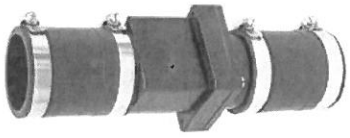
PLASTIC CHECK VALVES

- Ideal for horizontal installation.
- Compression seal connection for easy installation.
- Swing design flapper prevents clogging.
- Available for pipe size 1¼", 1½", 2", 3".
- 200 PSI burst rating.
- PVC weighted and shielded flapper will retain back pressure up to 125 PSI.
- Pressure rated at 125 PSI at 72° F.
- NSF approved.



Pipe Size	Order No.	Overall Length	Overall Width
1¼"	A9-12P	8¼"	$3^{3}/_{16}$"
1½"	A9-15P	8¼"	$3^{3}/_{16}$"
2"	A9-2P	$9^{9}/_{16}$"	4¼"
3"	A9-3P	13¼"	5¾"

RUBBER FLAPPER STYLE CHECK VALVE



Pipe Size	Order No.
2" NPT	A9-2PH

BALL CHECK VALVES

- Ideal for vertical mounting.
- Heavy duty cast iron or plastic construction.
- Natural rubber ball.
- Clean-out port and plug.
- Available in 1¼", 1½", 2" and 3" NPT threaded connections.
- Also available in 4" flanged (125#).
- Recommended for flow velocity of 3' to 5' per second.
- Horizontal installation requires a 20' static head.

Plastic Models			
Pipe Size	**Order No.**	**Maximum Pressure**	**Maximum Temperature**
1¼" NPT	A9-12BPT	100 PSI	150° F
1½" NPT	A9-15BPT		
2" NPT	A9-2BPT		

Cast Iron Models			
Pipe Size	**Order No.**	**Maximum Pressure**	**Maximum Temperature**
1¼" NPT	A9-12B	150 PSI	180° F
1½" NPT	A9-15B		
2" NPT	A9-2B		
3" NPT	A9-3B		
4" Flanged	A9-4BCF ①		
4" Flanged	A9-4BCT ②		

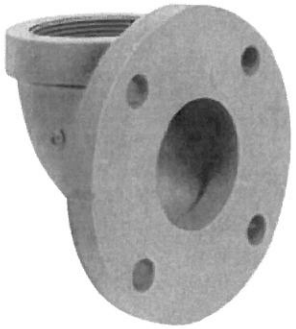
① A9-4BCF - Nitrile covered metal ball, access (clean out) port.
② A9-4BCT - Phenolic ball, no access cover.

FITTINGS

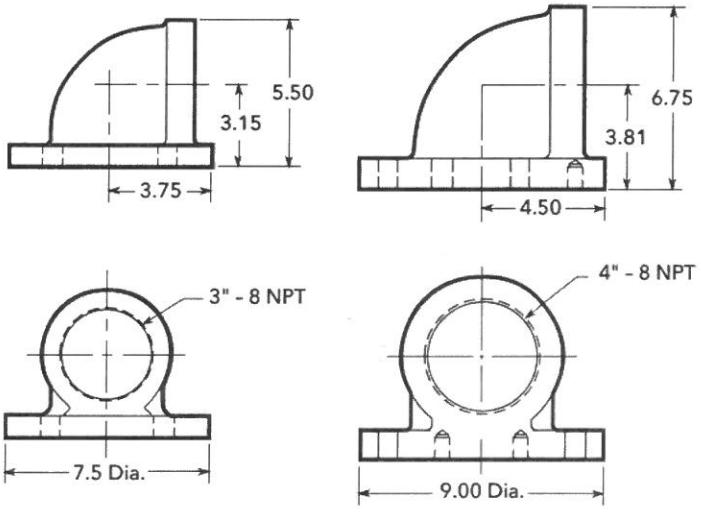
PIPE CONNECTORS

Short Radius Elbow

- Cast iron construction.
- 125 lb. ANSI rated flange at pump end.
- 3" NPT or 4" NPT threaded connection for discharge pipe.



Flange Size	Order Number	Used With
3"	A1-5	3", 125# ANSI Flange
4"	A1-6	4", 125# ANSI Flange



A1-5 **A1-6**

xylem
Let's Solve Water

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Seneca Falls, NY 13148
Phone: (866) 325-4210
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www.xyleminc.com/brands/centripro

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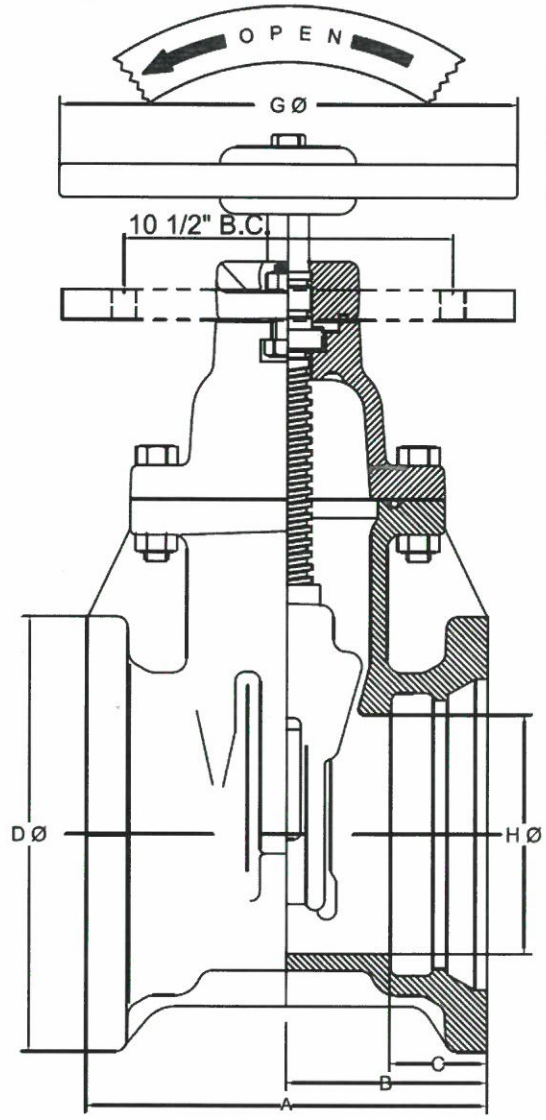
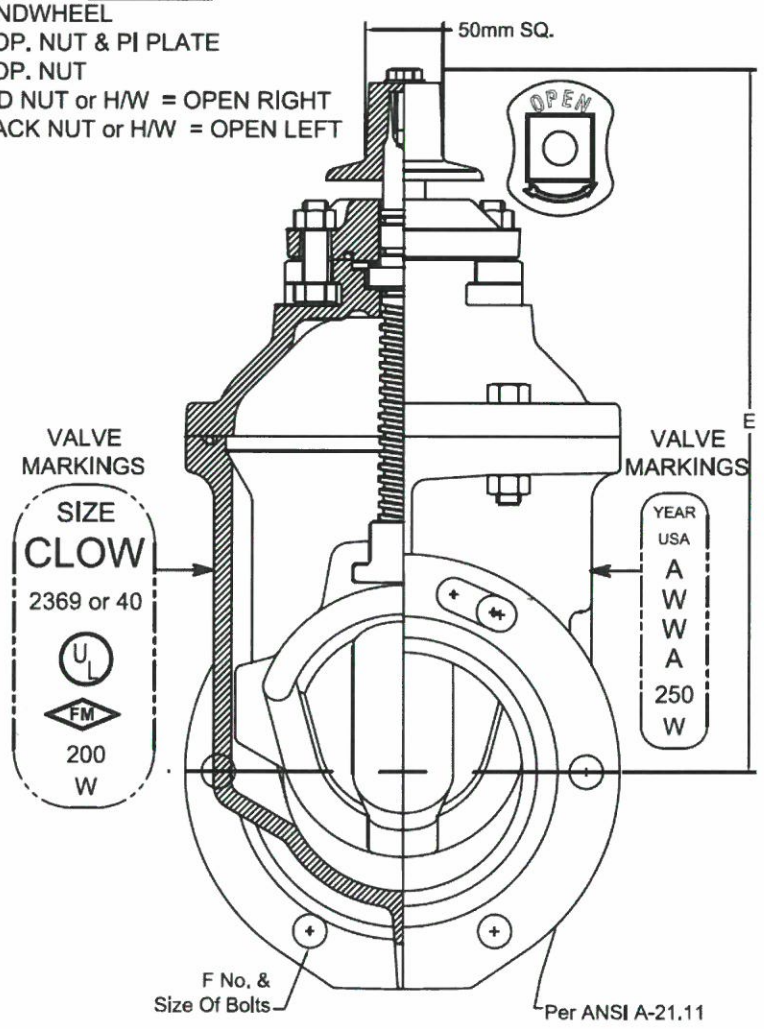
CLOW CANADA

PROJECT	50 - 300 R/W VALVE NRS M.J. ENDS GENERAL DIMENSIONS
OWNER	
CONTRACTOR	CLOW FIGURE F6100
DISTRIBUTOR	CLOW MODEL 2640 AWWA C509 FULL WALL CAST IRON
CONSULTANT	CLOW MODEL 2639 AWWA C509 FULL WALL DUCTILE IRON



OPTIONAL

1) HANDWHEEL
2) 2" OP. NUT & PI PLATE
3) 2" OP. NUT
4) RED NUT or H/W = OPEN RIGHT
5) BLACK NUT or H/W = OPEN LEFT



Underwriters' Laboratories of Canada

FM APPROVED

METRIC DIMENSIONS									NUMBER	WEIGHT	WEIGHT	WEIGHT
VALVE SIZE	A	B	C	D	E	F	G	H	OF TURNS	W/2" NUT	W/ HW	PI PLATE
50	210	105	62.5	115	275	4 -5/8"	185	50	6 1/2	—	—	—
62.5	—	—	—	—	—	—	—	—	—	—	—	—
75	215	108	62.5	195	315	4 -5/8"	250	75	10	—	—	—
100	240	120	62.5	230	375	4 -3/4"	250	110	13 1/2	87 lbs	93 lbs	103 lbs
150	265	130	62.5	290	480	6 -3/4"	300	160	19 1/2	136 lbs	145 lbs	152 lbs
200	335	165	62.5	350	572	6 -3/4"	350	210	25 1/2	206 lbs	218 lbs	222 lbs
250	395	195	62.5	400	670	8 -3/4"	450	260	31 1/2	352 lbs	371 lbs	368 lbs
300	405	200	67	455	760	8 -3/4"	450	310	37 3/4	480 lbs	500 lbs	496 lbs

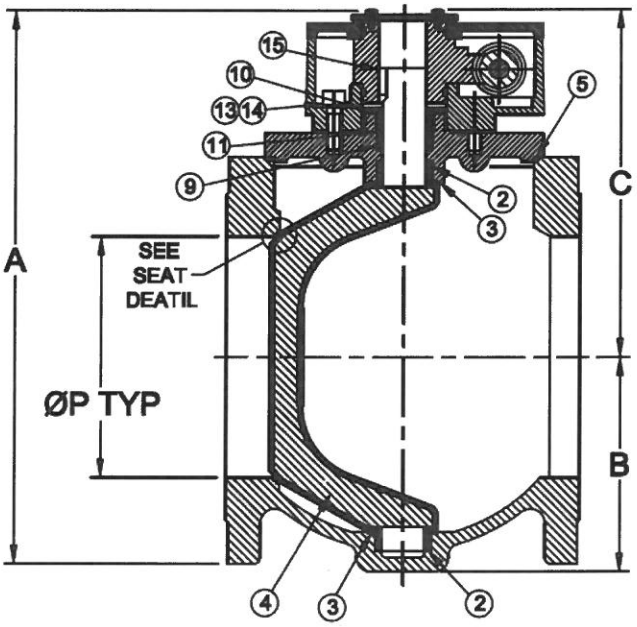
Eccentric Plug Valve Flo-E-Centric® Model 54-0

FLOMATIC®

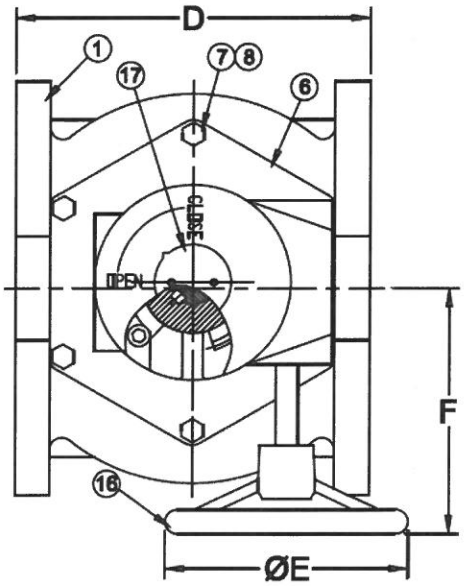
Flomatic Corporation

Sizes 6" thru 12"/ 150mm thru 300mm
Gear Box

Materials



SEAT DETAIL
NI WELDED SEAT



Max Temp 180°F (82°C)
Max Pressure 200 psi (14 bar)

Item #	Qty	Description	Material	ASTM	Item #	Qty	Description	Material	ASTM
1	1	Body	Ductile Iron	A536 (65-45-12)	10	1	Bushing	Brass	B16
2	2	Bushing	Stainless Steel	316	11	1	Gland	Brass	B16
3	2	Washer	PTFE	—	12	1	Gearbox	Ductile Iron	A536 (65-45-12)
4	1	Plug	Ductile Iron/NBR	A536 (65-45-12)	13	1	Bolt	Carbon Steel	1045, Cr Plated
5	1	O-Ring	EPDM	—	14	1	Washer	Carbon Steel	1045, Cr Plated
6	1	Bonnet	Ductile Iron	A536 (65-45-12)	15	1	Key	Carbon Steel	B16
7	4	Bolt	Stainless Steel	304	16	1	Handwheel	Cast Iron	A126 Class B
8	4	Washer	Stainless Steel	304	17	1	Position Indicator	Stainless Steel	18-8
9	5	V-Packing	NBR	—					

Dimensions (150# ANSI B16.5 flanges)

Valve Size		Part #	A		B		C		D		ØE		F		ØP		Gearbox Ratio	Weight	
Inch	mm		Inch	mm	Inch	mm	Inch	mm	Inch	mm	Inch	mm	Inch	mm	Inch	mm		lbs	kg
6	150	540000090	14.41	366	5.63	143	8.78	223	10.50	267	11.69	297	9.29	236	6.00	152	50:1	165	75
8	200	540000100	18.62	473	7.01	178	11.61	295	11.50	292	15.24	387	10.71	272	8.00	203	80:1	256	116
10	250	540000110	22.09	561	8.94	227	13.15	334	13.00	330	15.24	387	9.69	246	10.00	254	70:1	439	199
12	300	540000120	24.72	628	10.51	267	14.21	361	14.00	356	15.24	387	9.69	246	12.00	305	70:1	533	242

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Appendix C:
WWTP – Vertical Bar Screen –
Manufacturer's Cut Sheets

Project Number: 81235.09

The Chazen Companies
May 13, 2021
Revised February 23, 2022

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Aqualitec
Screening Equipment

SCREENTEC
VERTICAL BAR SCREEN

Performances

Applications: Municipal & Industrial

Flow capacity: up to 60mgd

Space bar opening: : 3/8" to 2" (1 to 60mm)

Design

Screentec is customized based on specifications and/or structural constraints.
Below are some guidelines of the design requirements.

MATERIALS

304 or 316 stainless steel

Surface treatment: Scouring, Passivation

T.I.G. welding techniques

SPACE REQUIREMENTS - FOOTPRINT

Depth: up to 50' (15m)

Width: 1.3' to 6.56' (400mm to 2000mm)

Discharge height: 4' (1200mm)

Installation angle: 90°

MOTOR CHARACTERISTICS

Absorbed power: ¾hp (0.56 KW)

Voltage: 240 or 480 VAC

Frequency: 60 Hz

Aqualitec Corp. - 610 W Carob Street, Compton, CA 90220
1-877-278-2214. Fax (323) 732 2815. www.aqualitec.com

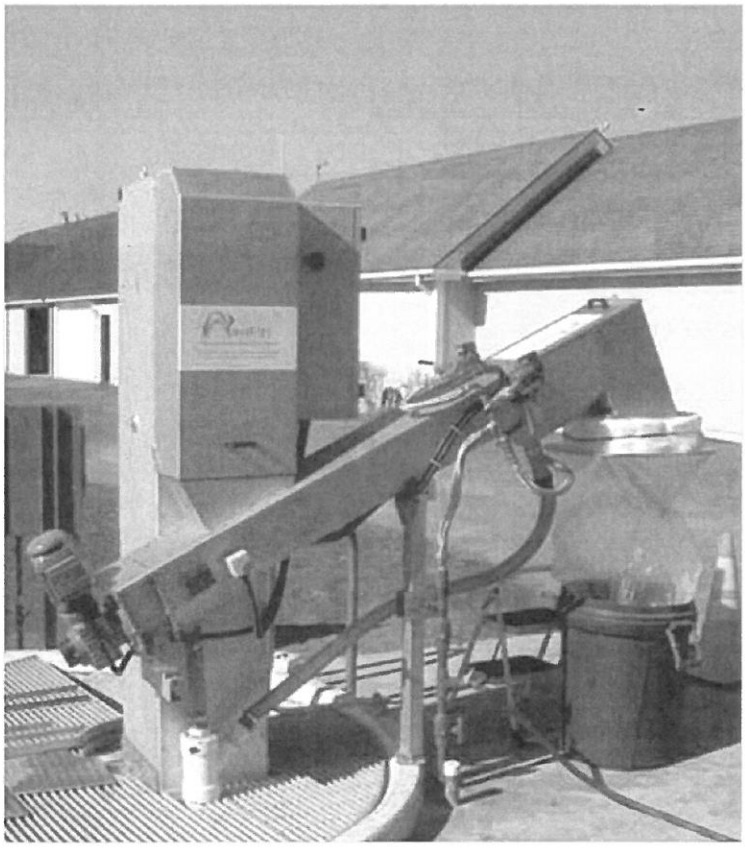
Aqualitec
Screening Equipment

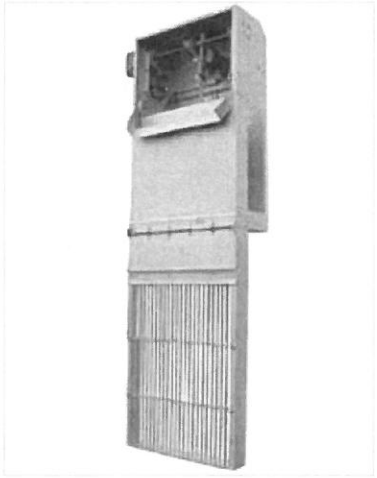
Aqualitec: Keep it Simple

Aqualitec
Screening Equipment

SCREENTEC
VERTICAL BAR SCREEN

Screentec:
The Mechanical Vertical Bar Screen Solution for Headworks, Lift Stations, Deep Wells and Manholes. By Aqualitec.





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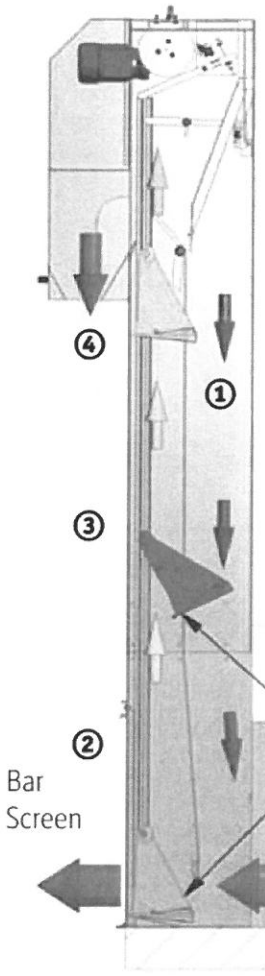
SCREENTEC
VERTICAL BAR SCREEN

Operating Mode

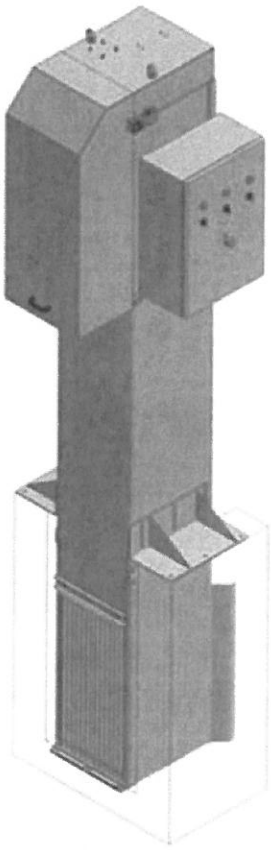


① The Rake, set up on a sturdy belt, moves downward following 2 guide rails on each side of the frame.

② The Rake collects all the screenings stuck by the bar screen.

③ The Rake goes up, lifting up all the collected screenings.

④ Screenings are ejected in a washer compactor Compactec or in a dumpster.

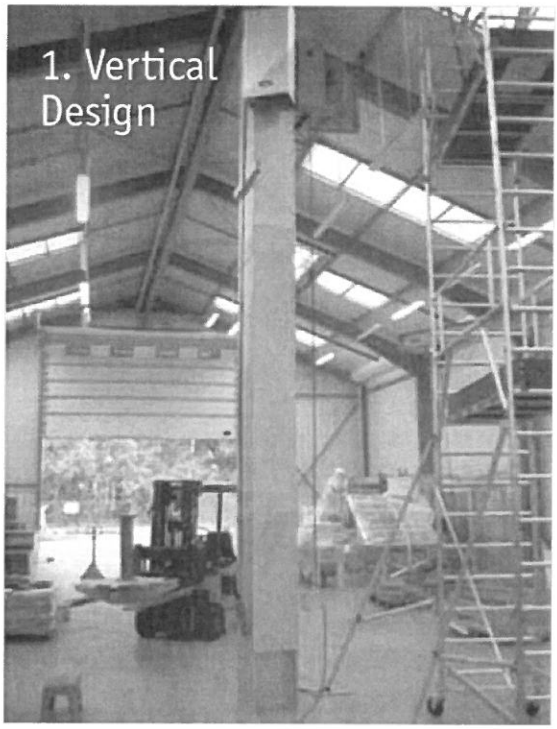


The mechanical vertical bar screen Screentec can be installed in many applications including Headworks, Lift Stations, Deep Wells and Manholes. Due to its vertical design, Screentec can retrofit any kind of structure with minimal or no changes.

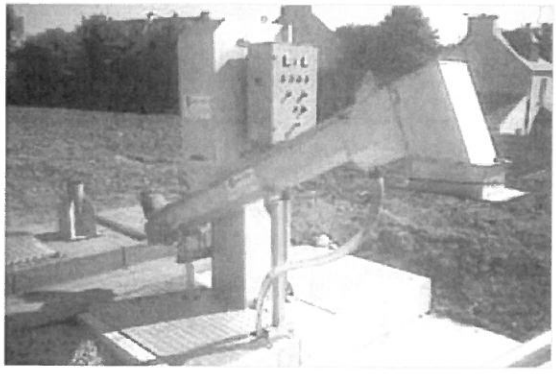
Aqualitec
Screening Equipment

SCREENTEC
VERTICAL BAR SCREEN

Features & Benefits



With a 90° angle installation, Screentec can fit in any kind of structure, up to 50' deep.



2. Minimal & Easy Maintenance

Screentec does not have moving parts at the bottom of the frame. The weekly maintenance will only consist of a visual check of the top frame. The access is safe since operators can open the secure hood from the grate level.

3. Odor Control

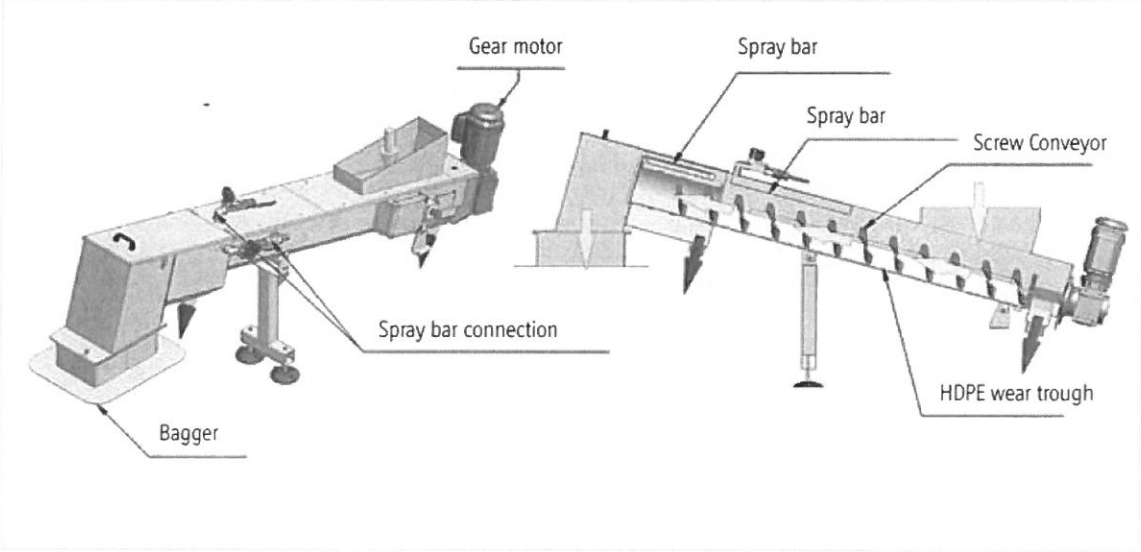
The frame of the vertical bar screen is completely enclosed. Adding a washer compactor Compactec with a bagger system will maintain total odor control. Screentec can be installed in residential areas without risk of odor complaints.

Aqualitec
Screening Equipment

COMPACTEC
WASHER COMPACTOR

Compactec:
The Washer Compactor That Improves Sanitary Conditions.

By Aqualitec.



Operating Mode:
The washer/compactor Compactec reduces the volume of screenings material from any kind of bar screen. Screenings enter in the inlet hopper and are conveyed by the shaftless auger into the washing zone. Then, the captured solids will be dewatered, compacted and discharged. The equipment is designed for a volume reduction of at least 50% and a dry solid concentration of at least 30%.

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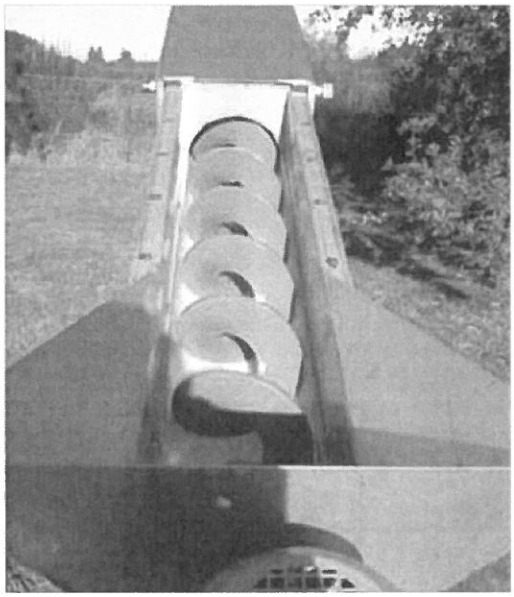
Aqualitec
Screening Equipment

COMPACTEC
WASHER COMPACTOR

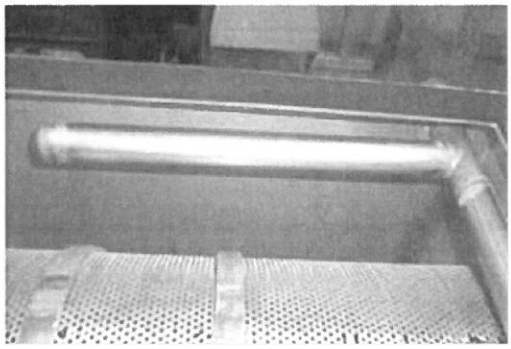
Features & Benefits

1. Drive Mechanism



The shaftless auger is made of alloy steel with a protective polyurethane paint. The transport tube is made of 304L or 316L stainless steel with a width of no less than 7" and a thickness of ¼". High-density polyethylene (HDPE) covers the transport tube to avoid wear.

2. Spray Bar System, Maximum Organics Back In The Process



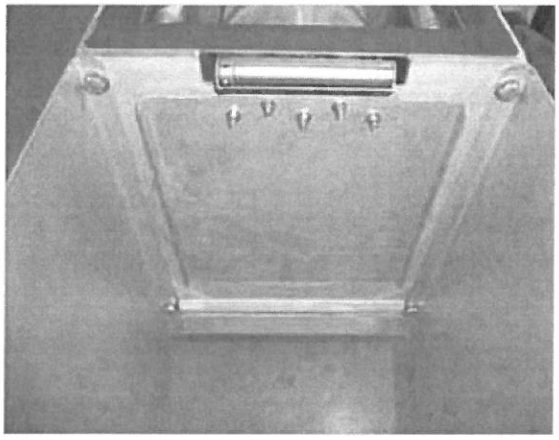
In order to have organics material back in the the wastewater process, 2 spray bars are provided. 1 installed on the conveying part, the other one on the compression box.

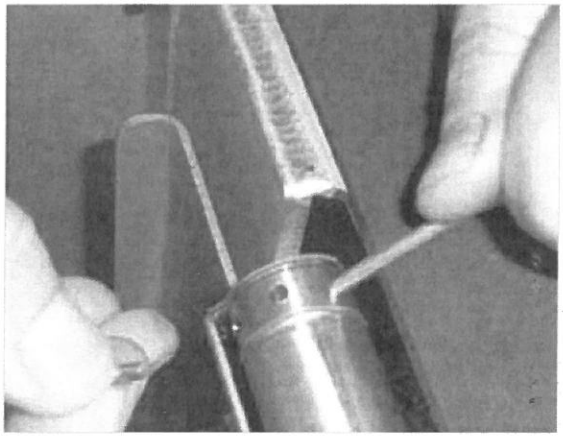
Aqualitec
Screening Equipment

COMPACTEC
WASHER COMPACTOR

Features & Benefits

3. Volume Reduction





To dewater and compress the debris, the screw will push them onto the lid. To comply with landfill regulation and the Paint Filter Test, the pressure of the lid can be easily adjusted.

4. Odor Control

All Aqualitec Corp. bar screen are totally enclosed. To keep the odor control, the washer compactor is provided with a bagger system.

Aqualitec
Screening Equipment

COMPACTEC
WASHER COMPACTOR

Performances

Dry solid concentration greater than 30%

Volume reduction greater than 50 %

Capacity: 0 to 9,500gallon/day (0 to 1,5m3/h) of compacted waste

Inclination: 0° to 25°

Design

Compactec is customized based on specifications and/or structural constraints. Below are some guidelines of the design requirements.

MATERIALS

304 or 316 stainless steel

Surface treatment: Scouring, Passivation

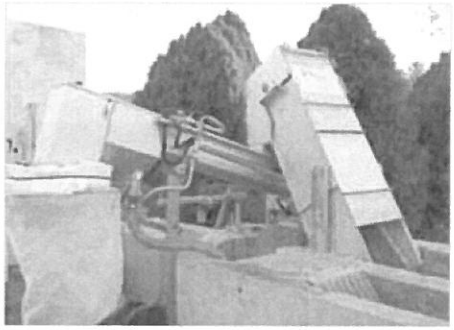
T.I.G. welding techniques

MOTOR CHARACTERISTICS

Absorbed power: ¾hp (0.56 KW)

Voltage: 240 or 480 VAC

Frequency: 60 Hz



Clearlake Oaks - California

Aqualitec Corp. - 610 W Carob Street, Compton, CA 90220
1-877-278-2214. Fax (323) 732 2815. www.aqualitec.com

Aqualitec
Screening Equipment

Aqualitec: Keep it Simple

SECTION

MECHANICALLY CLEANED SCREENS AND APPURTENANCES

PART 1 - GENERAL

1.01 SECTION DESCRIPTION

A. Manufacturer shall provide and test mechanically one (1) vertical bar screen front cleaning, downstream return, with motors, controls and appurtenances as indicated and specified.

B. The screen and control panels shall be a complete factory manufactured.

1.02 REFERENCES SPECIFICATIONS, CODES, AND STANDARDS

A. American Gear Manufacturers Association (AGMA)

B. National Electrical Manufacturers Association (NEMA)

C. American Federation of Bearing Manufacturers Association (AFBMA)

D. American Society for Testing and Materials (ASTM)

E. Underwriters Laboratory

1.03 QUALITY ASSURANCE

A. Experience:

1. The Manufacturer of the vertical bar screen specified herein shall have had equipment of this type in service for period of the last five (5) years in a minimum of 25 installations in order to be considered.
2. The vertical bar screen shall be assembled and shop tested at the manufacturing facility prior to shipment.

B. Equipment specified shall be the product of one (1) manufacturer.

C. Owner shall obtain the screens, motors and appurtenances from the mechanically cleaned screen manufacturer, as a complete and integrated package to insure proper coordination and compatibility and operation of the system.

D. Equipment specified shall be manufacturer's standard cataloged product and modified to provide compliance with the drawings, specifications and the service conditions specified and indicated.

E. Shop tests as specified.

F. The manufacturer shall be able to send one technician. Service of a factory-trained technician shall be provided and specifically trained on type of equipment specified. Service technician shall be present on site for all items listed below:

1. Functional testing: calibrate, check alignment and perform a functional test.
2. Field performance testing.
3. Training: field operation and maintenance instruction including all materials, slides, videos and handouts.
4. Any additional time required of the factory trained service technician to assist in placing the equipment in operation at no additional cost to the Owner.

G. Electrical Equipment Labeling Requirements:

1. Equipment control panel shall be UL listed assembly.

H. Fabrication shall be in compliance with all applicable ASTM 967 standards.

I. Factory welding shall use shielded arc, inert gas, TIG method.

J. All stainless steel subassemblies shall be acid passivated after welding for corrosion resistance and to provide a superior surface finish. The passivation shall be done by using an acid passivation paste in the weld and heat-affected areas and spray-on acid solutions elsewhere. After passivation, the weldments shall be thoroughly rinsed with clean water and allowed to air dry.

1.04 WARRANTY

Manufacturer shall provide a written one-year standard warranty from the date of use of the vertical bar screen equipment to guarantee that there shall be no defects in material or workmanship in any items supplied.

1.05 SUBMITTALS

A. Submit the following shop drawings:

1. Certified shop and erection drawings. Manufacturer shall submit electronic files of the proposed equipment in the capacity, size, and arrangement as indicated and specified.

2. Drawings showing materials of construction, thicknesses, operating and maintenance envelope and assembly weight.

4. Hydraulic calculations verifying compliance to the design criteria.

5. Shop drawing data for accessory items.

6. Manufacturer's literature as needed to supplement certified data.

7. Operating and maintenance instructions and parts lists.

8. Listing of reference installations as specified with contact names and telephone numbers.

9. List of recommended spare parts other than those specified.

10. Recommendations for short and long-term storage.

11. Shop and field testing procedures, set up and equipment to be used.

12. Special tools.

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

14. Schematic control and power wiring diagrams including interconnecting and internal wiring diagrams.

15. Control panel drawings.

16. Manufacturer's product data.

17. Equipment weight and lifting points for installation and removal purposes.

18. Number, size and weight of pieces shipped.

1.05 SPARE PARTS

A. Spare parts shall be provided and shall be interchangeable with similar parts installed.

1. Spare parts:

a. One (1) strap.

b. Two (2) sets of rake wheels.

c. One (1) set of slack sides bushing.

d. One (1) set of top detection bushing.

2. One (1) set of all special tools required.

PART 2 - PRODUCTS

2.01 SYSTEM DESCRIPTION

A. Screening system capacities and operating data shall be indicated in the mechanically cleaned screen schedule.

B. Screen shall be installed in a wet well as specified and indicated.

C. Service: Screen raw wastewater.

D. Screen shall discharge in a Washer/Compactor.

E. The screen shall be capable of operating with the screen 30 percent blinded.

F. Mechanically cleaned screen shall be front-clean and back-discharge, and installed in the existing wet well.

G. Mechanically cleaned screen with submerged rotating parts, pulley, cogwheel, sprockets, bearings, shaft that require regular maintenance are not acceptable.

H. Mechanically cleaned screen with an inclination different from 90^0 is not acceptable.

I. Multiple rake technology is not acceptable.

J. The screen technology shall be straight bars. Perforated screen basket is not acceptable.

K. Interface:

1. Room for inspection, adjustment and repair shall be provided.

2.02 MANUFACTURERS

A. Aqualitec Corp. Mechanical Vertical Bar Screen Screentec 400 Front Cleaning.

B. Or pre-approved equal. screening manufacturer seeking pre-approval must submit application a minimum of two (2) weeks prior to bid day. Charges for additional engineering to alter site Plans to meet the intention of the specification shall be at the cost of the manufacturer requesting such change.

2.03 SCREEN CONSTRUCTION

A. General

1. Screen: Shall mechanically front-clean and downstream discharge.

2. Mechanically-cleaned screen shall be front cleaning since the scraper shall

remove debris from the upstream side of the screen.

3. Screenings shall be discharged on the downstream side of screen through discharge chute in a Washer/Compactor.

B. Frame

1. Frame: Shall be constructed of type 304L stainless steel.

2. The side frames shall be suitably reinforced to support all loads imposed on the mechanism during operation, installation, assembly, or transportation.

3. Anchor support frames onto the operating floor shall be of type 304L stainless steel hardware.

4. Screen manufacturer representative shall approve screen frame field assembly.

5. Screen Enclosure: screen shall be fully enclosed above the operating floor with hinged access door.

6. The access of all the mechanical parts by the hood has to be secured by a hood latch and cover detector. The height of the hood shall be the level of one normal person stand up. Machine with a higher hood will be excluded automatically.

C. Bar Rack and Baseplate

1. Material: Shall be of type 304L stainless steel.

2. The vertical screen shall consist of rectangular 304L stainless steel bars with a total width of 15'' and a thickness of 1"3/6 x 5/16".

3. The bar screen shall be firmly fastened at top and bottom.

4. The bar screen shall be replaceable without welding.

5. Bar spacing shall be as specified. Provide screens accurately constructed to provide a clear spacing of ½" between the bars.

6. The bars shall be straight and cover the full equipment width. The point of discharge from the bar screen shall be 3'-11 ½" and screenings shall be discharged into a Washer/Compactor.

D. Dead Plate

1. Bar screens shall have a dead plate and stiffeners construct of type 304L stainless steel with a minimum thickness of $^1/_8$" (3 mm).

2. The dead plate shall be $^1/_8$" thick constructed of type 304L stainless steel plate and extends from the top of the bar screen to the point of discharge.

E. Discharge Chute

1. A discharge chute shall be added to divert screenings from screen to self-dumping hopper.

2. Material: shall be of type 304L stainless steel, minimum thickness of $^1/_8$".

F. Single Shovel Rake

1. The debris shall be removed from the bar screen by a 304L stainless steel single shovel rake assembly designed to mesh with the bar screen.

2. The single shovel rake shall consist of type 304L stainless steel teeth that penetrate completely the bar screens to catch and remove the debris that are blocked on the upstream side of the screen.

3. The shovel rake teeth shall be replaceable without welding.

G. Scraper

1. A scraper assembly shall be installed to assist removing the debris from the shovel rake.

2. The scraper ejector shall be type of 304L stainless steel and high-density polyethylene (HDPE) in order to reduce the noise but also shall penetrate completely in the shovel rake to insure effective debris removal.

H. Side Seals

1. To prevent bypass around the sides of the unit, seals shall be mounted on the upstream face of the screen and on each side of the unit.

2. The seals shall be secured in place by backing plates and constructed of type 304L stainless steel.

I. Anchor Bolts, Bolts and Nuts

1. Bolts, nuts, lock washers shall be of type 304L stainless steel.

2. Anchor bolts type shall be of type 304L stainless steel.

J. Drive Mechanism

1. The single shovel rake shall be mounted on one (1) sturdy strap resistant to any chemical agents and frost.

2. A pulley shall be used to transmit a rotational motion.

3. The strap shall be capable of lifting no less than 1,000 pounds.

4. The single shovel rake shall be equipped with four (4) high-density polyethylene (HDPE) castor in order to guide this shovel rake.

5. Two (2) inductive proximity sensors shall be placed at the top of the equipment to command the sense of rotation.

6. The gravity and the weight of the shovel rake shall insure the closing motion.

K. Overload Protection

1. A sensor torque overload (intensity) protection device shall stop the screen and start an alarm. Upstream of this protection, a thermal overload relay shall stop the gear motor.

    a. Contacts for screen failure shall be provided.

2.04 INTEGRATED BY PASS

1. Material: Shall be of type 304L stainless steel.

2. Integrated by pass frame shall be fixed to the vertical bar screen.

3. The integrated by pass shall consist of rectangular 304L slice gate with specific guide rails (structure attachment) for lifting.

4. Manual slice gate shall have a lift system including pinion and rack mechanism.

5. A manual screen shall be installed with a clear spacing of 1.5" between the bars downstream of the slice gate.

6. Hoist, cable, hook, winch & socket base shall also be furnished.

2.05 DRIVE SYSTEM

One (1) motor shall be provided.

A. Motor

1. Motor shall be NORD Gear Motor.

2. Motor shall operate without overheating at the speeds specified and indicated.

3. Motor shall have premium efficiency with nominal and minimum efficiencies per NEMA MG1.

4. Rating: 480V, 3-ph, 60 Hz, 3/4 HP maximum to limit the consumption of electricity. An electric motor over 3/4 HP will be excluded automatically.

5. Insulation: Shall be class F insulation with Class B temperature rise.

6. Motor shall have high temperature thermal overloads for motor winding high temperature and high motor brake temperature.

7. Motor shall have a sufficient capacity to start and operate screen at 30 percent blinded without exceeding nameplate ratings for current and power and without operating in the service factor.

2.06 CONTROLS AND INSTRUMENTATION

A. All controls shall be provided for the fully automatic operation of the screen. The screen shall be factory wired so that the electrician is only required to make the electrical connections to the control panel and from the control panel to a junction box at the screens.

B. Control panel shall UL listed and manufactured in the United States.

C. The mechanically cleaned bar screen shall be furnished with a complete control system housed in an enclosure complying with the specific requirements:

1- Design Local control panel shall be delivered to jobsite, prewired ready for installation.
2- Control panel: NEMA 4X stainless steel.
3- Power Requirements: 480 Volt, 60 Hz, 3-Phase.
4- Motor Requirements: 3/4 Hp.
5- Emergency Stop Button.
6- Unit shall be controlled manually, on timer or with an ultrasonic water level.

D. The local control panel plus other accessories shall perform the functions of:
1- Circuit breaker:
   a. Motor starters.
   b. Control power transformer.

c. Obstruction alarm.

E. The following controls shall be provided with the control panel:

1- Reversing motor starter for the motor.
2- START, STOP and RESET pushbutton.
3- HAND-OFF-REVERSE selector switch.

2.07 DESIGN REQUIREMENTS

Mechanically Cleaned Screen	Data
Number of screen	1
Average flow	342.000 GPD
Peak flow	1,368,000 GPD
Clear opening between bars	1/2"
Angle of inclination	90°
Wet Well depth	6'-2 ½''
Pipe Diameter	10''

2.07 SHOP TESTING

A. Motors shall be shop testing.

B. Control panel shall be shop testing:

a. Test all functions and alarms of the control panel.

C. Screen shall be shop testing:

a. The bar screen shall be completely factory assembled and inspected prior to shipment.

PART 3 - EXECUTION

3.01 INSTALLATION

A. All installed items shall be in accordance with shop drawings and manufacturer instructions with no exceptions.

B. Manufacturer shall furnish four copies of operation and maintenance manuals which shall be retained at the installation site to assist plant operators.

3.02 FIELD TESTING

A. Field testing shall not be conducted without a procedure with no exceptions noted, calibration certificates for all testing equipment, and a completed and signed pretesting check list.

B. After installation, inspection, operation, testing and adjustment of the equipment, a manufacturer's field service technician shall conduct performance test for the unit in presence of the owner to determine its ability to deliver its rated capacity under specified conditions.

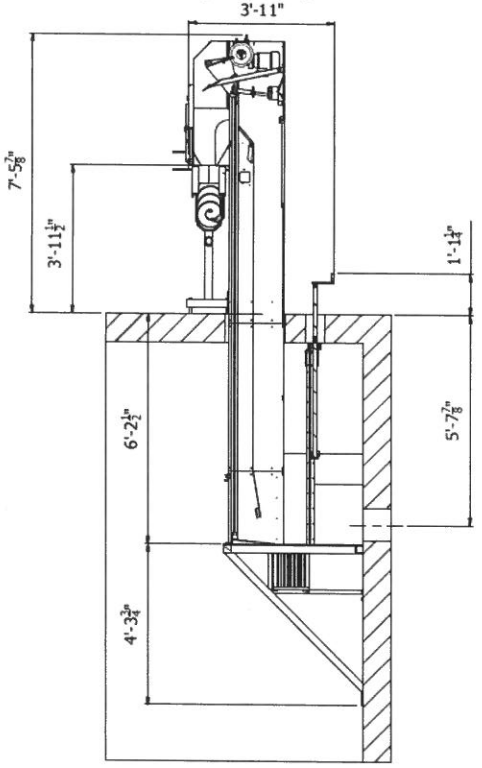
   a. Performance Test:

      During tests, observe and record flow rates, wet well water depths, headloss, and motor inputs. Repeat tests until specified results are obtained.

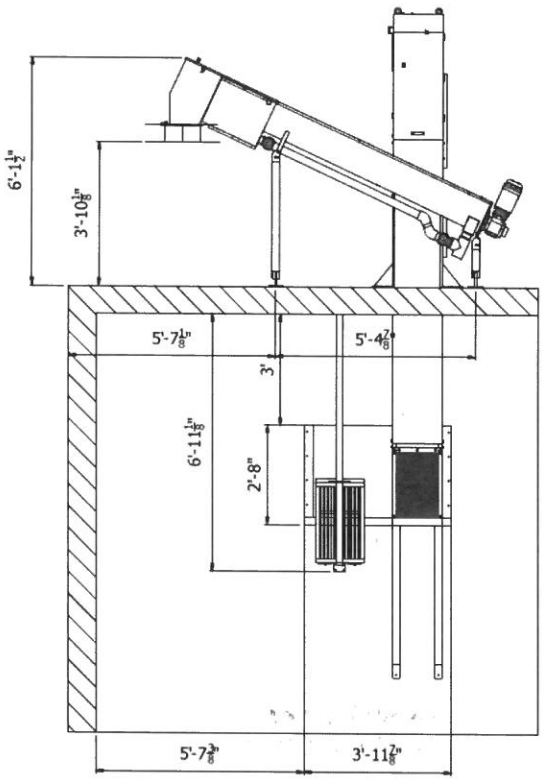
C. Make all adjustments necessary to place equipment in specified working order at time of above tests.

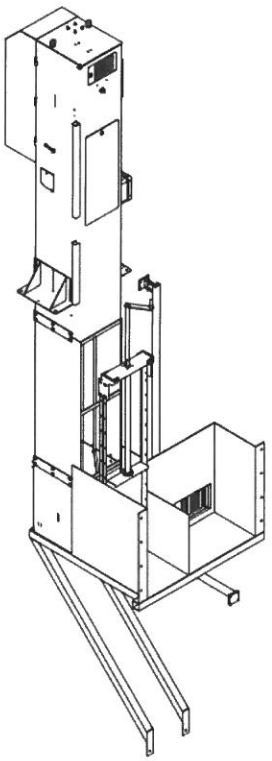
END OF SECTION

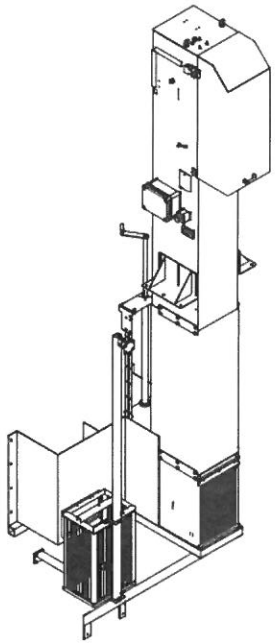
A-A (1/40)

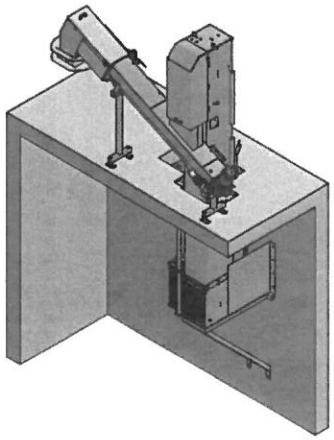


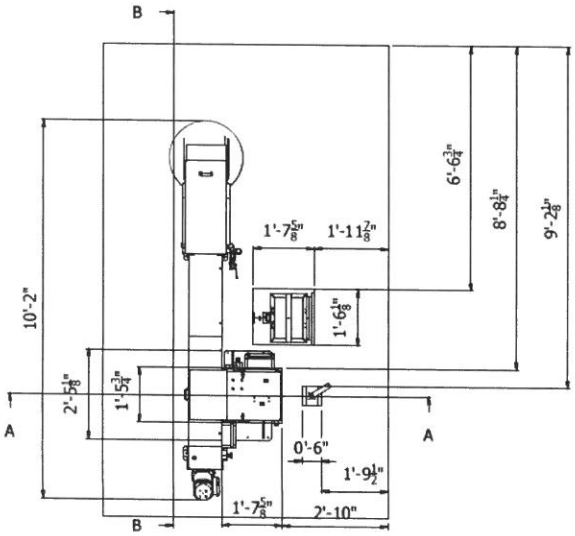
B-B (1/40)











Code article: **AQDV1153-IMP**		Description: **Screentec DV400 - KOESTER**				
Aqualitec Screening Equipment		Matieral:	F			
			E			
			D			
		Weight: 832.02 kg	C			
			B			
Projection :	Scale:	Sheet:1	Ind	Modification	Name	Date
Designer: Florian		Size:A4	Drawings are Aqualitec Corp. property, copy or communication submitted to authorization.			

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Appendix D:
WWTP – RPZ – Manufacturer's Cut Sheets

Project Number: 81235.09

The Chazen Companies
May 13, 2021
Revised February 23, 2022

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For Health Hazard Applications

Job Name _____ Contractor _____

Job Location _____ Approval _____

Engineer _____ Contractor's P.O. No. _____

Approval _____ Representative _____

LEAD FREE*

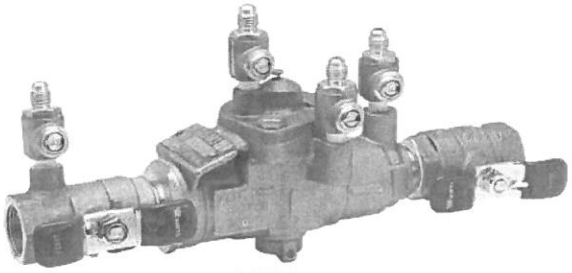
Series LF009

Reduced Pressure Zone Assemblies

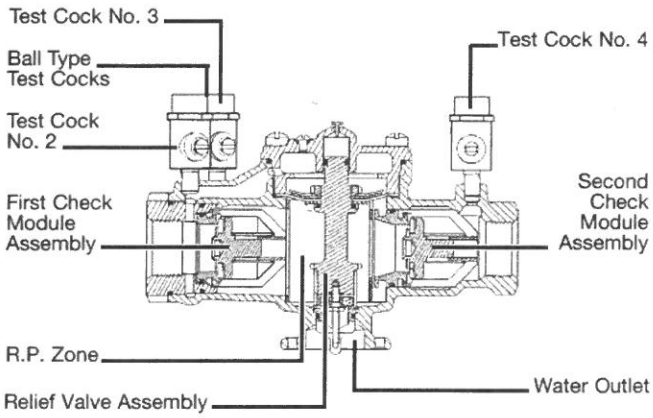
Sizes: ¼" – 3" (8 – 80mm)

Series LF009 Reduced Pressure Zone Assemblies are designed to protect potable water supplies in accordance with national plumbing codes and water authority requirements. This series can be used in a variety of installations, including the prevention of health hazard cross-connections in piping systems or for containment at the service line entrance. The LF009 features Lead Free* construction to comply with Lead Free* installation requirements.

This series features two in-line, independent check valves, captured springs and replaceable check seats with an intermediate relief valve. Its compact modular design facilitates easy maintenance and assembly access. Sizes ¼" – 1" (8 – 25mm) shutoffs have tee handles.



LF009



Features

- Single access cover and modular check construction for ease of maintenance
- Top entry – all internals immediately accessible
- Captured springs for safe maintenance
- Internal relief valve for reduced installation clearances
- Replaceable seats for economical repair
- Lead Free* cast copper silicon alloy body construction for durability ¼" – 2" (8 – 50mm)
- Fused epoxy coated cast iron body 2½" and 3" (65 and 80mm)
- Ball valve test cocks — screwdriver slotted ¼" – 2" (8 – 50mm)
- Large body passages provides low pressure drop
- Compact, space saving design
- No special tools required for servicing

Specifications

A Reduced Pressure Zone Assembly shall be installed at each potential health hazard location to prevent backflow due to backsiphonage and/or backpressure. The assembly shall consist of an internal pressure differential relief valve located in a zone between two positive seating check modules with captured springs and silicone seat discs. Seats and seat discs shall be replaceable in both check modules and the relief valve. There shall be no threads or screws in the waterway exposed to line fluids. Service of all internal components shall be through a single access cover secured with stainless steel bolts. Body and shutoffs shall be constructed using Lead Free* cast copper silicon alloy materials. Lead Free* reduced pressure zone assembly shall comply with state codes and standards, where applicable, requiring reduced lead content.

The assembly shall also include two resilient seated isolation valves, four resilient seated test cocks and an air gap drain fitting. The assembly shall meet the requirements of: USC; ASSE Std. 1013; AWWA Std. C511; CSA B64.4. Shall be a Watts Series LF009.

Now Available
WattsBox Insulated Enclosures.
For more information, send for literature ES-WB.

NOTICE

Inquire with governing authorities for local installation requirements

NOTICE

The information contained herein is not intended to replace the full product installation and safety information available or the experience of a trained product installer. You are required to thoroughly read all installation instructions and product safety information before beginning the installation of this product.

***The wetted surface of this product contacted by consumable water contains less than 0.25% of lead by weight.**

Watts product specifications in U.S. customary units and metric are approximate and are provided for reference only. For precise measurements, please contact Watts Technical Service. Watts reserves the right to change or modify product design, construction, specifications, or materials without prior notice and without incurring any obligation to make such changes and modifications on Watts products previously or subsequently sold.

WATTS®

Available Models: ¼" – 2" (8 – 50mm)

Suffix:

QT	– quarter-turn ball valves
S	– strainer
LF	– without shutoff valves
PC	– internal polymer coating
W/Press**	– press inlet x press outlet (½" – 2" only)

Prefix:

U	– union connections

Available Models: 2½" – 3" (65 – 80mm)

Suffix:

NRS	– non-rising stem resilient seated gate valves
OSY	– UL/FM outside stem and yoke resilient seated gate valves
S-FDA	– FDA epoxy coated strainer
QT-FDA	– FDA epoxy coated quarter-turn ball valves
LF	– without shutoff valves

Note: The installation of a drain line is recommended. When installing a drain line, an air gap is necessary (see ES-AG).

Materials: ¼" – 2" (8 – 50mm)

Lead Free* cast copper silicon alloy body construction, silicone rubber disc material in the first and second check plus the relief valve. Replaceable polymer check seats for first and second checks. Removable Relief valve seats. Stainless steel cover bolts.

Standardly furnished with NPT body connections.
Model LF009QT furnished with quarter-turn, full port, resilient seated, Lead Free* cast copper silicon alloy body ball valve shutoffs.

Materials: 2½" and 3" (65 – 80mm)

- (FDA approved) Epoxy coated cast iron unibody with plastic seats
- Relief valve with stainless steel seat and trim
- Lead Free cast copper silicon alloy body ball valve test cocks

Pressure / Temperature

Sizes ¼" – 2" (8 – 50mm) Suitable for supply pressure up to 175psi (12.1 bar). Water temperature: 33°F – 180°F (0.5° – 82°C).

Sizes 2½" and 3" (65 and 80mm) are suitable for supply pressures up to 175psi (12.1 bar) and water temperature at 110°F (43°C) continuous, 140°F (60°C) intermittent.

Standards

USC
ASSE No. 1013
AWWA C511
CSA B64.4
IAPMO File No. 1563.

Approvals

ASSE, AWWA, CSA, IAPMO

Approved by the Foundation for Cross-Connection Control and Hydraulic Research at the University of Southern California.

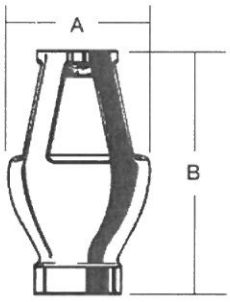
Approval models QT, PC, NRS, OSY.

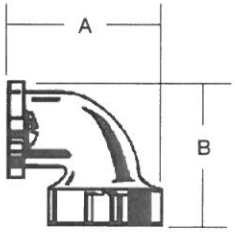
UL Classified
2½" and 3" (65 and 80mm) with OSY gate valves.

¾" - 2" (20-50mm) without shutoff valves (-LF)
(except LF009M3LF)

Air Gaps and Elbows

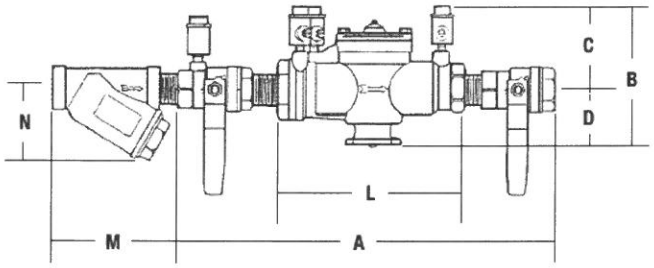
MODEL	for 909, 009 and 993 sizes	DRAIN OUTLET		DIMENSIONS A		DIMENSIONS B		WEIGHT	
		in.	mm	in.	mm	in.	mm	lbs.	kgs.
909AGA	¼"–½" 009, ¾" 009M2/M3	½	13	2⅜	60	3⅛	79	0.625	0.28
909AGC	¾"–1" 009/909, 1"–1½" 009M2	1	25	3¼	83	4⅞	124	1.5	0.68
909AGF	1¼"–2" 009M1, 1¼"–3" 009/909, 2" 009M2, 4"–6" 993	2	51	4⅜	111	6¾	171	3.25	1.47
909AGK	4"–6" 909, 8"–10" 909M1	3	76	6⅜	162	9⅝	244	6.25	2.83
909AGM	8"–10" 909	4	102	7⅜	187	11¼	286	15.5	7.03
909ELA	¼"–½" 009, ¾" 009M2/M3	–	–	–	–	–	–	–	–
909ELC	¾"–1" 009/909	–	–	2⅜	60	2⅜	60	0.38	0.17
* 909ELF	1¼"-2" 009M1, 1¼"–2" 009/909, 2" 009M2, 4"–6" 993	–	–	3⅝	92	3⅝	92	2	0.91
* 909ELH Vertical	2½"–3" 009/909	–	–	–	–	–	–	–	–





** Viega ProPress® connections are optional factory-installed fitting on each end of the approved/certified assembly.

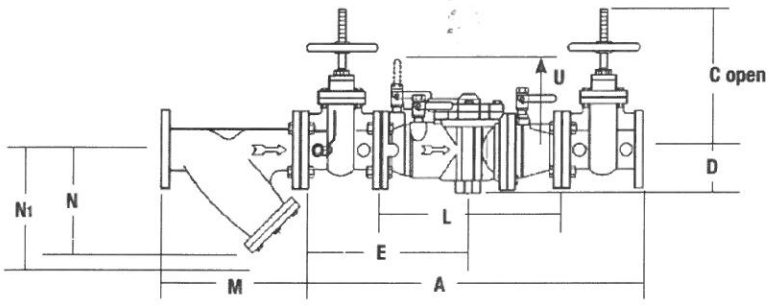
Dimensions – Weight Size: ¼" – 2" (8 – 50mm) LF009

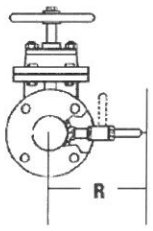


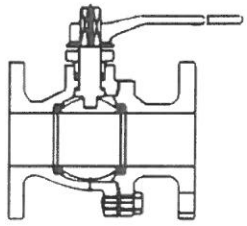
LF009 ¼" – 2"

SIZE (DN)		DIMENSIONS (APPROX.)														WEIGHT	
		A		B		C		D		L		M		N			
in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in	mm	in	mm	lbs.	kgs.
¼	8	10	250	4⅝	117	3⅜	86	1¼	32	5½	140	2⅜	60	2½	64	5	2
⅜	10	10	250	4⅝	117	3⅜	86	1¼	32	5½	140	2⅜	60	2½	64	5	2
½	15	10	250	4⅝	117	3⅜	86	1¼	32	5½	140	2¾	70	2¼	57	5	2
¾	20	10¾	273	5	127	3½	89	1½	38	6¾	171	3 3/16	81	2¾	70	6	3
1	25	14½	368	5½	140	3	76	2½	64	9½	241	3¾	95	3	76	12	5
1¼	32	17⅜	441	6	150	3½	89	2½	64	11⅜	289	4 7/16	113	3½	89	15	6
1½	40	17⅞	454	6	150	3½	89	2½	64	11⅛	283	4⅞	124	4	102	16	7
2	50	21⅜	543	7¾	197	4½	114	3¼	83	13½	343	5 5/16	151	5	127	30	13

Dimensions – Weight Size: 2½" and 3" (65 and 80mm) LF009







Watts G-4000 Series
QT – Ball Valves

STRAINER SIZE		DIMENSIONS (APPROX.)						WEIGHT	
		M		N		N1†			
in.	mm	in.	mm	in.	mm	in.	mm	lbs.	kgs.
2½	65	10	254	6½	165	9¾	248	28	12.7
3	80	10⅛	257	7	178	10	254	34	15.4

†Clearance for servicing

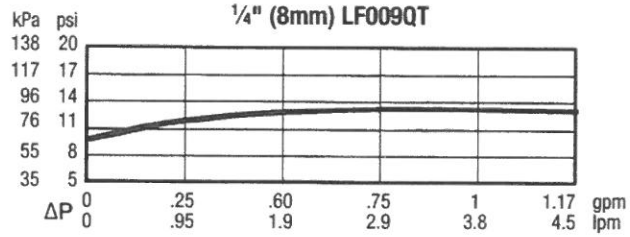
MODEL	SIZE DN		DIMENSIONS (APPROX.)														WEIGHT	
			A		C		D		E		L		R		U			
	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	lbs.	kgs.
LF009LF	2½	65	—	—	—	—	4½	114	—	—	18⅛	460	—	—	10⅝	270	76	34.5
LF009OSY	2½	65	33¼	845	15⅞	403	4½	114	16⅜	416	18⅛	460	7¾	197	10⅝	270	166	75.3
LF009NRS	2½	65	33¼	845	11⅜	289	4½	114	16⅜	416	18⅛	460	7¾	197	10⅝	270	161	73.0
LF009QTFDA	2½	65	33¼	845	6	152	4½	114	16⅜	416	18⅛	460	7¾	197	10⅝	270	150	68.0
LF009LF	3	80	—	—	—	—	4½	114	—	—	18⅛	460	—	—	10⅝	270	76	34.5
LF009OSY	3	80	34¼	870	18½	470	4½	114	16⅝	422	18⅛	460	8¾	222	10⅝	270	198	89.8
LF009NRS	3	80	34¼	870	12¾	324	4½	114	16⅝	422	18⅛	460	8¾	222	10⅝	270	191	86.6
LF009QTFDA	3	80	34¼	870	7	178	4½	114	16⅝	422	18⅛	460	8¾	222	10⅝	270	158	71.7

Capacity

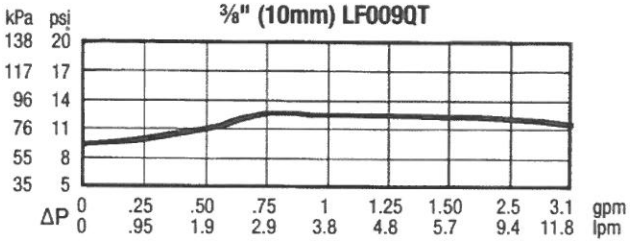
Performance as established by an independent testing laboratory.

*Typical maximum system flow rate (7.5 feet/sec., 2.3 meters/sec.)

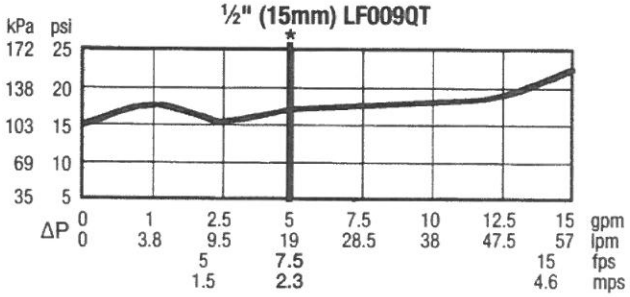
¼" (8mm) LF009QT



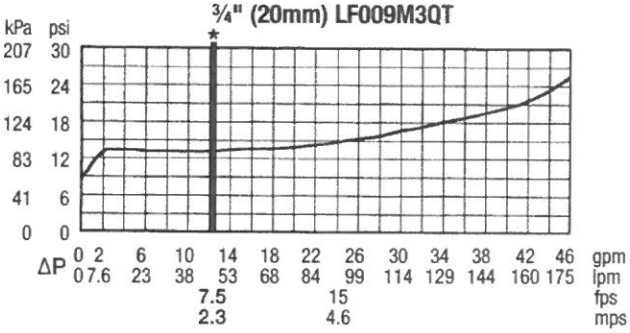
⅜" (10mm) LF009QT



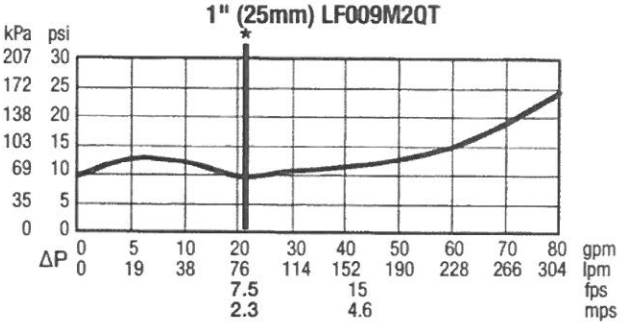
½" (15mm) LF009QT



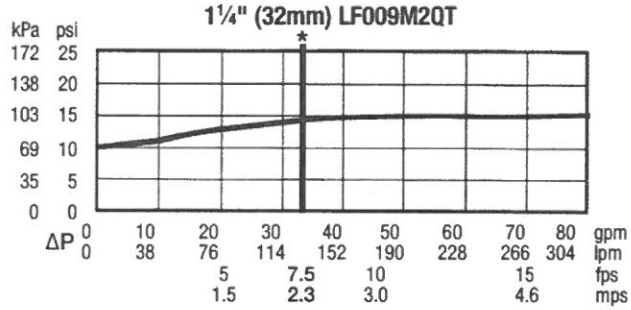
¾" (20mm) LF009M3QT



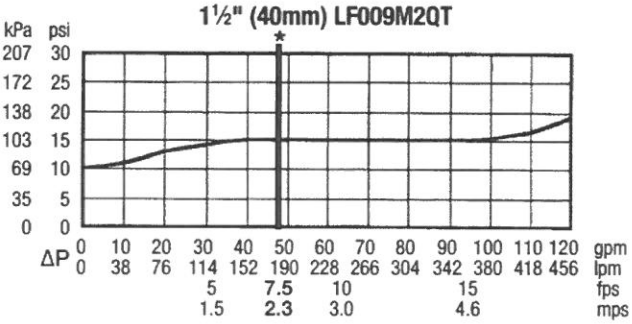
1" (25mm) LF009M2QT



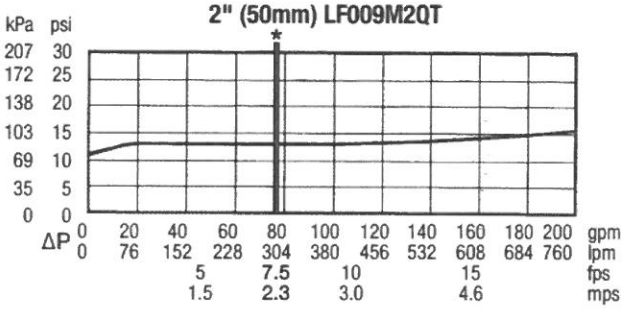
1¼" (32mm) LF009M2QT



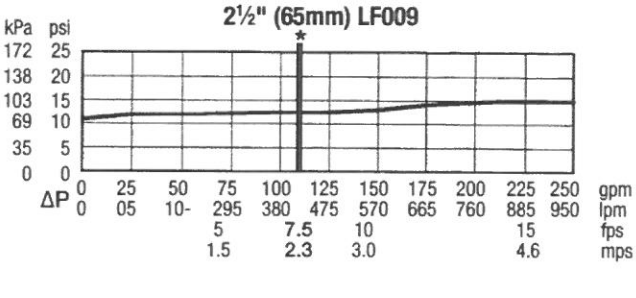
1½" (40mm) LF009M2QT



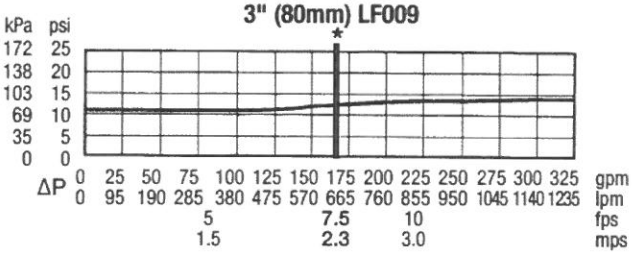
2" (50mm) LF009M2QT



2½" (65mm) LF009



3" (80mm) LF009



WATTS®

USA: T: (978) 689-6066 • F: (978) 975-8350 • Watts.com
Canada: T: (905) 332-4090 • F: (905) 332-7068 • Watts.ca
Latin America: T: (52) 81-1001-8600 • Watts.com

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Appendix E:
WWTP –Tanks - Manufacturer's Cut Sheets

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114 CUBIC METRE PRECAST WASTEWATER HOLDING TANK MODEL H114S

WILKINSON HEAVY PRECAST LIMITED
DUNDAS, ONTARIO 905-628-5611
www.wilkinsonheavyprecast.com

CONSTRUCTION DETAILS *

5076.320 psi
Concrete: 35 MPa at 28 Days, 5 to 8% Air Entrainment.
65.617 ft 7.874"
Reinforcing: 20 M Bars at 200 mm centres each way in roof, walls and floor.
Eight extra 15 M bars around each roof access opening. 49.213 ft
Minimum cover over reinforcing steel - 25 mm.
Weight: 96,000 kg (48,000 kg Per Half Section) 0.984" 211643.77 lbs (105,821.89 lbs Per Half Section)
Actual Capacity: 27,832 Litres Per Vertical Metre. 2241.023 gal Per Vertical Ft
114,110 Litres to Underside of Roof. 30144.673 gal

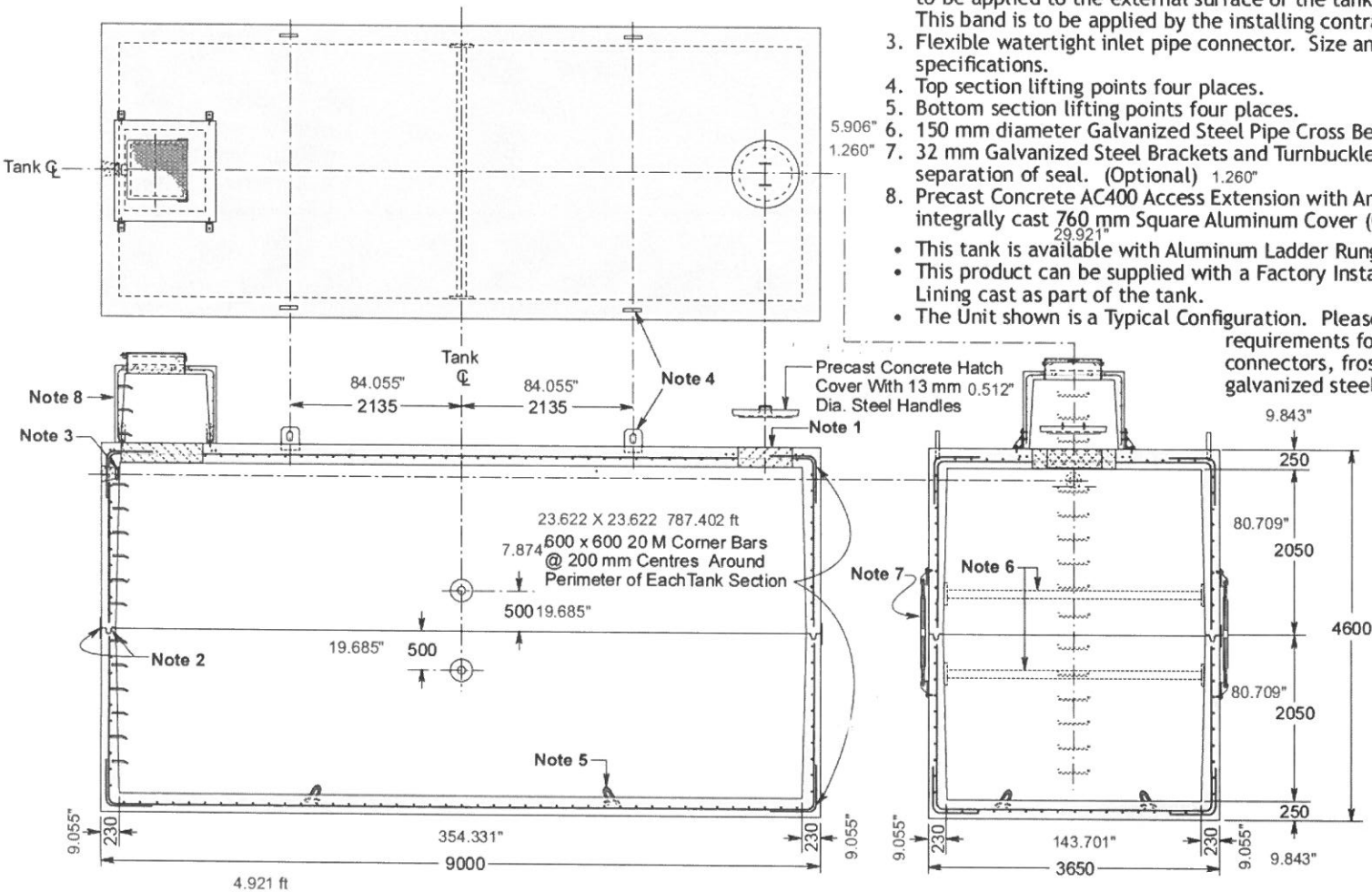
NOTES

29.969"

1. Large 685 mm diameter roof access openings facilitate tank maintenance. Unless otherwise specified/ordered this tank will be shipped with 840 mm 33.071" diameter concrete hatch covers. Please note that each cover weighs approximately 125 kg and must be handled only with suitable mechanical 275.578 lbs lifting equipment. Please see Access Riser section for available options.
2. Close tolerance of Tongue and Groove Joint and a Fibrous Mastic Sealant ensure a solid structural and watertight seal. Primer and Mastic Band will be supplied to be applied to the external surface of the tank over the joint between sections. This band is to be applied by the installing contractor.
3. Flexible watertight inlet pipe connector. Size and position to suit customer's specifications.
4. Top section lifting points four places.
5. Bottom section lifting points four places.
6. 150 mm diameter Galvanized Steel Pipe Cross Beams (Stainless Steel Optional). 5.906"
7. 32 mm Galvanized Steel Brackets and Turnbuckles in 4 Places to prevent separation of seal. (Optional) 1.260"
8. Precast Concrete AC400 Access Extension with Anti-Frost Heave System and integrally cast 760 mm Square Aluminum Cover (Optional).

29.921"

- This tank is available with Aluminum Ladder Rungs to the floor (Optional).
- This product can be supplied with a Factory Installed Polyethylene or P.V.C. Lining cast as part of the tank.
- The Unit shown is a Typical Configuration. Please call the factory to discuss your requirements for flexible watertight pipe/wall connectors, frost resistant watertight extensions, galvanized steel or aluminum hinged covers, flanged roof vents and many other custom appurtenances that can be supplied.



All below-grade precast concrete structures shall comply with notes for "Manholes and Other Below Grade Structures on sheet G002.

Dimensions in mm
N.T.S.

* Commensurate with a 1.5 Metre burial over the top slab in firm soil away from any area of vehicular traffic.

For recommended installation procedures refer to Wilkinson Installation Guidelines and Lifting and Assembly Instructions.

WARNING ! IMPROPER INSTALLATION ESPECIALLY IN UNSTABLE SOILS CAN RESULT IN THE STRUCTURAL FAILURE OF THIS PRODUCT

9 May, 2008

PRECAST ACCESS RISER MODEL AC400 with Optional Cast-In Covers

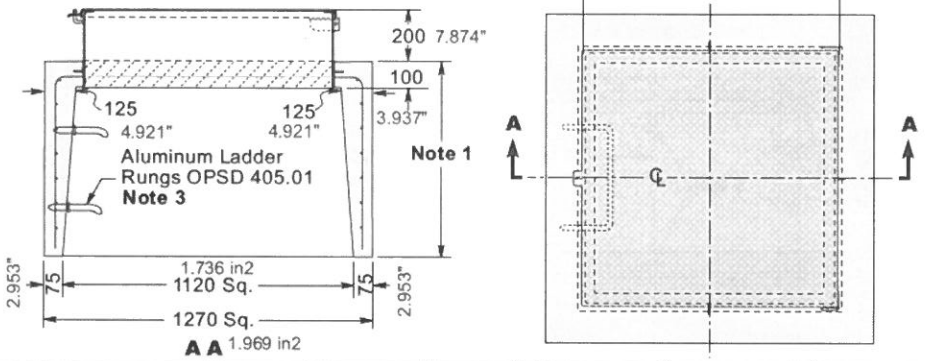
WILKINSON HEAVY PRECAST LIMITED
DUNDAS, ONTARIO 905-628-5611
www.wilkinsonheavyprecast.com

CONSTRUCTION DETAILS

Concrete: 35 MPa at 28 days, 5 to 8% Air Entrainment. (5076.320 psi)

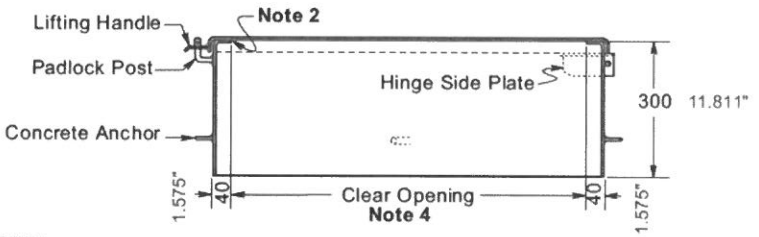
Reinforcing: 4 x 4 6/6 ww mesh in roof and walls.

Weight: 1.8 M - 2000 kg	5.906 ft -	4409.245 lbs
1.5 M - 1725 kg	4.921 ft -	3802.974 lbs
1.2 M - 1500 kg	3.937 ft -	3306.934 lbs
.9 M - 1300 kg	2.953 ft -	2866.009 lbs
.6 M - 1000 kg	1.969 ft -	2204.620 lbs
.3 M - 650 kg	0.984 ft -	1433.000 lbs



DRIP-PROOF AND LOCKABLE FRAME & COVER

- Standard material is 5 mm (0.197") galvanized steel; this design is also available in aluminum or stainless steel.



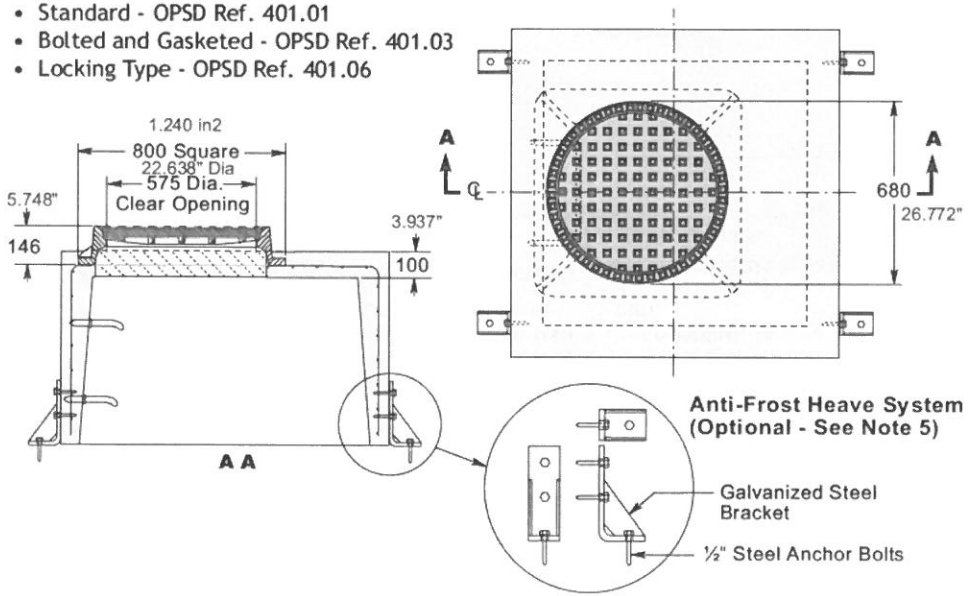
NOTES

0.984, 1.969, 2.953, 3.937, 4.921, 5.906 ft

1. Available in heights of .3, .6, .9, 1.2, 1.5 and 1.8 metres.
2. Neoprene gasket - Optional.
3. Polyethylene coated aluminum ladder rungs available on request. Some designs utilize a custom made ladder to the floor of the chamber.
4. Standard sizes - 600, 750 and 900 mm square. 23.622, 29.528, 35.433 in
5. Optional galvanized steel Anti-Frost Heave System ensures a permanently watertight connection with the top of the tank.

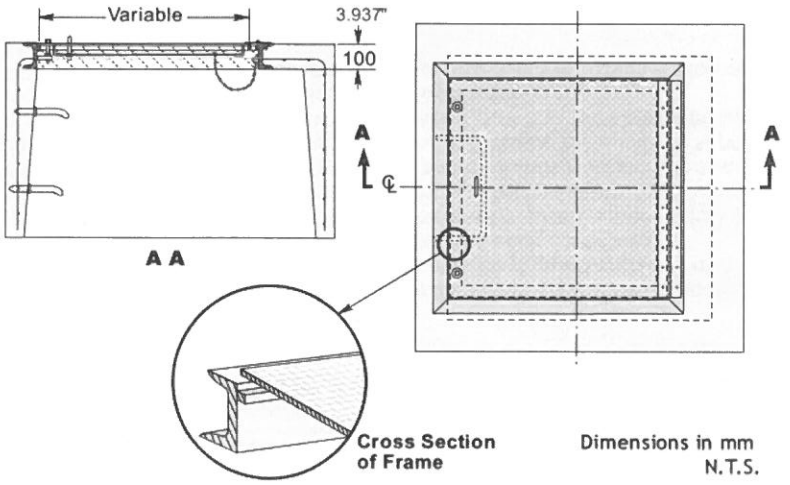
AVAILABLE CAST IRON FRAMES & COVERS

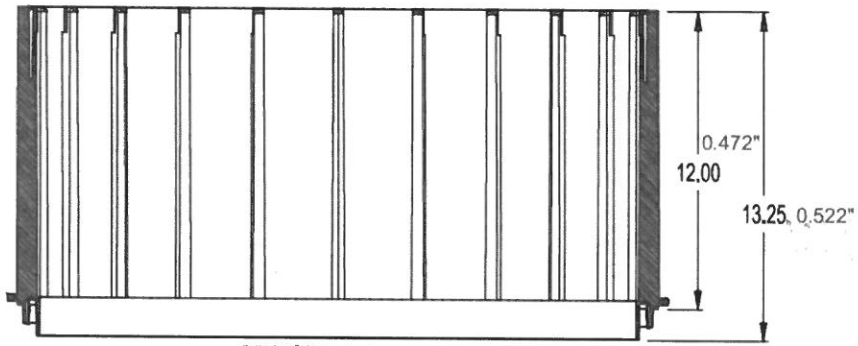
- Standard - OPSD Ref. 401.01
- Bolted and Gasketed - OPSD Ref. 401.03
- Locking Type - OPSD Ref. 401.06



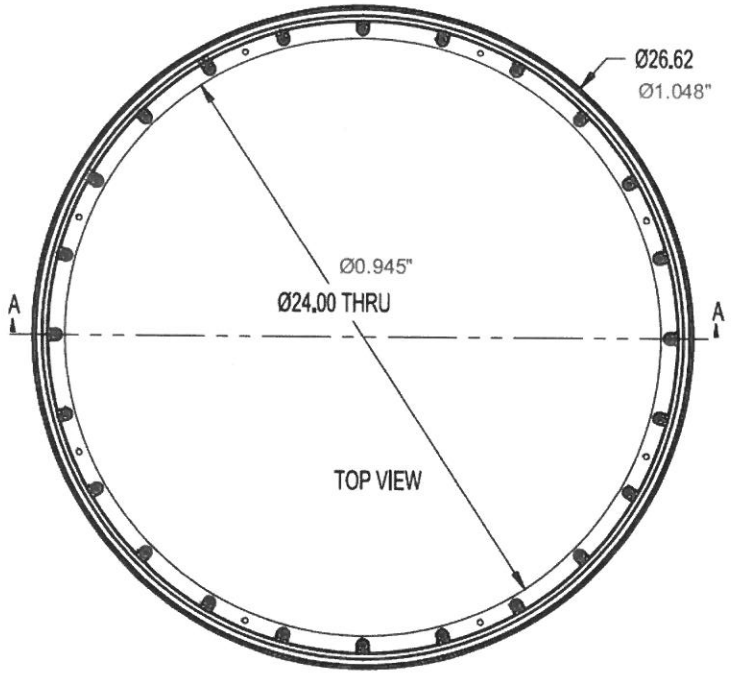
FLUSH TYPE FRAME & COVER

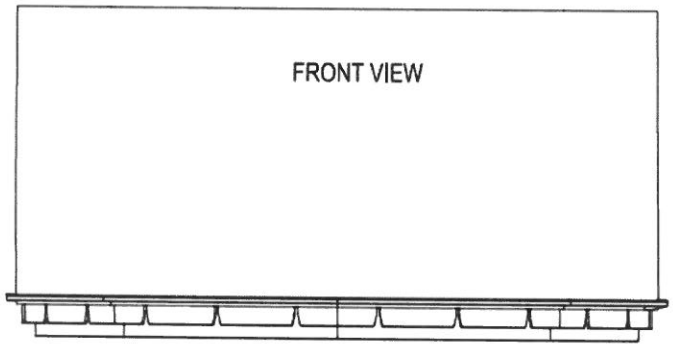
- Available in Stainless Steel or Aluminum.

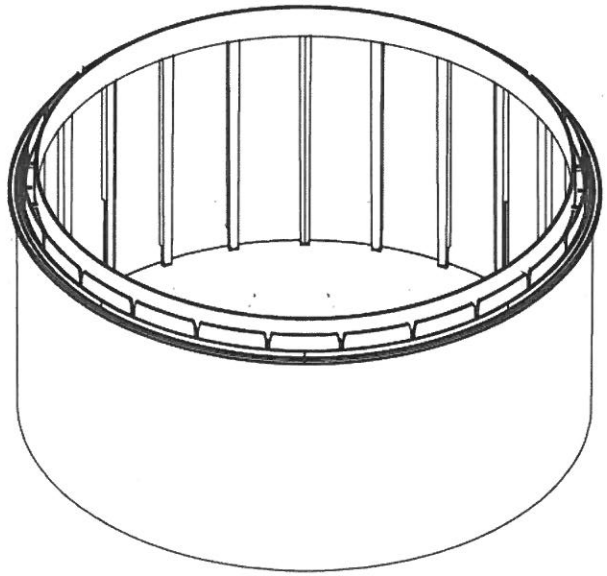


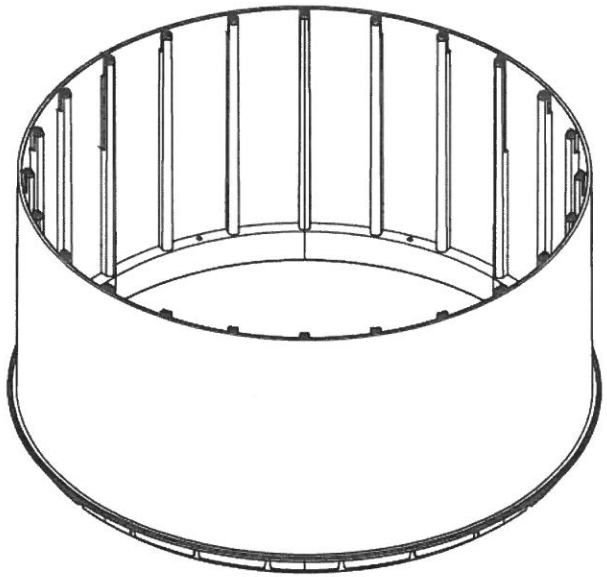


SECTION A-A









POLYLOK 12 X 24 RISER
PART NO. 3008-R12
MATERIAL - HPDE
COLOR - GREEN

PRECAST 3 x 4 METRE RECTANGULAR MANHOLE

WILKINSON HEAVY PRECAST LIMITED
DUNDAS, ONTARIO 905-628-5611
www.wilkinsonheavyprecast.com

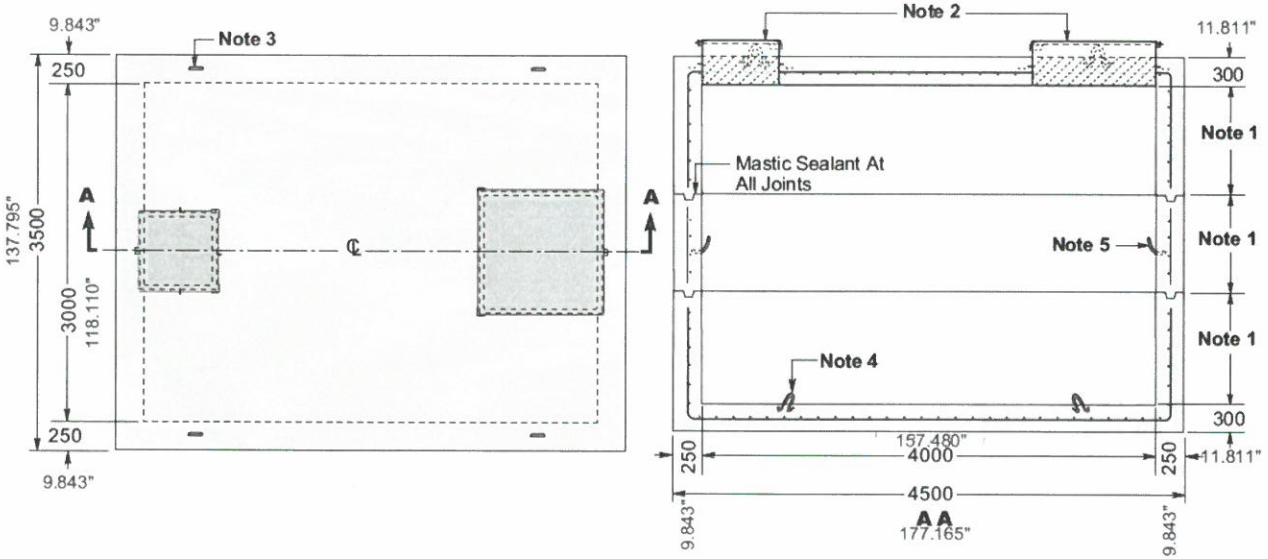
CONSTRUCTION DETAILS

Concrete: 35 MPa at 28 Days, 5 to 8% Air Entrainment. Precast concrete materials and construction conforms with CSA A23.4-00 5076.320 psi

Reinforcing: * 10 M bars at 150 mm centres each way in roof, walls and floor. Eight extra 15 M bars around roof access opening. 49.213 ft Minimum cover over reinforcing steel - 25 mm. 0.984" 32.808 ft 5.906"

Weight: Base/Roof Slab 11,500 kg 25353.160 lbs
Walls 9200 kg/Vertical Metre 6182.115 lbs/Vertical Foot

Calculation for Pump Chamber Capacity: 12,000 Litres/Vertical Metre 966.236 gal Per Vertical Ft



Dimensions in mm
N.T.S.

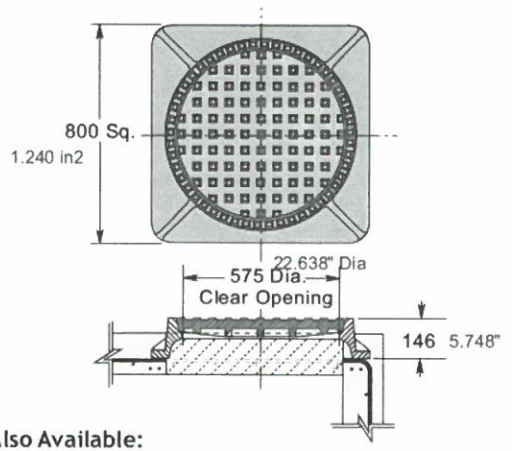
NOTES

1. Available in heights of 1 and 1.5 Metres 3.281, 4.921 ft
2. Drip proof and lockable frame and cover shown cast into top slab. Standard construction is 5 mm low carbon steel plate, hot dip galvanized after fabrication. This design is also available in aluminum or stainless steel. 0.197"
3. Top section lifting points four places.
4. Bottom section lifting points four places.
5. Lifting points in walls four places.

* Reinforcing detail can be customized to suit conditions of installation.

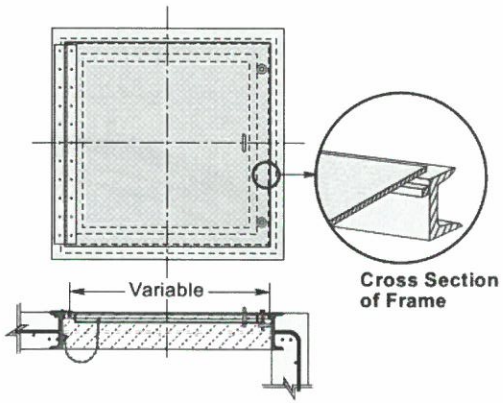
OPTIONAL COVERS - Cast Into Top Slab

STANDARD CAST IRON FRAME and COVER
OPSD Ref. 401.01



Also Available:
Bolted and Gasketed Frame and Cover - OPSD Ref. 401.03 and Locking Cover - OPSD Ref. 401.06

FLUSH TYPE FRAME and COVER



Available in Galvanized Steel, Stainless Steel or Aluminum

WARNING ! IMPROPER INSTALLATION ESPECIALLY IN UNSTABLE SOILS CAN RESULT IN THE STRUCTURAL FAILURE OF THIS PRODUCT

4 September, 2008

PRECAST SQUARE MANHOLE 2.5 M Square

WILKINSON HEAVY PRECAST LIMITED
DUNDAS, ONTARIO 905-628-5611
www.wilkinsonheavyprecast.com

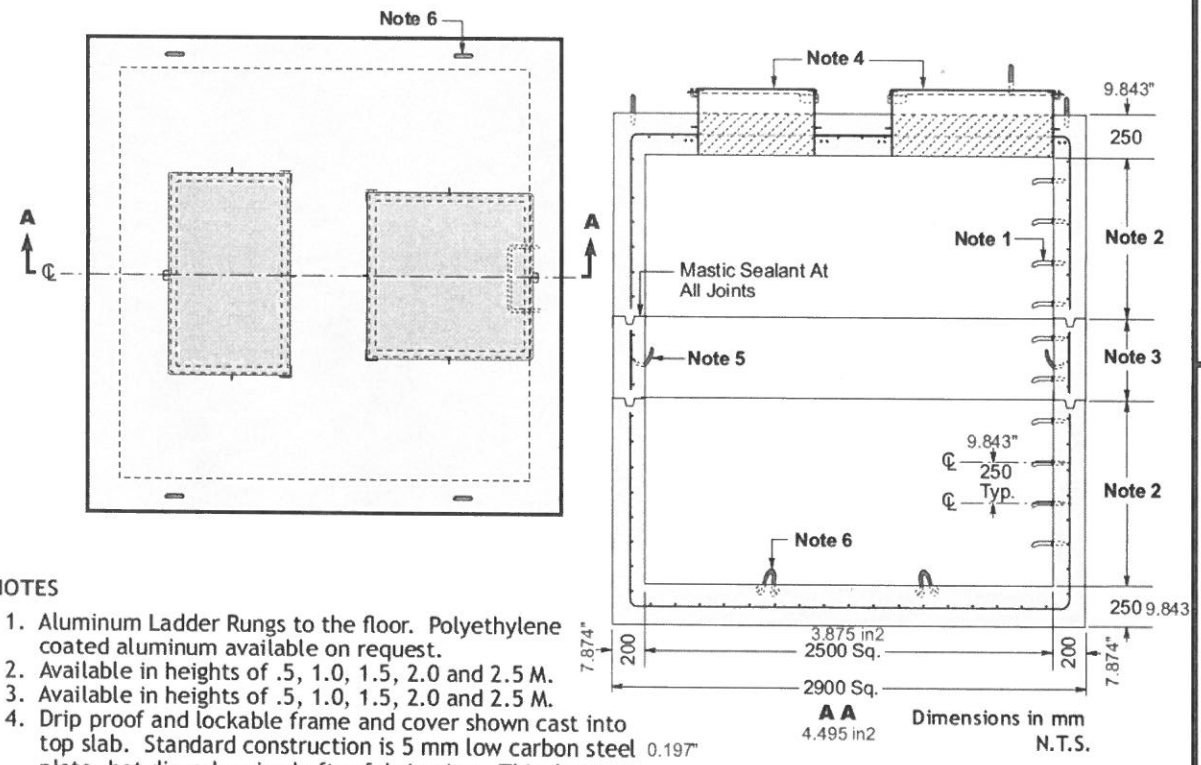
CONSTRUCTION DETAILS

Concrete: 35 MPa (5076.320 psi) at 28 Days, 5 to 8% Air Entrainment. Precast concrete materials and construction conforms with CSA A23.4-00

Reinforcing:* 10 M bars at 150 mm centres each way in roof, walls and floor. Extra 20 M bars around roof access opening. 65.617 ft
Minimum cover over reinforcing steel - 25 mm. 0.984" (32.808 ft 5.906")

Weight: Base/Roof Slab 5200 kg 11464.040 lbs
Walls 5335 kg/Vertical Metre 3584.954 lbs/Vertical Foot

Calculation for Pump
Chamber Capacity: 6250 Litres/Vertical Metre 503.248 gal Per Vertical Ft



NOTES

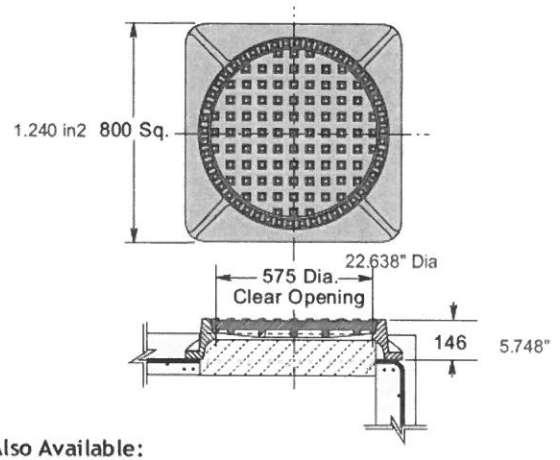
1. Aluminum Ladder Rungs to the floor. Polyethylene coated aluminum available on request.
2. Available in heights of .5, 1.0, 1.5, 2.0 and 2.5 M.
3. Available in heights of .5, 1.0, 1.5, 2.0 and 2.5 M.
4. Drip proof and lockable frame and cover shown cast into top slab. Standard construction is 5 mm low carbon steel 0.197" plate, hot dip galvanized after fabrication. This design is also available in aluminum or stainless steel.
5. Lifting points in walls four places.
6. Top/bottom section lifting points four places.

* Reinforcing detail can be customized to suit conditions of installation.

2.) 1.640, 3.281, 4.921, 6.562, 8.202 ft
3.) 1.640, 3.281, 4.921, 6.562, 8.202 ft

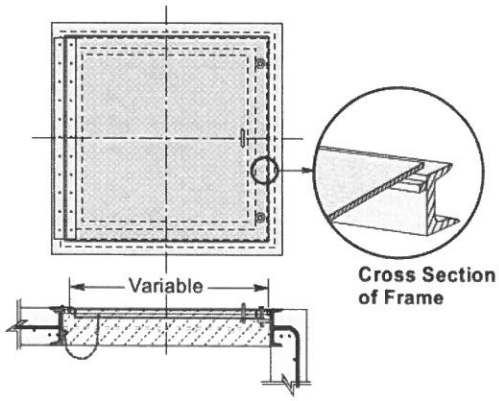
OPTIONAL COVERS - Cast Into Top Slab

STANDARD CAST IRON FRAME and COVER
OPSD Ref. 401.01



Also Available:
Bolted and Gasketed Frame and Cover - OPSD Ref. 401.03
and Locking Cover - OPSD Ref. 401.06

FLUSH TYPE FRAME and COVER



Available in Galvanized Steel, Stainless Steel or Aluminum

WARNING ! IMPROPER INSTALLATION ESPECIALLY IN UNSTABLE SOILS CAN RESULT IN THE STRUCTURAL FAILURE OF THIS PRODUCT

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Appendix F:
WWTP – Blowers – Manufacturer's Cut Sheets

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卓越設計 技術創新

GREAT DESIGN TECHNICAL INNOVATION

節能減碳高效率 - 廣勝魯氏鼓風機

ENERGY CONSERVATION & HIGH EFFICIENCY - GREATECH ROOTS BLOWER

SdB系列 SdB Model

性 能

口徑: 40mm~200mm (1.5"~8")
風量: 0.6~34 m³/min (36~2040 m³/hr)
壓力: 0~8000 mmAq (0~0.8 kgf/cm²)

Performance

Bore Size: 40mm~200mm(1.5"~8")
Capacity: 0.6~34 m³/min(36~2040 m³/hr)
Pressure: 0~8000 mmAq(0~0.8 kgf/cm²)

特 點

三葉魯氏鼓風機
循環氣流、全機冷卻
超低噪音、超低震動
節能省電、高效率
直立設計、省空間
結構堅固、易保養
氣體潔淨、無油汙
直結傳動、免皮帶

Advantage

Tri-Lobe Roots Blower
Air cooled and circulated for whole blower
Operate quietly,Extreme low vibration
Saving electicity and gear oil
Vertical design,Space saving
Strong construction,Easy maintenance
Clean air, Oil free conveying
Coupling driven,No need belt

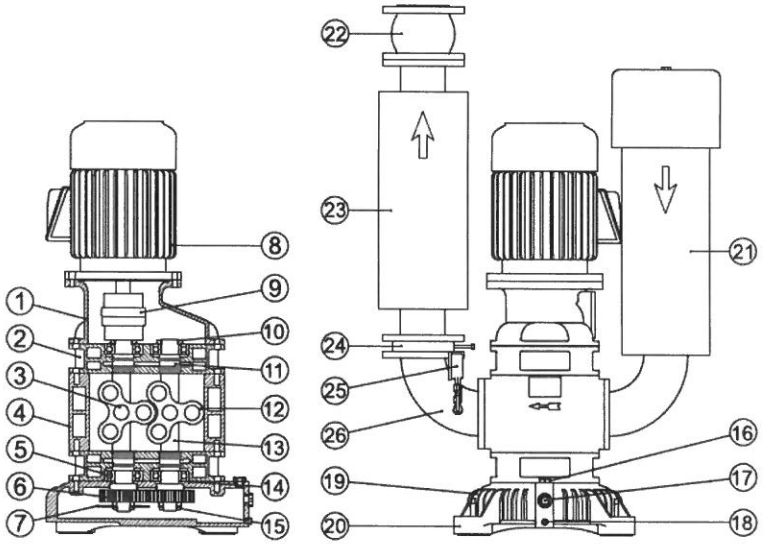
用 途

廢水處理、水產養殖、粉粒輸送、穀類輸送、造紙工業、食品工業、電鍍、半導體工業、化學工業...等更適合安裝於醫院、學校、飯店、住宅區、辦公大樓及其他需要安靜的場所。

Application

Waste Water Treatment, Aquaculture, Electroplating Industry, Powder Conveyance, Grain Transport, Paper production Food Industry, Semiconductor Industry, Chemical Industry...etc.
Especially suitable to install in Hospital, School,Hotel,Residential Area,Office Building, where need low noise

構造圖&材質表 Construction & Material List



No.	Item		Material
1	motor case	馬達座	FC250
2	bearing case	軸承座	FC250
3	drive shaft	主動軸	SCM440
4	cylinder	汽 缸	FC250
5	bearing	軸 承	SUJ2
6	gear	齒 輪	SCM415
7	oil splash	甩油板	SS400
8	motor	馬 達	
9	coupling	聯軸器	FCD500
10	screw nut	螺 帽	SS400
11	shaft seal	軸 封	S45C
12	rotor	葉 輪	FC250
13	driven shaft	被動軸	SCM440

No.	Item		Material
14	bearing plate	軸承壓板	SS440
15	screw nut	螺 帽	SS400
16	oil plug	加油塞	S45C
17	oil gauge	油 鏡	S45C
18	oil drainer	洩油塞	S45C
19	gear oil box	齒輪箱	FC250
20	vibration isolator	防震腳	NBR
21	suction silencer	入口消音器	SS400
22	flexible joint	防震接頭	NBR
23	discharge silencer	出口消音器	SS400
24	check valve	逆止閥	FC250
25	pressure gauge	壓力表	SUS304
26	elbow joint	出口彎頭	SS400

性能表 Performance Table

入口風量及出口壓力 Suction Air & Discharge Pressure

Greatech Circulating Air Cooling Roots Blower 50HZ-4P

型號 Model	口徑 Bore (mm)	壓力 Pressure (mmAq)				風量 Capacity (m^3/min)				功率 Power (kW)			
		1000 mmAq		2000 mmAq		3000 mmAq		4000 mmAq		5000 mmAq		6000 mmAq	
		m^3/min	kW	m^3/min	kW	m^3/min	kW	m^3/min	kW	m^3/min	kW	m^3/min	kW
SdB40	40	0.74	0.42	0.66	0.47	0.60	0.53	0.54	0.61	0.49	0.69	0.44	0.80
SdB45	40	0.96	0.53	0.86	0.66	0.78	0.78	0.70	0.89	0.63	0.99	0.57	1.07
SdB50	50	1.89	0.99	1.77	1.23	1.66	1.38	1.45	1.57	1.32	1.78	1.15	2.00
SdB60	65	2.39	1.33	2.23	1.54	2.09	1.78	1.91	2.07	1.82	2.47	1.75	2.79
SdB65	65	2.76	1.49	2.59	1.72	2.42	2.12	2.27	2.50	2.16	2.84	1.92	3.10
SdB75	80	3.38	1.79	3.18	2.31	3.00	2.67	2.80	3.12	2.62	3.71	2.53	4.25
SdB80	80	4.52	2.72	4.31	3.23	4.15	3.96	3.94	4.73	3.73	5.28	3.55	5.92
SdB90	100	6.43	3.89	6.04	4.62	5.73	5.46	5.43	6.62	5.17	7.61	4.92	8.73
SdB100	100	8.24	5.54	7.78	6.19	7.37	7.25	7.00	8.18	6.68	9.27	6.40	10.5
SdB110	125	9.98	7.05	9.43	8.25	8.93	10.1	8.48	11.3	8.09	12.4	7.75	13.8
SdB125	125	11.4	7.80	10.8	8.83	10.2	10.7	9.69	12.8	9.24	14.6	8.85	16.2
SdB150	150	19.6	10.5	18.8	12.3	18.1	15.2	17.4	17.5	16.9	20.6	16.4	23.7
SdB160	150	28.0	14.8	26.7	18.1	25.5	22.1	24.4	25.8	23.4	29.2	22.6	33.1

0.75kw=1HP,1.5kw=2HP,2.2kw=3HP,3.7kw=5HP,5.5kw=7.5HP,7.5kw=10HP
11kw=15HP,15kw=20HP,18.5kw=25HP,22kw=30HP,30kw=40HP,37kw=50HP

Greatech Circulating Air Cooling Roots Blower 60HZ-4P

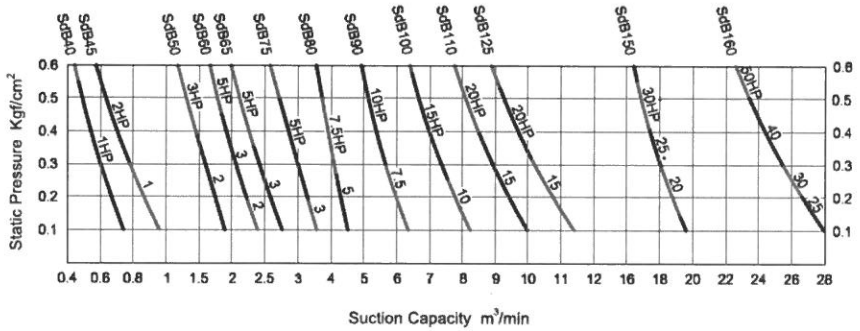
型號 Model	口徑 Bore (mm)	壓力				風量 Capacity (m^3/min)				功率 Power (kW)			
		1000 mmAq		2000 mmAq		3000 mmAq		4000 mmAq		5000 mmAq		6000 mmAq	
		m^3/min	kW	m^3/min	kW	m^3/min	kW	m^3/min	kW	m^3/min	kW	m^3/min	kW
SdB40	40	1.05	0.49	0.94	0.56	0.83	0.65	0.75	0.75	0.67	0.87	0.62	1.01
SdB45	40	1.20	0.65	1.09	0.83	0.98	0.98	0.89	1.12	0.80	1.19	0.73	1.28
SdB50	50	2.23	1.12	2.10	1.39	1.97	1.55	1.88	1.79	1.81	1.94	1.72	2.14
SdB60	65	2.74	1.71	2.52	1.95	2.42	2.26	2.33	2.57	2.27	2.94	2.22	3.35
SdB65	65	3.15	1.86	2.92	2.12	2.76	2.46	2.64	2.83	2.55	3.20	2.47	3.60
SdB75	80	4.47	2.47	4.23	2.85	3.99	3.28	3.76	3.67	3.53	4.26	3.31	4.82
SdB80	80	6.17	3.36	5.90	3.97	5.65	4.83	5.42	5.64	5.18	6.30	4.96	6.89
SdB90	100	8.39	4.62	7.98	5.82	7.62	6.72	7.31	7.93	7.06	9.01	6.85	10.7
SdB100	100	11.7	6.33	11.2	7.01	10.7	8.29	10.3	9.38	9.90	11.1	9.60	12.4
SdB110	125	13.9	8.08	13.2	9.25	12.6	11.2	12.1	12.6	11.7	14.1	11.3	15.7
SdB125	125	16.3	9.12	15.5	10.7	14.7	13.2	14.1	14.8	13.5	16.2	13.0	17.8
SdB150	150	24.3	11.9	23.5	14.7	22.9	18.0	22.2	21.5	21.6	24.3	21.0	27.6
SdB160	150	33.9	15.7	32.7	18.9	31.6	23.4	30.6	27.8	29.5	32.0	28.5	36.2

	Bore (in)	1000mmAq		2000mmAq		3000mmAq		4000mmAq		5000mmAq		6000mmAq	
		ft3/min	kW	ft3/min	kW	ft3/min	kW	ft3/min	kW	ft3/min	kW	ft3/min	kW
SdB65	2.560	111.241	1.86	103.119	2.12	97.468	2.46	93.231	2.83	90.052	3.20	87.227	3.60
SdB75	3.150	157.857	2.47	149.381	2.85	140.906	3.28	132.783	3.67	124.661	4.26	116.892	4.82
SdB100	3.937	413.182	6.33	395.524	7.01	377.867	8.29	363.741	9.38	349.615	11.1	339.021	12.4
SdB150	5.906	858.146	11.9	829.895	14.7	808.706	18.0	783.986	21.5	762.797	24.3	741.608	27.6

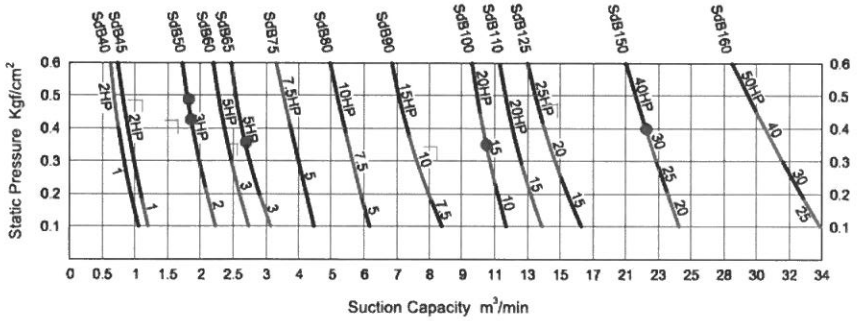
性能曲線 Performance Curve

1 Kgf/cm² = 14.2 psi
1 m³/min = 35.3 cfm

50HZ-4P

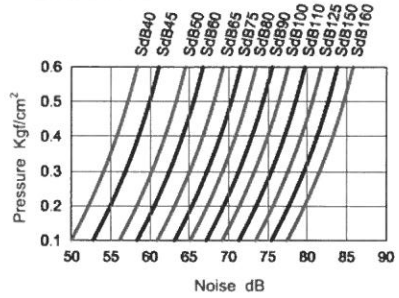


60HZ-4P

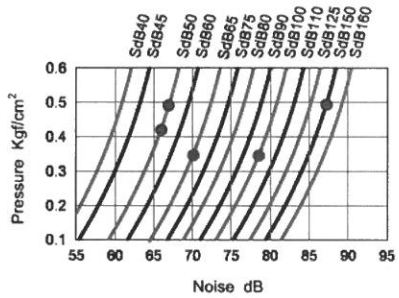


噪音曲線 Noise Curve

50HZ-4P



60HZ-4P

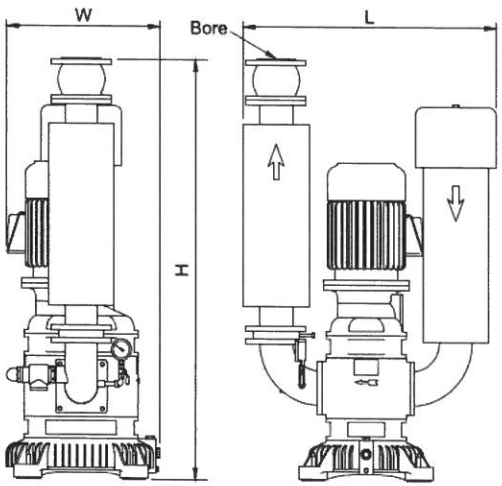


外型尺寸 Outline Dimension

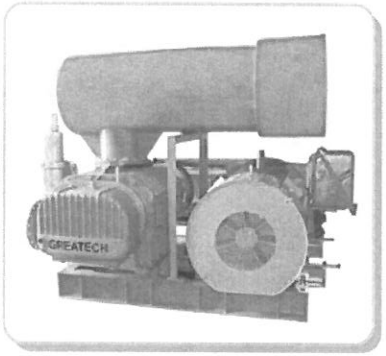
	L	W	H	Bore
SdB50	26.378"	16.535"	36.024"	2"
SdB65	28.622"	17.717"	36.811"	2.5"
SdB100	37.480"	22.835"	56.614"	4"
SdB150	49.843"	27.677"	81.496"	6"

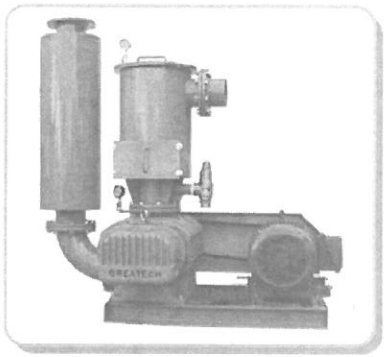
Unit=mm

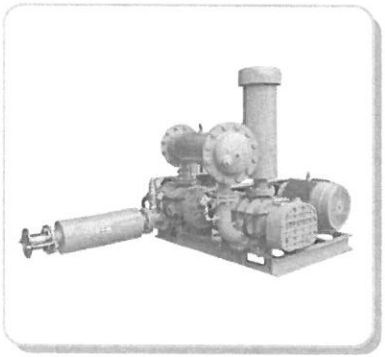
型號 Model	長 L	寬 W	高 H	口徑 Bore
SdB40	590	345	707	1.5"
SdB45	590	345	737	1.5"
SdB50	670	420	915	2"
SdB60	687	428	960	2" / 2.5"
SdB65	727	450	935	2.5"
SdB75	824	465	1250	2.5" / 3"
SdB80	824	465	1295	3"
SdB90	880	533	1408	4"
SdB100	952	580	1438	4"
SdB110	1060	580	1987	5"
SdB125	1070	580	2015	5"
SdB150	1266	703	2070	6"
SdB160	1266	703	2115	6" / 8"



其他產品 Other Products







單位換算 Unit Conversion

壓力 Pressure

Kgf/cm²	kPa	mbar	psi	mmAq mmH₂O	Torr mmHg
1	98.0665	980.665	14.2231	10,000	735.559
0.010197	1	10	0.145	101.9716	7.50062
0.001019	0.1	1	0.0145	10.19716	0.750062
0.07031	6.895	68.95	1	703.08	51.7157
0.0001	0.009806	0.098	0.001422	1	0.073556
0.00136	0.13332	1.33321	0.019336	13.5951	1

風量 Capacity

CMM (m³/min)	CFM (ft³/min)	LPM (l/min)
1	35.32	1000
0.0283	1	28.3125
0.001	0.0353	1

功率 Power

kW	HP	PS
1	1.3404	1.3596
0.746	1	1.0143
0.7355	0.9859	1

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Appendix G:
WWTP – Air Diffusers – Manufacturer's Cut Sheets

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a division of Environmental Dynamics International

Parts Catalog

diffuser express®

5601 Paris Road
Columbia, MO 65202
Tel: 573-474-9456
sales@diffuserexpress.com
www.diffuserexpress.com

Dear Valued Customer,

Welcome to Diffuser Express®, a service division of EDI, committed to excellence in supplying diffusers, membranes, and specialty diffuser items for new and existing water and wastewater treatment applications. The programs available from Diffuser Express are structured to deliver EDI's quality products with "express" service and competitive pricing. Diffuser Express services all major brands.

The Diffuser Express catalog and our online catalog is your connection to EDI's advanced technology aeration products for new construction and upgrade projects. Diffuser Express also stocks a multitude of replacement membranes and parts to upgrade your existing systems for improved operating efficiency or increased capacity.

EDI's products will keep your aeration system at the front edge of technology. Our flexible membrane diffusers employ proprietary materials and specialized manufacturing techniques for maximum oxygen transfer efficiency, air handling, and service life performance.

When application know-how or total system design assistance is required, Diffuser Express can serve as a direct link to EDI's Application Engineering Group. From here, you will benefit from the vast aeration and biological treatment expertise that EDI has amassed from servicing over 400 million customers from around the world since 1975.

EDI is confident that you will be pleased with the quality products and customer service provided from Diffuser Express and we look forward to improving the performance of your aeration and biological treatment system.

Sincerely,

Environmental Dynamics International

CONTENTS

T-Series Diffuser

The FlexAir™ T-Series diffuser unit is a fine pore, flexible membrane diffuser capable of providing a high level of oxygen transfer efficiency with maximum operating flexibility.

T-Series units are configured with a premium quality EPDM rubber membrane sleeve specifically perforated for high volumetric air-handling capacity. For industrial and non-standard domestic applications, alternate membrane materials including urethane, silicone, and other specialty polymers are available.

Alternate perforation patterns are available for energy sensitive applications or where maximum oxygen transfer efficiency is desired. EDI also offers a variety of sizes of diffusers to meet airflow requirements.

The FlexAir T-Series diffuser unit may be operated over a wide range of airflows and requires minimum maintenance for long-term performance. The triple-check valve system eliminates the intrusion of water and solids into the diffuser unit and air supply piping under normal operation conditions.

Standard T-Series diffusers with 3/4-inch NPT (male) stainless steel nipples are factory assembled and ready for installation. For specialty applications alternate inlet connections are available.

T-Series Diffuser

Specifications:

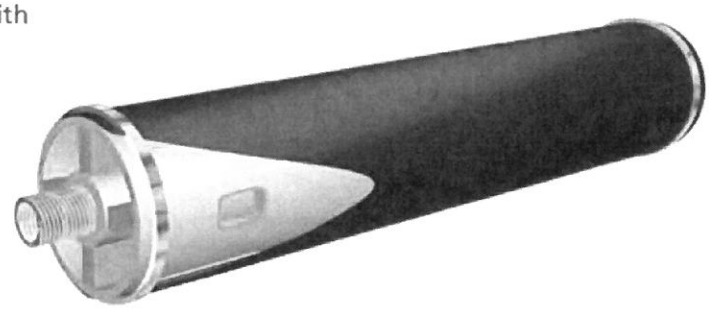
Diffuser body constructed of ABS and PVC; alternate materials available.

Standard configuration includes 3/4-inch stainless steel nipple installed. The stainless steel nipple can also be shipped loose, or EDI can provide a thru-mount connection for mounting units on square tubing.

Standard diffuser membranes are EPDM and PU, with Silicone and PTFE membranes available.

Multiple lengths and diameters available.

Membranes held in place with 304 SS clamps. 316 SS clamps available. Call for pricing.



Benefits:

Economical capital cost and ease of installation

Designed for coarse bubble diffuser to fine bubble diffuser upgrades

More energy efficient than coarse bubble

Several membrane perforation patterns from which to choose

Please contact Diffuser Express with technical questions regarding product selection.

1-877-EDI-AIR8 (334-2778) or 573-474-9456
email: sales@diffuserexpress.com

FlexAir™ Fine Bubble Parts

Disc Diffusers

The FlexAir™ disc diffuser is a fine pore flexible membrane or ceramic media diffuser that provides operational flexibility with maximum oxygen transfer efficiency.

For ease of installation and maintenance, EDI's disc diffusers offer two connection methods: threaded and integrated saddle mount. The threaded disc diffuser can be installed in any 3/4-inch fitting or pipe nipple. Pipe with wall thickness equal to or greater than SCH40 can be drilled and tapped for connecting the diffuser. Additionally, diffusers can be installed using UDM (see "Specialty Disc Diffuser Items") when using thinner wall pipe for air distribution.

The 9-inch diameter diffuser is also available with EDI's innovative Integral Saddle Mount, which provides unmatched mechanical strength.

Disc diffusers are constructed of glass-filled polypropylene and suitable for deep tank (high-temperature) applications. Alternate materials of constructions are available for special applications.

FlexAir disc diffuser units are available with premium quality EPDM membranes. Multiple perforation patterns are available to optimize system performance. The flexible membrane diffusers incorporate a triple-check valve design to prevent intrusion of liquid or solids into the diffuser or air piping under normal on/off operating conditions.

The 9-inch Spectrum Saddle Mounted Diffuser is also available with premium quality ceramic media diffusers. The ceramic disc diffuser is best suited for continuous aeration applications where maximum online service life is required.

Threaded Disc Diffuser

Specifications:

Exclusively available in 7", 9" & 12" models

Glass fiber-reinforced polypropylene construction for maximum chemical, temperature, and UV resistance

Advanced technology premium-quality membrane materials available in EPDM and other special polymer blends

Resistant to fouling and plugging for low maintenance

High-capacity membrane option available for maximum airflow and low operating pressure

Benefits:

Economical capital cost and ease of installation

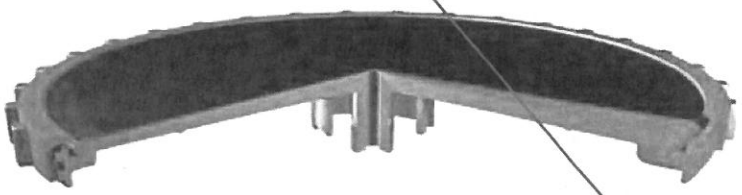
Available in 7", 9", & 12" or 90mm & 110mm

Mounts on any pipe material (PVC, ABS, CPVC, & SS)

Patented EZ Seal for quick hand-tight seal

Rugged heavy-duty construction

Pre-assembled in our facilities



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email: sales@diffuserexpress.com

FlexAir™ Fine Bubble Parts

Integral Saddle Mounted Disc Diffuser

Specifications:

Exclusively available for 9" and 12" diameter discs

Glass fiber-reinforced polypropylene construction for maximum chemical, temperature, and UV resistance

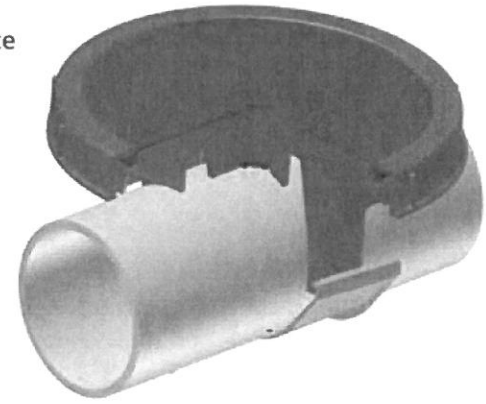
Advanced technology premium-quality membrane materials available in EPDM and other special polymer blends

Triple-check valve design prevents entry of liquid/solids into piping. Ideal for on/off applications

Resistant to fouling and plugging for low maintenance

Integral Saddle Mount provides ease of installation and maintenance

High-capacity membrane option available for maximum airflow and low operating pressure



Benefits:

3 times stronger than conventional mounting or push-on systems

Pre-assembled and leak tested in our facilities

Patented KlicLoc™ retainer for positive mechanical lock

Spectrum™ *Ceramic* Saddle Mounted Disc Diffuser

Specifications:

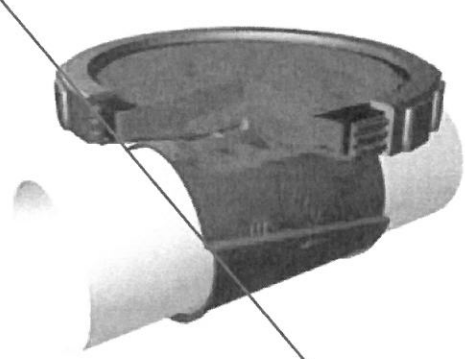
Base and ring are constructed of glass-filled polypropylene.

Spectrum™ Saddle Mount withstands 200-pound edge load without failure with KlicLoc™ retainer for positive mechanical mount.

Standard diffuser media is aluminum oxide.

Available saddle sizes: 3", 4", 90mm, 110mm diameter pipe.

Ceramic and membrane media options are interchangeable.



Please contact Diffuser Express with technical questions regarding product selection.

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email: sales@diffuserexpress.com

FlexAir™ Fine Bubble Parts

Product Data

T-Series Diffuser

Part Number	Model	Membrane Material	Design Airflow		Active Surface Area		Diffuser Dimensions	
			scfm	N m³/hr	ft²	m²	DxL	DxL
00249	62x610	Urethane	2-8	3-14	1.00	.09	2.6x24	66x610
00250	62x610	EPDM	2-8	3-14	1.00	.09	2.6x24	66x610
00251	62x650	Urethane	2-9	3-15	1.07	.1	2.6x26	66x650
00252	62x650	EPDM	2-9	3-15	1.07	.1	2.6x26	66x650
01202	62x762	Urethane	3-10	5-17	1.28	.12	2.6x30	66x762
01026	62x762	EPDM	3-10	5-17	1.28	.12	2.6x30	66x762
01030	62x1003**	Urethane	3-14	5-24	1.71	.16	2.6x39	66x1003
01029	62x1003**	EPDM	3-14	5-24	1.71	.16	2.6x39	66x1003
00253	91x502	Urethane	4-13	7-22	1.25	.12	3.7x20	95x502
00256	91x502	EPDM	4-13	7-22	1.25	.12	3.7x20	95x502
00259	91x762	Urethane	7-20	12-34	1.97	.18	3.7x30	95x762
00262	91x762	EPDM	7-20	12-34	1.97	.18	3.7x30	95x762
00265	91x1003**	Urethane	9-27	15-46	2.64	.25	3.7x39	95x1003
00268	91x1003**	EPDM	9-27	15-46	2.64	.25	3.7x39	95x1003

*Peak airflow is approx twice the design airflow

Threaded Disc Diffuser

Part Number	Model	Design Airflow		Active Surface Area		Diffuser Diameter	
		scfm	N m³/hr	ft²	m²	in	mm
01691	7" Micro	3.0	4.8	.26	.024	9.0	299
02001	7" High Capacity	7.5	12	.26	.024	9.0	229
01798	9" Micro	6.0	9.5	.41	.038	10.9	277
01799	9" High Capacity	10	16	.41	.038	10.9	277
06078	12" Micro	9.4	15	.64	.059	12.9	328
06080	12" High Capacity	16	25	.64	.059	12.9	328

*Peak airflow is approx twice the design airflow

Integral Saddle Mount Diffuser

Part Number	Model	Design Airflow		Active Surface Area		Diffuser Diameter	
		scfm	N m³/hr	ft²	m²	in	mm
CALL	9" Micro	6.0	9.5	0.41	0.038	10.9	277
CALL	9" High Capacity	10	16	0.41	0.038	10.9	277
CALL	12" Micro	9.4	15	0.64	0.059	12.9	328
CALL	12" High Capacity	16	25	0.64	0.059	12.9	328

*Peak airflow is approx twice the design airflow

Spectrum™ Ceramic Saddle Diffuser

Part Number	Model	Design Airflow		Active Surface Area		Diffuser Diameter	
		scfm	N m³/hr	ft²	m²	in	mm
CALL	9" Standard	10	16	.41	.038	10.9	277

*Peak airflow is approx twice the design airflow

PermaCap™ Coarse Bubble Diffuser

EDI PermaCap diffusers are effective and efficient coarse bubble membrane diffuser units. PermaCap coarse bubble units offer great value as a low-cost aeration/mixing solution.

PermaCap units are configured with a premium-quality EPDM membrane perforated to minimize bubble coalescence. The flexible membrane is specifically designed to exclude solids and provide long-term trouble-free operation. Diffuser base and retaining ring are manufactured from durable ABS.

The PermaCap diffuser may be operated over a wide range of airflows and requires minimum maintenance for long-term performance. The integral check valve eliminates the intrusion of water and solids into the air piping under normal on/off operations.

PermaCap units are available with either 3/8-inch diameter NPT (male) or 3/4-inch diameter NPT (male) threaded inlet to allow quick and simple installation into threaded pipe applications. 3/4-inch units can be mounted using the Universal Diffuser Mount (see "Specialty Disc Diffuser Items").

Units are particularly suited for single drop pipe installation in package treatment plants and channel aeration. Units are suitable for mounting on either the top or bottom of the air distribution piping.

PermaCap™ Coarse Bubble Diffuser

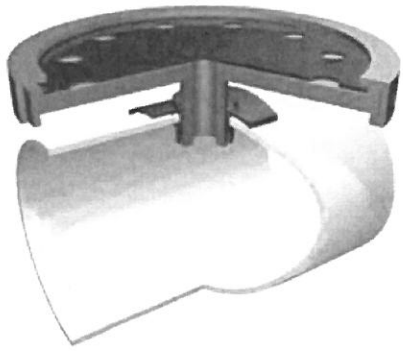
Specifications:

Base and ring are constructed of ABS.

Base unit connection is 3/4" or 3/8" male NPT.

Standard diffuser membranes are EPDM.

Larger 5" diameter for maximum air distribution



Part Number	Model	Design Airflow		Diffuser Diameter	
		scfm	N m³/hr	in	mm
00732	Coarse 3/8"	2–20	2–32	5.0	127
00137	Coarse 3/4"	2–20	2–32	5.0	127
00831	Medium 3/8"	1–8	1–13	5.0	127
00555	Medium 3/4"	1–8	1–13	5.0	127

Please contact Diffuser Express with technical questions regarding product selection.

1-877-EDI-AIR8 (334-2778) or 573-474-9456
email: sales@diffuserexpress.com

MaxAir™ SS Coarse Bubble Diffuser

EDI MaxAir SS diffusers are stainless steel coarse bubble diffuser assemblies used for maximum mixing applications. Units offer superior coarse bubble distribution and maximum air-handling capacity with good oxygen transfer.

Diffusers are constructed of superior materials for long service life. Diffuser body is heavy gauge 316 SS sheet and is continuous welded to 316 SS cast inlet and ends.

MaxAir SS units can be applied in even the most demanding aeration/mixing applications including flow equalization, channel mix/aerate, and aerobic digester aeration/mixing applications.

The open bottom construction minimizes possible entrapment of solids in the unit when shut off providing superior long-term operation. If required EDI can supply the MaxAir units with an optional deflector installed.

MaxAir SS diffusers employ a 3/4-inch diameter NPT (male) threaded inlet for ease of installation and universal application. EDI offers 12-inch and 24-inch SS MaxAir Diffuser Units to meet your application needs.

MaxAir™ SS Coarse Bubble Diffuser

Specifications:

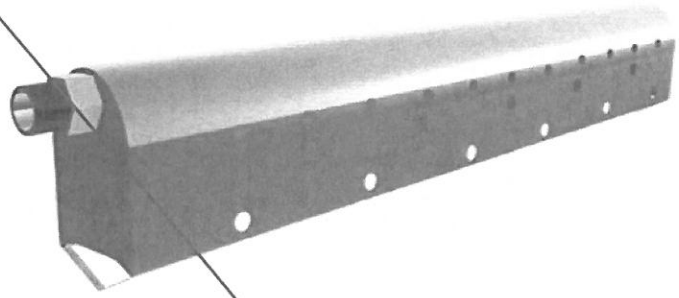
Heavy duty 316 SS construction

3/4" male NPT nipple for connection

Cast inlet and end cap

Continuous welded construction

Open bottom or closed bottom (with deflector) options



Part Number	Model	Design Airflow		Length	
		scfm	N m³/hr	in	mm
00864	12" Open Bottom	0–30	0–48	12.4	315
00866	12" w/ Deflector	0–30	0–48	12.4	315
00865	24" Open Bottom	0–55	0–87	24.0	620
00867	24" w/ Deflector	0–55	0–87	24.0	620

Please contact Diffuser Express with technical questions regarding product selection.

1-877-EDI-AIR8 (334-2778) or 573-474-9456
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Environmental Dynamics International
5601 Paris Rd Columbia MO 65202
+1 (573)-474-9456

Appendix H:
WWTP – Automatic Backwashing Inline Filters – Manufacturer's Cut Sheets

Project Number: 81235.09

The Chazen Companies
May 13, 2021
Revised February 23, 2022

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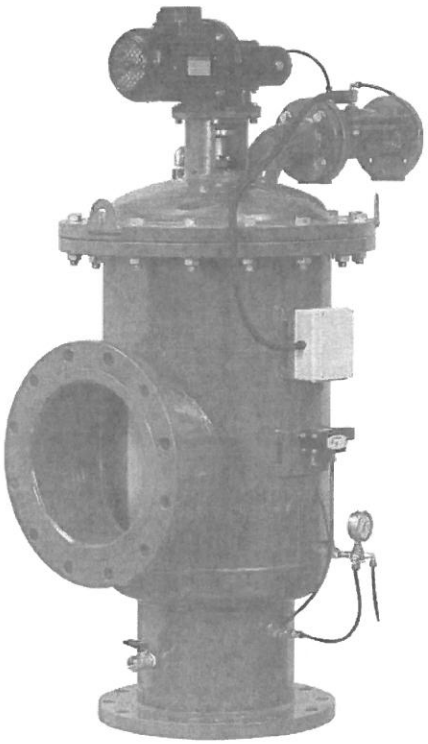
amiad® WATER SYSTEMS | AMIAD

ABF Filters

Automatic self-cleaning filters for high loads of suspended solids and heavy duty applications



flowrates	filtration degrees	water for cleaning	minimum operating pressure
up to 7200 m^3/h (32000 US gpm)	3500-200 micron	less than 1% of the total flow	2 bar (30 psi)

features:

- Heavy duty filter for high loads of suspended solids and high flowrates
- Durable electrically driven revolving-brush cleaning mechanism
- Automatic flushing according to pressure differential and/or time
- Option for continuous flushing
- Low pressure operation, suitable for 2 bar (30 psi) and lower
- No interruption of downstream flow during flushing
- Applications: Water supply systems, cooling water, wastewater treatment
- Industries: manufacturing, mining, water and wastewater treatment plants, turf, agriculture, etc.

How the ABF Strainers Work

General

Amiad's ABF Series consists of heavy duty automatic filters with an electric self-cleaning mechanism. The five models of the "ABF" product line range in flow-rates of up to 7200 m³/h (32000 US gpm) with screens ranging from 3,500-200 micron filtration degree.

The Filtering Process

Raw water enters the inside of the screen-cylinder (1) from the filter's Inlet (2) and flows through the screen to the filter's Outlet (3). The dirt particles are trapped on the inner screen surface and formulate a "filtration cake" that causes a differential pressure across the screen.

The Self-Cleaning Process

During the self-cleaning process, filtered process water continues to flow. The Exhaust Valve (4) opens and the Drive Unit (5) rotates two stainless steel brushes (6) which sweep the inner surface of the cylindrical screen. The particles trapped on the screen are dislodged by the brushes and flushed out the exhaust valve.

The Control System

The control system is comprised of a Pressure Differential Switch (7) that senses the pressure differential across the screen and sends a signal to the control board when it reaches a pre-defined value (usually 0.5 bar / 7 psi). The control board initiates the self-cleaning process.

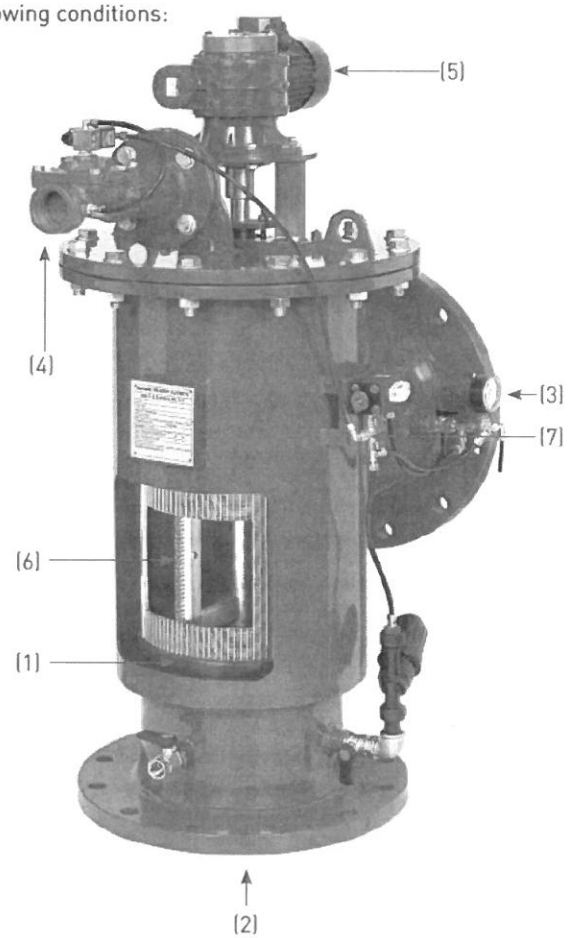
The filter begins a self-cleaning cycle under any one of the following conditions:

1. Receiving a signal from the Pressure Differential Switch
2. Time interval parameter set at the control board
3. Manual Start

"ABF" Models

Amiad's "ABF" product-line consists of the following models:

- ABF-3000 for up to 150 m³/h (660 US gpm)
- ABF-6000 for up to 700 m³/h (3100 US gpm)
- ABF-10000 for up to 1000 m³/h (4400 US gpm)
- ABF-15000 for up to 1800 m³/h (8000 US gpm)
- Mega ABF 40000 up to 4000 m³/h (17600 US gpm)
- Mega ABF 60000 for up to 7200 m³/h (32000 US gpm)



Technical Specifications

Filter Type	ABF-3000	ABF-6000	ABF-10000	ABF-15000	Mega ABF 40000	Mega ABF 60000
General Data						
Maximum flowrate*	150 m³/h (660 US gpm)	700 m³/h (3100 US gpm)	1000 m³/h (4400 US gpm)	1800 m³/h (8000 US gpm)	4000 m³/h (17600 US gpm)	7200 m³/h (32000 US gpm)
Inlet/Outlet diameter	3"-6" (80-150 mm)	8"-14" (200-350 mm)	8"-16" (200-400 mm)	14"-20" (350-500 mm)	16"-28" (400-600 mm)	20"-36" (500-900 mm)
Standard filtration degrees	Perforated screen 3500, 2500, 1500, 800 micron Wedge Wire Screen 800, 500, 300, 200 micron					
Min. working pressure	2 bar (30 psi) 1 bar (15 psi) upon request					
Max. working pressure	10 bar (145 psi) 16 bar (232 psi) upon request					
Max. working temperature	60°C (140°F) 95°C (203°F) upon request					
Electrical Supply	230/480 VAC					
Weight (empty)	110 kg (245 lb)	213-260 kg (470-573 lb)	310-380 kg (683-838 lb)	650 kg (1430 lb)	2250 kg (4960 lb)	6200 kg (13670 lb)

Flushing Data						
Minimum flow for flushing	50 m³/h (220 US gpm)	50 m³/h (220 US gpm)	70 m³/h (300 US gpm)	70 m³/h (300 US gpm)	70-140 m³/h (300-600 US gpm)	70-140 m³/h (300-600 US gpm)
Reject water volume per flush cycle	150 liter (40 US gallon)	200 liter (53 US gallon)	300 liter (80 US gallon)	300 liter (80 US gallon)	1200 liter (317 US gallon)	1200 liter (317 US gallon)
Flushing cycle time	15 seconds	15-30 seconds At 60 Hz			4 x 15-30 seconds	
Exhaust valve	2" 50 mm	2" 50 mm	3" 80 mm	3" 80 mm	4 x 3" 80 mm	4 x 3" 80 mm
Flushing criteria	Differential pressure of 0.5 bar (7psi), time intervals and manual operation					

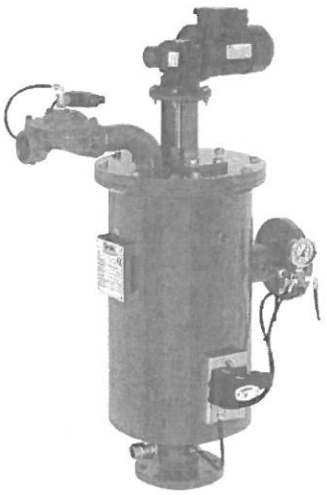
* Consult Amiad for optimum flow depending on filtration degree & water quality.

Technical Specifications

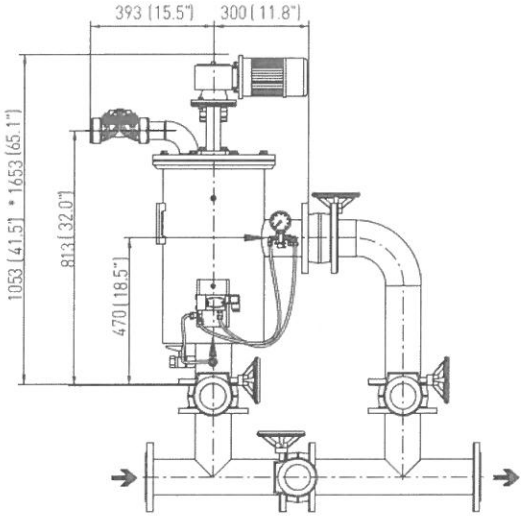
Filter Type	ABF-3000	ABF-6000	ABF-10000	ABF-15000	Mega ABF 40000	Mega ABF 60000
Screen Data						
Filter area	3000 cm² (465 in²)	6000 cm² (930 in²)	10000 cm² (1550 in²)	15000 cm² (2325 in²)	40000 cm² (6200 in²)	60000 cm² (9300 in²)
Screen types	316 St. St. wedge wire 316 St. St. perforated screen					
Control and Electricity						
Rated operation voltage	3 phase, 380/440V, 50/60Hz					
Electric motor	1/4 HP Gear Output 14 RPM	¾ HP Gear Output 18 RPM	1 HP Gear Output 22 RPM	1.5 HP Gear Output 18 RPM	4 x 1 HP Gear Output 22 RPM	4 x 1.5 HP Gear Output 18 RPM
Current consumption	0.7 Amp.	1.5 Amp.	2.5 Amp.	3.0 Amp.	2.5 Amp.	3.0 Amp.
Control voltage	24 VAC					
Construction Materials*						
Filter housing and lid	Epoxy or Polyester coated carbon steel 37-2					
Cleaning mechanism	Stainless steel 316L, PVC, Acetal					
Exhaust valve	Epoxy-coated cast iron, Natural rubber					
Seals	Synthetic rubber, Teflon					
Control	Brass, Stainless steel, Nylon					

* Amiad offers a variety of construction materials. Please consult us for specifications.

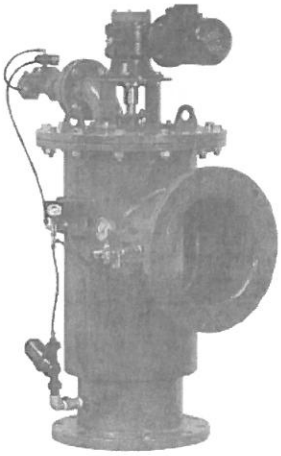
ABF 3000

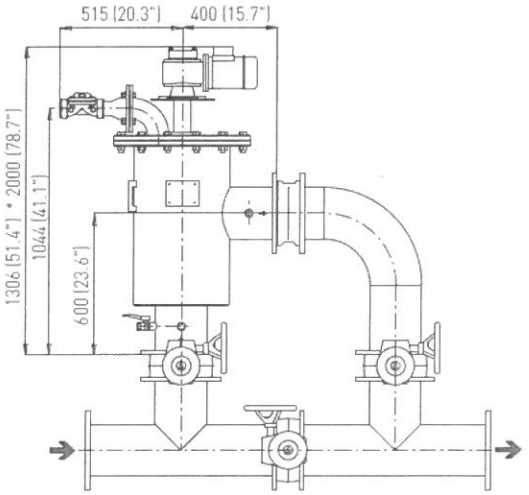


Typical Installation Drawing

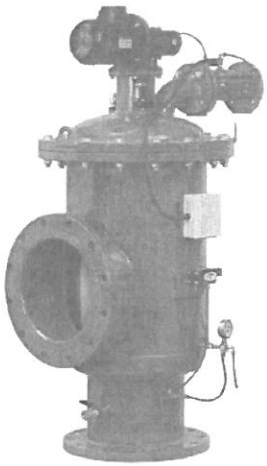


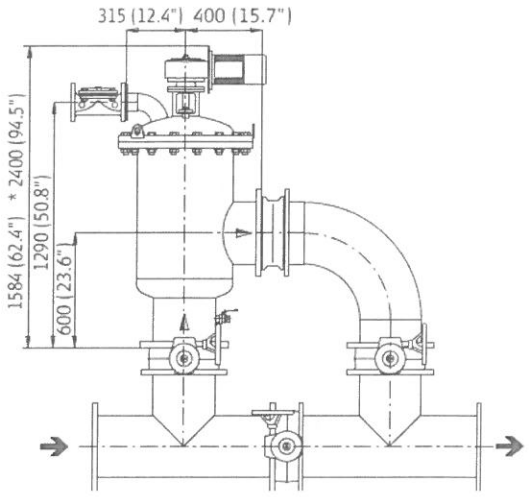
ABF 6000





ABF 10000

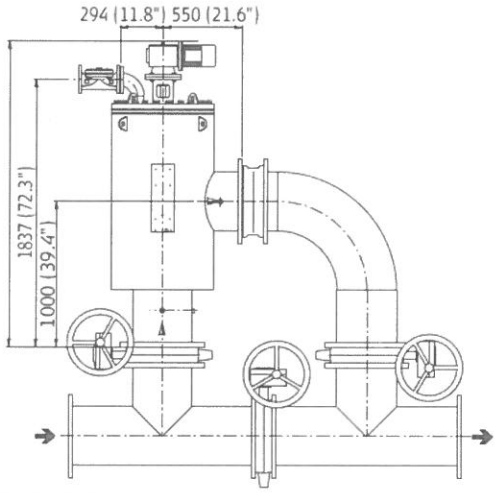




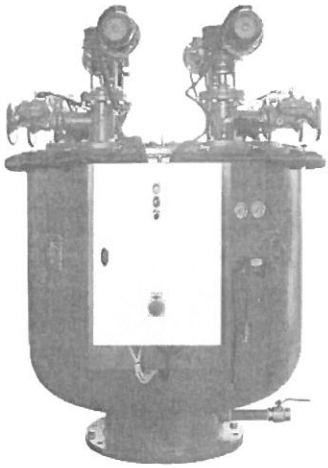
Dim: mm (inch)
*Approx. length required for maintenance

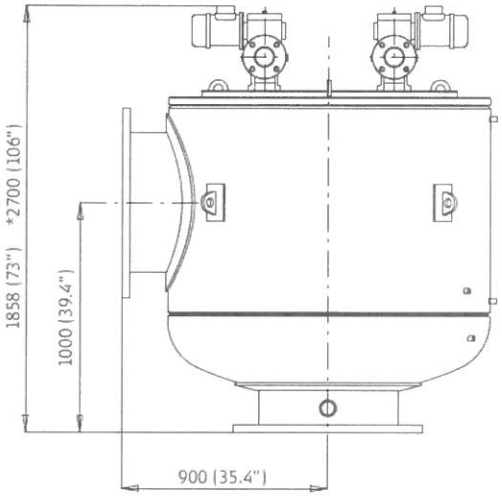
ABF 15000

Typical Installation Drawing



MEGA ABF 40000





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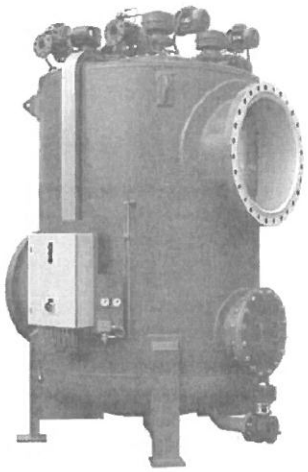
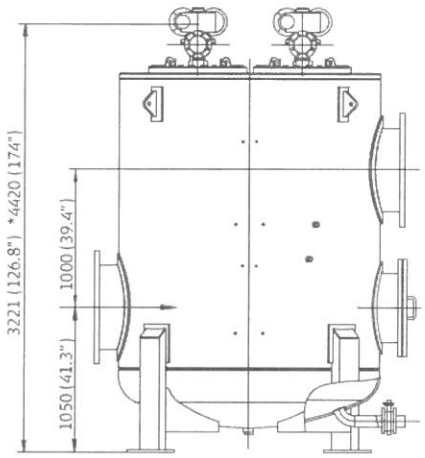
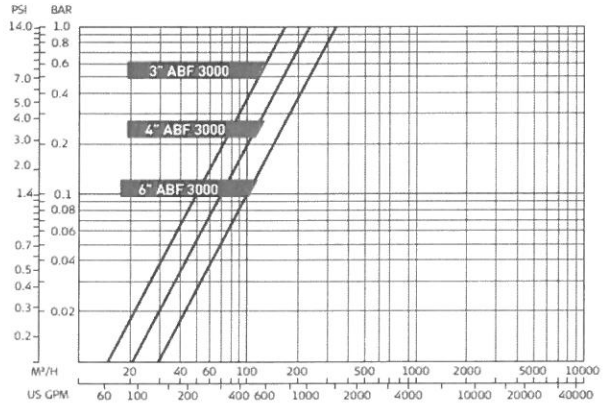




Dim: mm (inch)
*Approx. length required for maintenance

Head Loss Graphs
in clean water

ABF 3000



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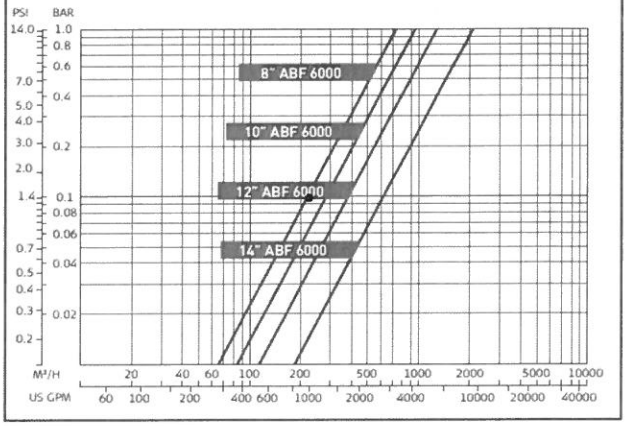

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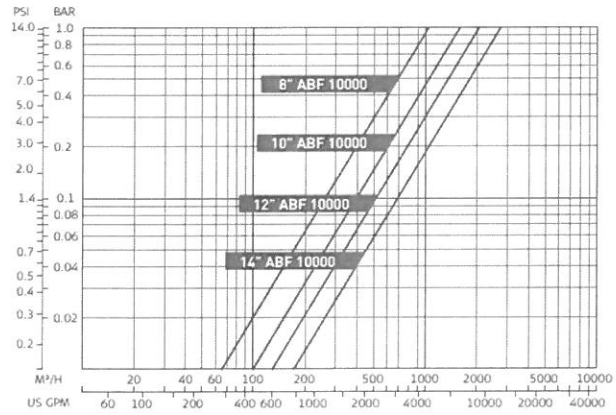

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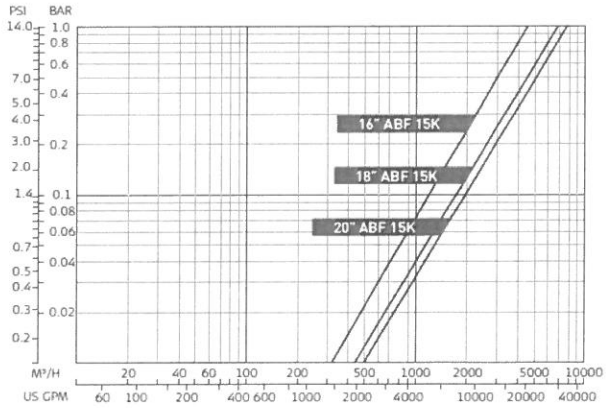

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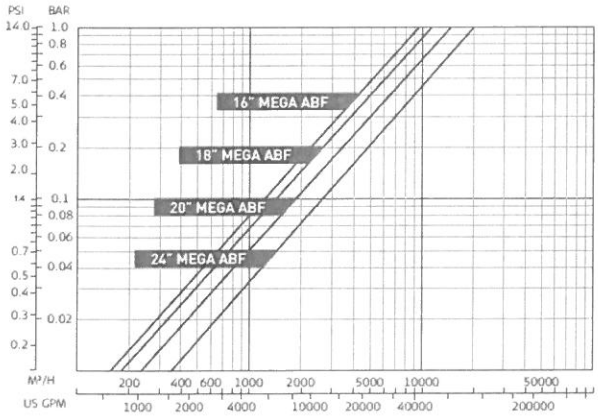

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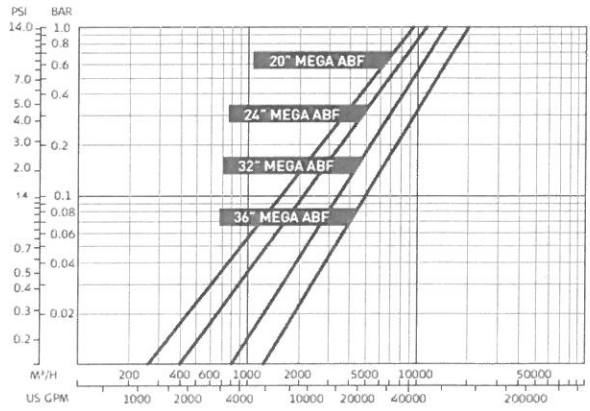

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FTS – Filtration & Treatment Systems, Istanbul yolu 26 Km, Yurt Orta Sanayii, Saray, Ankara,
Tel: 90 312 8155266/7, Fax: 90 312 8155248, E-mail: info@fts-filtration.com

amiad WATER SYSTEMS ARKAL FILTOMAT AMIAD

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Appendix I:
WWTP – Membranes – Manufacturer's Cut Sheets

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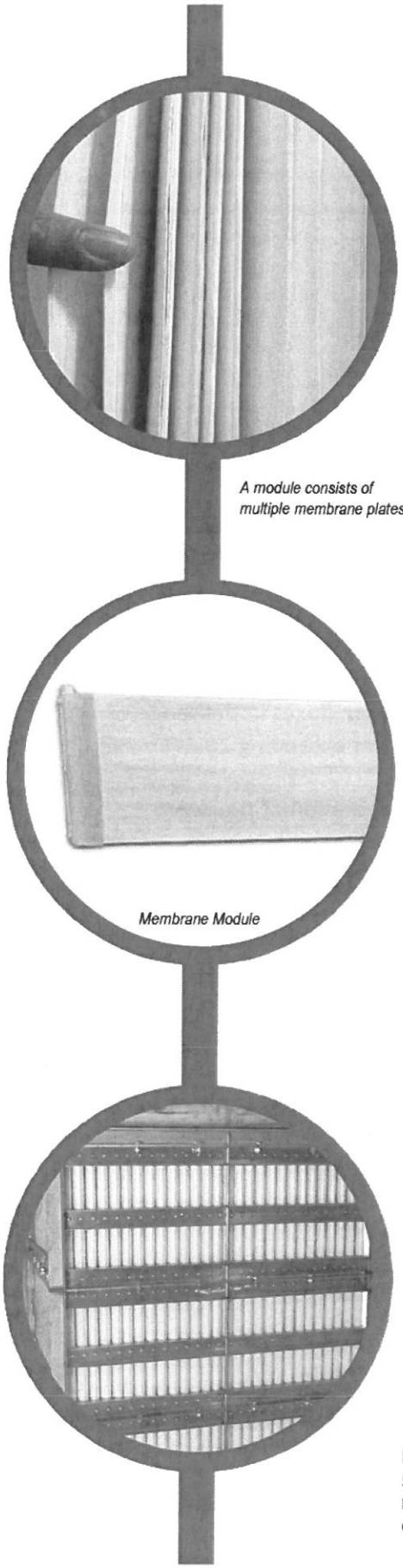

A module consists of multiple membrane plates.

Membrane Module

FIBREPlate™

Hybrid-Membrane for Game Changing Performance

The SMALLER and SMARTER MBR Solution

Membrane Properties	FPM500	FPM400
Normal Membrane Surface Area	46.4 m^2 (500 ft^2)	37.2 m^2 (400 ft^2)
Module Height	757 mm (29.8")	757 mm (29.8")
Module Width	61 mm (2.4')	61 mm (2.4")
Module Length	1870 mm (73.6")	1542 mm (60.7")
Membrane Type	PVDF	PVDF
Nominal Pore Size	0.04 micron	0.04 micron
Flow Path	Outside – In	Outside – In
Operating Specifications		
Typical Operating Flux	15 gfd	15 gfd
Flow Rate Per Module	5.2 gpm	4.16 gpm
Maximum Permeation Transmembrane Pressure (TMP)	10 psig	10 psig
Typical Operating Pressure	2.5 psig	2.5 psig
Maximum Operating Pressure	40 °C	40 °C
Operating pH Range	4 to 10	4 to 10
Typical Back Pulse TMP	1.5 psig	1.5 psig
Maximum Back Pulse TMP	4 psig	4 psig
Cleaning Specifications		
Maximum NaOCl Exposure (ppm hours)	2,000,000	2,000,000
Maximum Concentration for NaOCl (ppm)	2,000	2,000
Cleaning pH Range	2 to 11	2 to 11
Maximum Cleaning Temperature	40 °C	40 °C

FibrePlate™ membranes are manufactured by Fibracast Inc., a global leader in the research, development and production of advanced membrane technologies for water and waste water treatment.

Fibracast Ltd.
525 Glover Road
Hannon, Ontario L0R 1P0
Canada

T: 905.218.6665
T: 905.218.6669
E: info@fibracast.com
www.fibracast.com

FIBRACAST

FIBRACAST

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E: info@fibracast.com
www.fibracast.com

Mr. Justin Bonn, A.Sc.T.
Vice President, Pre-Construction
Streamgo
400 Jones Road Unti 17
Stoney Creek, Ontario, L8E 5P4

Subject: Fibracast Recommended Flux Rates at 10 °C.

To whom it may concern,

Fibracast is using its proprietary Flux Tables to determine the acceptable flux at various temperatures. The fluxes presented in the Table have been obtained during pilot studies and corrected for various temperatures using the following formula:

$$J_T = J_{20} \times (1.024)^{(T-20)}$$

For a temperature of 10 °C, Fibracast recommends using maximum fluxes in the range of 11 to 12.5 GFD for the MAX Month Flow, and Peak Hourly flux not exceeding 20 GFD.

Lower fluxes are perfectly acceptable as they ease the overall operation of the MBR.

We hope this information will be helpful to you.

Yours truly.

Bernard Dussault
Process Engineering Manager
Fibracast Limited

c.c.: Mark Gehring
Cezzanta Andrade

Kevin Hall
StreamGo Water Solutions Inc.
400 Jones Road
Unit 17
Stoney Creek, ON Canada, NY L3Y 4Z6

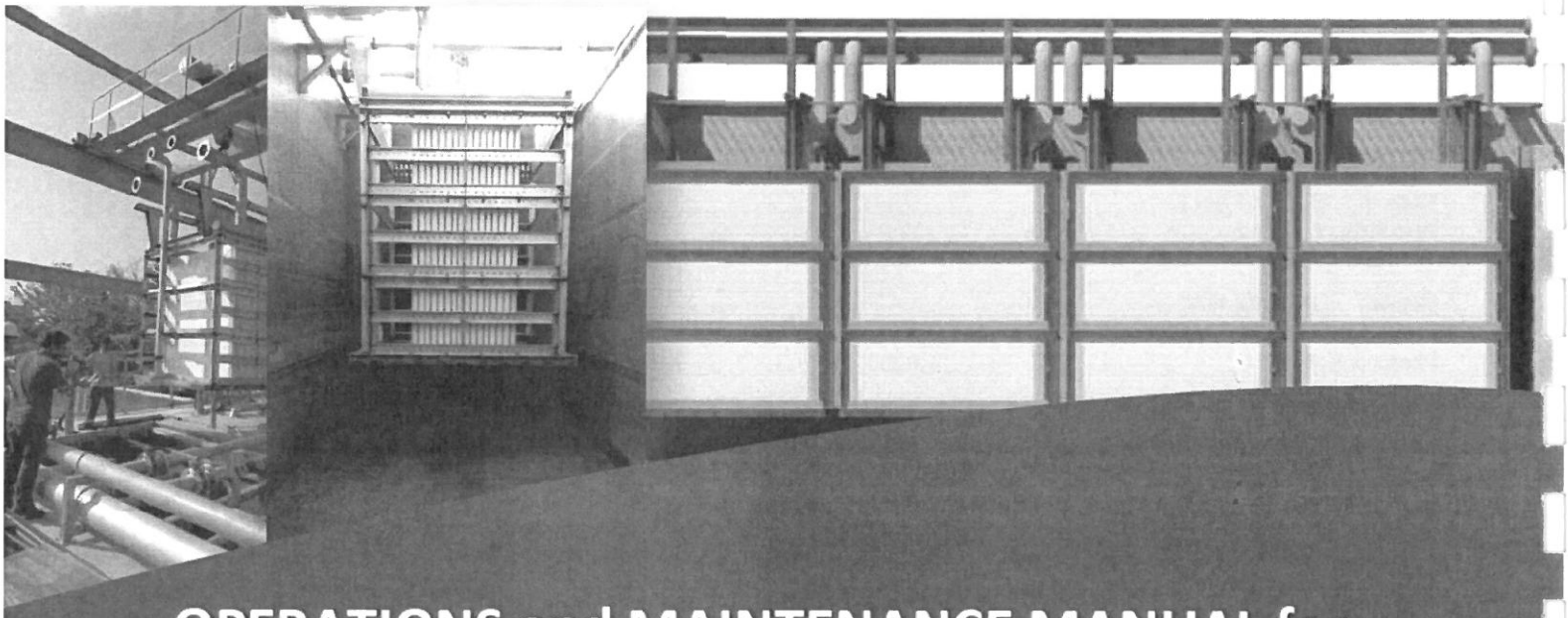
Job Number: 420-187706-1
Sdg Number: Woodhill Condos

Client Sample ID: **MBR Effluent**
Lab Sample ID: **420-187706-1**

Date Sampled: 12/18/2020 0910
Date Received: 12/18/2020 1150
Client Matrix: Water

Analyte	Result/Qualifier	Unit	RL	RL	Dilution
Method: 353.2 Rev.2.0		Date Analyzed:		12/21/2020 1803	
Nitrate Nitrite as N	20	mg/L	1.0	1.0	20
Method: EPA 351.2 Rev.2		Date Analyzed:		12/29/2020 1113	
Prep Method: 351.2		Date Prepared:		12/28/2020 0918	
TKN as N	<1.0	mg/L	1.0	1.0	1.0
Method: EPA 365.3 1978		Date Analyzed:		12/22/2020 1000	
Prep Method: 365.2/365.3/365		Date Prepared:		12/18/2020 1700	
Phosphorus, Total	0.030	mg/L	0.010	0.010	1.0
Method: SM 4500 O C		Date Analyzed:		12/18/2020 1400	
Oxygen, Dissolved	7.7	mg/L	1.0	1.0	1.0
Method: SM 5210B-2011		Date Analyzed:		12/18/2020 1400	
Biochemical Oxygen Demand	5.8 *	mg/L	4.0	4.0	2.0
Method: SM2540D-2011		Date Analyzed:		12/23/2020 0857	
Total Suspended Solids	<1.0	mg/L	1.0	1.0	1.0
Method: SM4500 NO2 B-11		Date Analyzed:		12/18/2020 1724	
Nitrite as N	0.012	mg/L	0.010	0.010	1.0
Method: Total Nitrogen		Date Analyzed:		01/04/2021 1433	
Nitrogen, Total	20	mg/L	1.0	1.0	1.0
Method: SM 9223B-2004		Date Analyzed:		12/18/2020 1645	
Escherichia coli	7.3	CFU/100mL	1.0	1.0	1.0

FIBRACAST



OPERATIONS and MAINTENANCE MANUAL for FIBREPLATE™ MEMBRANE SYSTEMS

Rev. 6 - November, 2017

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TABLE OF CONTENTS

Version	Date	Description Of Revisions
1.0	July 2015	DRAFT
3.0	November 2015	UPDATE
4.0	March 2016	UPDATE
5.0	October 2016	UPDATE
6.0	November2017	Align with Design Manual updates

Glossary

Backwash/Backpulse – Reversing the flow with permeate through the membranes to clean them

Bioreactor – Also known as an aeration tank. Aerated tank of sludge where the biological treatment of wastewater occurs.

Cassette – Large membrane unit that holds many modules

F:M Ratio – Feed to micro-organism ratio. The ratio between the amount of feed coming into the bioreactor and the amount of micro-organisms available to consume it

Flux – Flow through a given area, usually measure in gallons per foot per day

Module – Small membrane sub-unit of membrane sheets

Net Flux – Flow through a given area after taking into account the water used for backwashing

RAS – Return Activated Sludge – The sludge that flows out of the membrane tank back to the aeration tank

SRT – Solids Retention Time – the amount of time that solids spend in the bioreactor, usually measured in days.

TMP – Trans-membrane Pressure – the pressure difference between the inside and outside of the membrane.

TSS – Total Suspended Solids

1 Introduction

This Operations & Maintenance Manual is for operating a FibrePlate™ membrane system. The manual outlines general safety precautions, a description of FibrePlate™ membranes, how to install them, and how to operate them. Make sure to follow all construction drawings and make sure that cassettes and membranes are installed according the drawings for your particular project. A copy of any as-built drawings should be kept with this Manual, as well as any O&M manuals for all ancillary equipment. For specific operating instructions in regards to using your control system, see the specific Control Narrative for your plant.

WARNINGS: Failure to follow these guidelines may result in damaged or destroyed FibrePlate™ modules and cassettes.

- **Contact Fibracast prior to maintaining membranes or cassettes for updates and to review the procedure and critical items.**
- When installing or reinstalling membranes into the cassette, follow procedure exactly or damage may occur.
- Use a shower screen when spraying modules with water. Never spray modules directly with a pressurized stream of water.
- Backpulses should be done no more than 65% of the forward permeation flow
- To avoid water hammer proper accelerations and decelerations should be programmed into the VFD. Enough time for valve changeover if valves are used to initiate backpulses.
- Maintenance Cleans should be done at least once every 7 days regardless of TMP increase.
- Membrane Air scour must be continuous except for a 5 second aerator re-wetting period to occur during a Backpulse at least every 30 minutes
- Always ensure there is no air in the permeate piping system before attempting a backpulse
- Always keep cassettes upright when modules are installed.
- Do not allow modules to dry once glycerin solution has been rinsed away.

2 WHMIS

It is recognized that a safety policy and program will already be in place at the installation site of your membrane system. General safety comments are not meant to circumvent any safety policies, procedures, or programs that are currently in place. It is meant to supplement these and include safety sections that may be unique to a membrane system that the user may not be aware of.

Workplace Hazardous Material Information System (WHMIS):

Chemicals are used in membrane impregnation and preservation as well as in recovery and maintenance cleanings. WHMIS is the recognized Workplace Hazardous Material Information System used in Canadian Workplaces.

PURPOSE

To provide employees with information regarding any hazardous products that may use, handle or be exposed to at the workplace.

SCOPE

This applies to all employees, temporary employees, and contractors.

STANDARDS AND PROCEDURES

Hazardous materials must not be used, handled or stored by employees unless they have received WHMIS training.

Material Safety Data Sheets (MSDS) will be available at the end of this section for each chemical used or handled with regards to the membrane system. MSDS's must be current. The time limitation on MSDS's is three (3) years from the preparation date.

All controlled products will meet the labeling requirements of the WHMIS legislation. Employees must immediately report if a label is missing or not legible.

If controlled products are decanted from the supplier container, a workplace label must be used. All controlled products must be clearly identified. A workplace Label will include: a product identifier identical to what is on MSDS, information for the safe handling of the product, and that a MSDS is available.

RESPONSIBILITIES

Ensure that the appropriate WHMIS training has been conducted for employees.

Ensure MSDS sheets are available for all hazardous products in the workplace.

Maintain the MSDS book.

Review any new products.

Not use or handle a hazardous product unless they are trained and authorized.

Report any hazardous products that are not clearly labeled.

Please review MSDS sheets before handling of any chemicals. MSDS sheets should be kept with this manual. Links to relevant MSDS sheets are listed below:

1. Glycerin

http://msds.univarcanada.com/wercswv.asp?A=putHTM%00&RID=F_PDF%5C%27EN%27%5C%27RENS%27%5C%27NR07248%27%5C%27MTR%27%5C%27ANSI%27%5C%7Bts+%272013-07-12+08%3A32%3A21%27%7D

2. Sodium hypochlorite

http://msds.univarcanada.com/wercswv.asp?A=putHTM%00&RID=F_PDF%5C%27EN%27%5C%27RENS%27%5C%27LA2764%27%5C%27MTR%27%5C%27ANSI%27%5C%7Bts+%272014-04-03+14%3A00%3A12%27%7D

3. citric acid

http://candmz04.brenntag.ca/MSDS/En/00060156.pdf

4. sodium metabisulfite

http://msdssearch.dow.com/PublishedLiteratureDOWCOM/dh_004f/0901b8038004f697.pdf

3 Description of FibrePlate™ System, Components, and Technical Data

3.1 FibrePlate™ Technology

FibrePlate™ is an innovative membrane which combines hollow fiber and flat sheet technology. The FibrePlates™ are assembled in a double permeate header module, which are installed in a cassette. Due to the geometry of the fibers, the cassettes have a very high packing density. The technology utilizes the benefits of both hollow fibers and flat sheet membranes, while overcoming the challenges identified with these products. FibrePlate™ was developed with the end user in mind, building on the foundation of wastewater membrane technology and taking it to a whole new level.

FibrePlate™ takes strong, non-woven PET flat sheets and molds them into hollow channels that can achieve the geometrical advantages of hollow fibers. Sheets of hollow channels are then coated with a thin membrane dope layer. Coated sheets are strong, self-supporting with excellent hydraulic control resulting in efficient backwashing and low stress levels transmitted to the vertical headers.

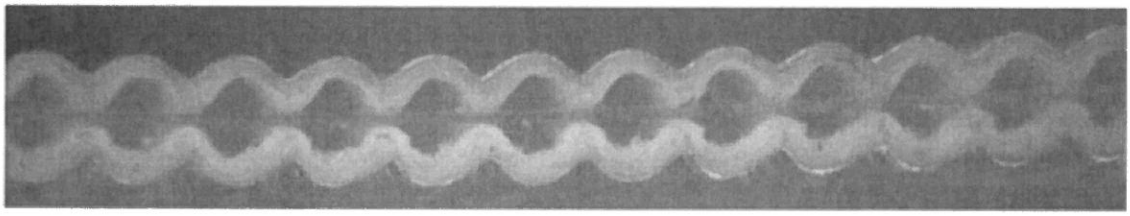


Figure 3-1 FibrePlateTM Technology - Coated sheet cross section

The FibrePlate™ Membrane Bioreactor (MBR) process is a wastewater treatment technology that combines suspended-growth biological treatment with immersed membrane filtration. The FibrePlate™ membranes act as the solid-liquid separation step in the process, in place of the secondary clarifiers and tertiary filters. The FibrePlate™ membrane acts as a barrier; rejecting solid particles while passing permeate through the membrane fibers. The result is a high-quality permeate with very low suspended solids.

3.2 The FibrePlate™ Membrane.

Table 3-1 FibrePlateTM Membrane Specification shows the physical specifications of the FibrePlate™ membrane.

Table 3-1 FibrePlateTM Membrane Specification

Physical Specifications	
Membrane Material	PVDF
Configuration	Outside-In
Membrane Surface Properties	Non-Ionic & Hydrophilic
Nominal Pore Size	0.04 micron
Absolute Pore Size	0.1 micron
Fiber OD	1.3 mm (0.05 in)
Fiber ID	1.0 mm (0.04 in)
Membrane Thickness	0.3 mm (0.01 in)
Membrane Backing Thickness	0.1 mm (0.003 in)
Operating Specifications	**MBR Applications**
Max Permeation TMP (Trans Membrane Pressure)	69.0 kPa (10 psi)
Max Backwash TMP	27.5 kPa (4 psi)
Typical Operating Backwash TMP	10.0 kPa (1.5 psi)
Average Initial Clean Water Permeability (@ 20°C)	375 lmh/bar (15 gfd/psi)
Max Operating Temperature	40°C
Operating pH Range	4.0 – 9.0
Cleaning Specifications	

Max Cleaning Temperature	45°C
Max NaOCl Exposure	2,000,000 ppm.hrs
Max Cleaning NaOCl Concentration	2,000 ppm
Cleaning pH Range	2.0 – 11.0 (<30°C)

3.2.1 Achievable Permeate Quality

The FibrePlate™ membrane is a physical barrier, which stops the passage of all particles that are larger than the membrane pores. It is the solids/liquid separation step of the MBR plant. The membrane retains particulate material in the mixed liquor, leaving only high quality permeate to pass through the pores. The permeate quality which can be achieved when FibrePlate™ is utilized to treat municipal wastewater are listed in Table 3-2 below. This is provided that the plant is operated in accordance with the Operations and Maintenance Manual.

The removal of other constituents, such as COD/BOD, ammonia, total nitrogen and total phosphorous are functions of the biological system design and operation which could be by Fibracast or by others.

Table 3-2 FibrePlateTM MBR Permeate Quality

Effluent Quality Parameter	Guaranteed Quality
TSS	< 5 mg/L (< 1 mg/l achievable)
Turbidity	< 0.2 NTU, 95% of the time < 0.5 NTU, 100% of the time
SDI_{15}[1]	< 3

[1] SDI $_{15}$ value can be provided on a project by project basis, if there is downstream RO

3.3 The FibrePlate™ Module.

The FibrePlate™ module contains 16 membrane sheets potted at both ends with permeate collecting headers. The headers mount on the sides and this horizontal configuration allows a clear flow path for mixed liquor and membrane air scour bubbles through the module. Each sheet is made up of hundreds of hollow tubes. Modules come in two sizes, the FPM400 has 400 ft^2 of active area, and the FPM500 has 500 ft^2 of active area.

In the Tables and Figures below, the individual module's dimensions and area are listed and illustrated.

Table 3-3 FibrePlateTM FPM400 Module Dimensions

Module	Width	Length	Thickness
FPM400	29.80 inch	60.71 inch	2.36 inch
	757.00 mm	1542 mm	60.00 mm
FPM500	29.80 inch	73.61 inch	2.36 inch
	757.00 mm	1870 mm	60.00 mm

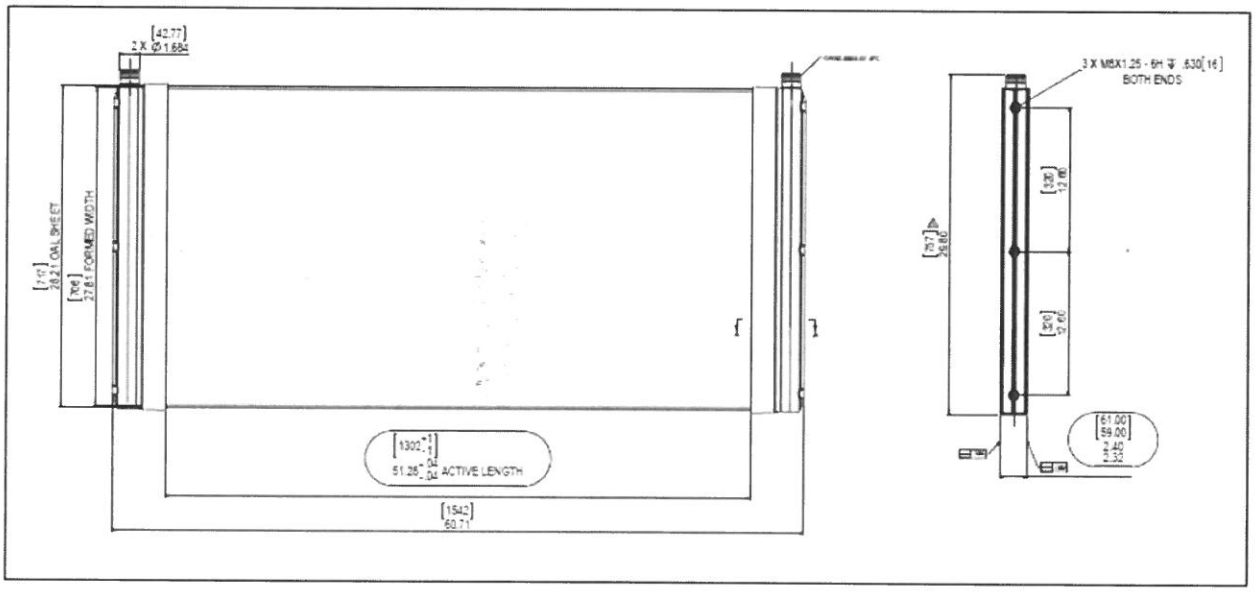


Figure 3-2 FPM400 Module Dimensions

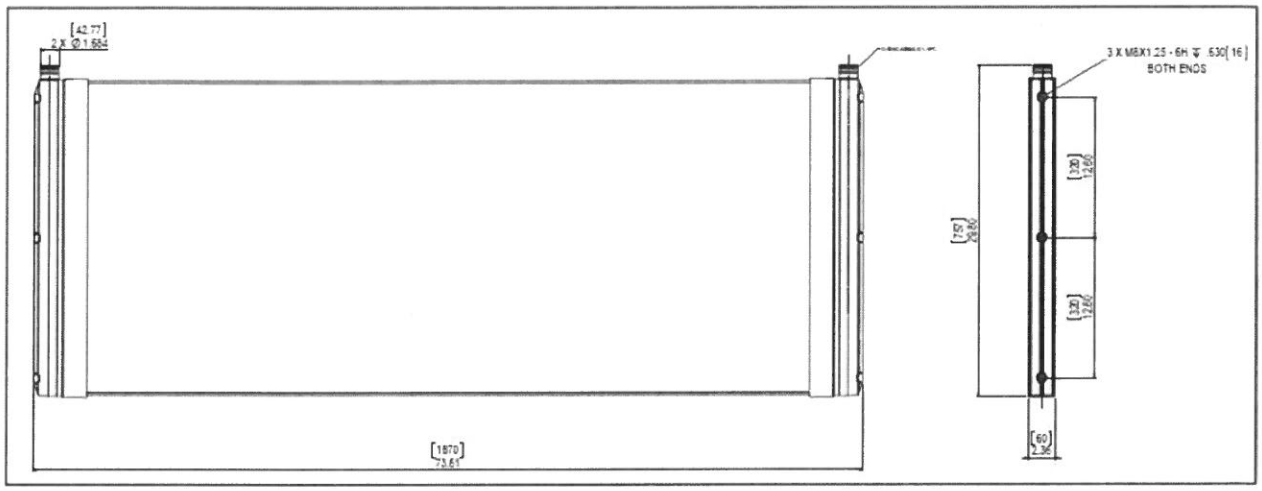


Figure 3-3 FPM500 Module Dimensions

Table 3-4 Module weights

Product	FPM400	FPM500
Dry Weight	22 lb (10 kg)	24 lb (11 kg)
Glycerin Impregnated (shipping weight)	42 lbs (19 kg)	51 (23 kg)

3.4 The FibrePlate™ Cassette

The cassette frame houses the FibrePlate™ modules. A cassette holds 28 modules in each block, with a maximum of 3 blocks stacked on top of each other. Cassettes are shipped with the modules pre-installed in cassettes. However, if required partially filled cassettes to a minimum number can be used. If the cassette has empty module slots, the respective permeate and air connections are blocked. FibrePlate™ cassettes have coarse bubble air diffusers (aerators) built in. Two permeate collections headers are also built in at the top of the cassette.

In the Tables and Figures below, the individual cassette's dimensions and area are listed and illustrated.

Table 3-5 FPC400 Cassette Dimensions

FPC400 84M 3 Block Cassette For FPM400 Module	Width	Length	Height
	68.82 inch	109.88 inch	116.87 inch
	1748 mm	2791 mm	2968 mm

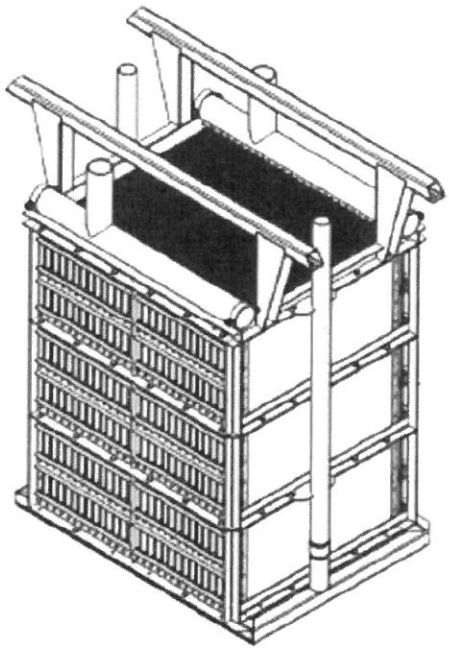


Figure 3-4 FibrePlateTM 84M 3 Block Cassette

Table 3-6 FPC500 Cassette dimensions

FPC500 84M 3 Block Cassette For FPM500 Module	Width	Length	Height
	80.87 inch	109.88 inch	119.87 inch
	2054.44 mm	2791.00 mm	3045.00 mm

Table 3-7 Cassette Weights

84M 3 Block Cassette	Dry Weight	Wet/Sludged weight
FPC500	6,300 lbs	10,000 lbs
FPC400	6,000 lbs	9,000 lbs

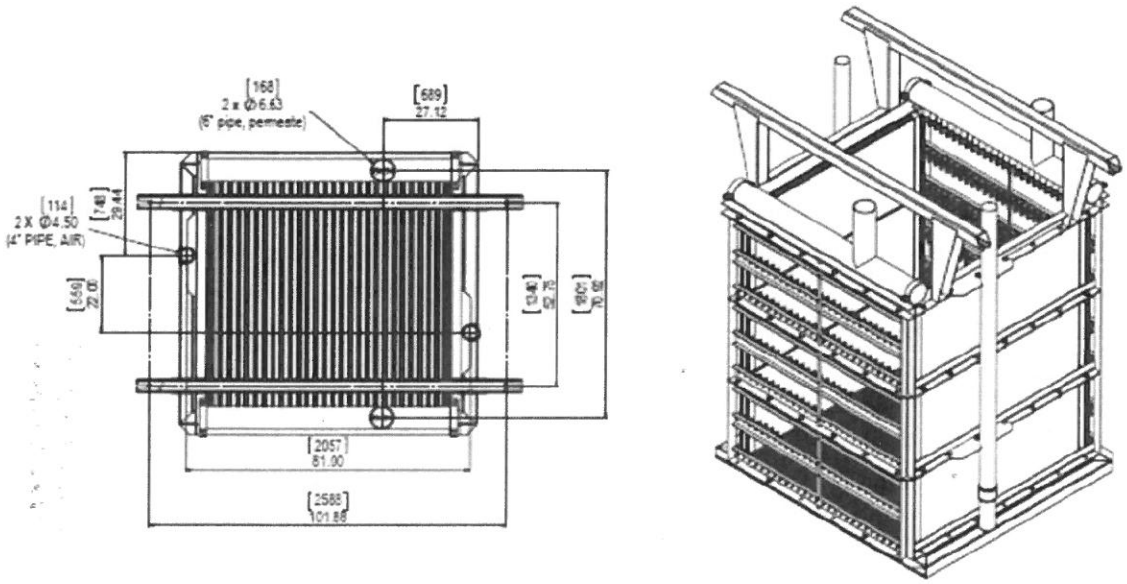


Figure 3-5. FPC500 cassette drawing

Table 3-8 FibrePlateTM 84M 3 Block Cassette Connections

Cassette	84M 3 blocks
Number of Permeate Connections per Cassette	2
Size of Permeate Connections	6 inch
Permeate Connections	Vertical pipe
Number of Aeration Connections per Cassette	2
Size of Aeration Connections	4" inch
Aeration Connections	Vertical pipe

3.5 FibrePlate™ Membrane Aeration

Membrane aeration has several purposes to ensure proper operation of the FibrePlate™ Membrane in MBR applications. First of all, membrane aeration is the primary means by which mixed liquor flow is induced through the FibrePlate™ modules. When air is added to the bottom of the membrane blocks, mixed liquor replaces the space created by the air bubbles as they rise upwards through the membrane sheets. Second, membrane aeration, as well as the turbulent flow which follows an aeration bubble, continuously scours and transports solids away from the membrane which could otherwise accumulate causing a loss in permeability and eventually blocking of pores (fouling). Finally, the FibrePlate™ modules and sheets are designed such that the sheets are in constant motion as vibration. This vibration is induced by the aeration passing between the sheets and by their wavy shape.

The FibrePlate™ membrane cassette is designed such to fully distribute air flow across all active modules. It is not possible to quantify aeration distribution. However, qualitatively, even air flow and evidence of no channeling can be observed if the aeration pattern at the top of the membrane tank shows to be uniform across the entire cassette cross-sectional footprint.

The typical aeration setting in an MBR plant is that several cassettes are arranged in a row, or "train", and each train has one main air header for the delivery of air. Each cassette has two air connections, which are attached to the main header. The air flow to the two air pipes is continuous, save for period air stoppages for aerator re-wetting. A typical layout of this equipment is shown in Figure 3-6. Cassette Air Connection Pipes.

4" Air Connections (2 per cassette)

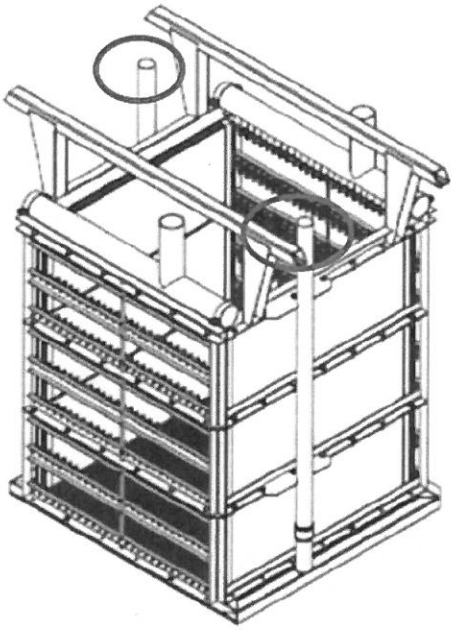


Figure 3-6. Cassette Air Connection Pipes

There are 28 aerators for each cassette, one for each stack of modules. If a cassette is partially populated, the inlets to the aerators that are not needed can be blocked using rubber plugs.

Air is constantly supplied to the cassette from the membrane train aeration header through the aeration tubes in the FibrePlate™ MBR system.

The air bubbles used to aerate FibrePlate™ membranes come from medium bubble diffusers, which are an integral part of the FibrePlate™ cassette. Each FibrePlate™ 84M cassette has two 4 inch pipe connections that transfer air to the diffusers; each pipe transfers to one side of the diffusers in for the cassette.

The FibrePlate™ cassette is designed to accommodate modules in blocks, with each block holding up to 28 modules. There are three blocks that are stacked above one another, in order to fully populate the cassette. As modules are located one above another vertically, modules will "re-use" air that has passed through the module located below. Partially filled cassettes typically will consist of 3 partially filled blocks stacked on top of one another in order to minimize the amount of air required. As such, the air flow requirement is based on the amount of columns of modules stacked atop one another. As the FibrePlate™ Cassette blocks have 28 module spots, the maximum amount of columns is 28.

3.6 The FibrePlate™ Cassette Train

FibrePlate™ cassettes are linked together in a train. The cassettes are connected to a common permeate header, which is then connected to a permeate pump. One train can contain up to 10 cassettes. Individual cassettes are isolatable by valves leading off of the permeate header. A cassette train normally will be one of many trains in an MBR plant.

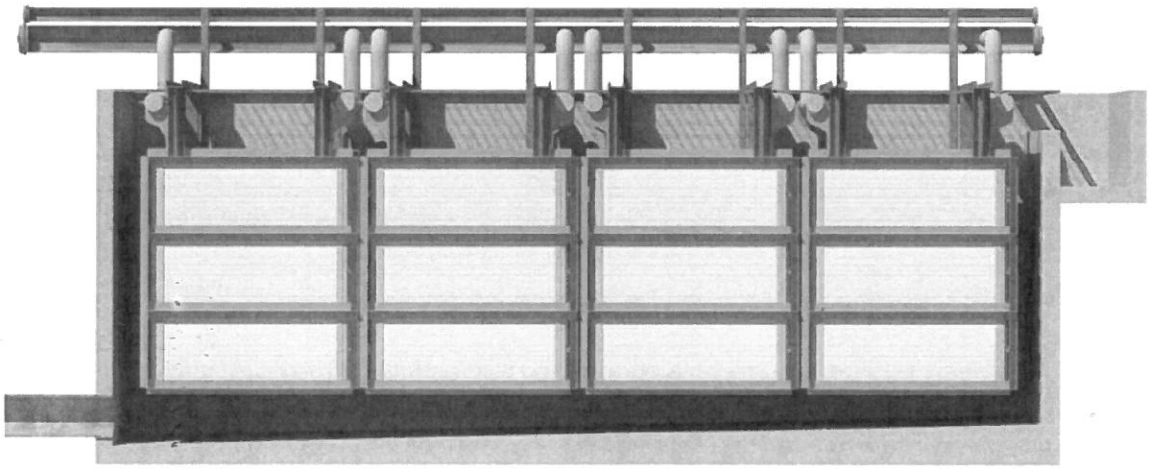


Figure 3-7. Four FibrePlate™ cassettes connected in a train.

All of the cassettes in a membrane train will be serviced by a single permeate pump and blower, although in some cases a blower may aerate more than one train. Multiple trains are designed into plants for redundancy purposes to ensure the plant has adequate filtration capacity even when one train is down for maintenance.

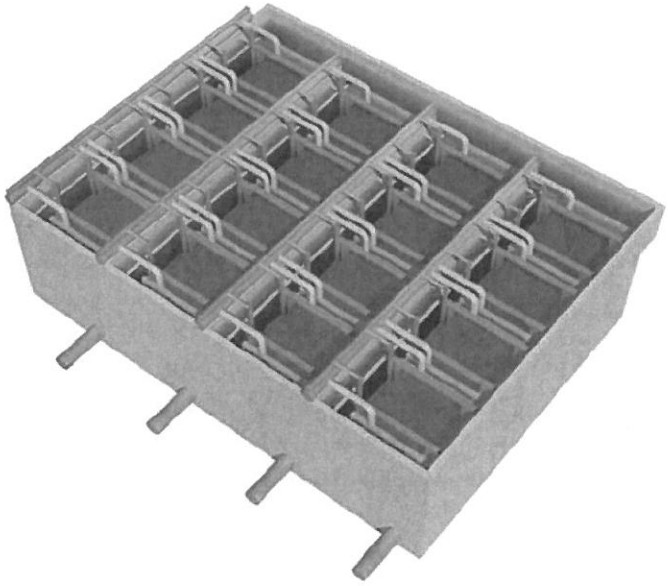


Figure 3-8. Four cassette trains making up a plant

3.6.1 Cassette Redundancy

Membrane trains can be out of service for a variety of reasons including equipment maintenance, maintenance and recovery cleaning, membrane inspections and repairs. As such, design conditions are made for the capacity of the remaining operating trains when one or more is out of service. Commonly, this is called an N-1 condition if one train is out of service and N-2 if two trains are out of service.

3.7 Basic Ancillary Equipment to Operate

In addition to FibrePlate™ membrane cassettes, other ancillary equipment is needed for the complete operation of the MBR system. These equipment items are listed below. Detailed descriptions of each item, as well as drawings, performance curves, and maintenance requirements, can be found in their respective O&M manuals which should be included in Appendix A: Ancillary Equipment O&M Manuals.

3.7.1 Membrane Air scour blower

The membrane air scour blowers will be operated continuously as long as a train is operating in Production mode. The blowers can be shared between trains. The blowers will normally run on VFD's and have adjustable speeds.

3.7.2 Permeate Pump

Each train will have a dedicated permeate pump, usually this will be a reversible rotary lobe type pump. The permeate pump will create a vacuum to draw clean water through the membranes and discharge it to the disinfection stage of the plant. Permeate pumps will be located near their respective train and will

run for a set production cycle length. Reversible pumps will change direction and run for a set length of time to perform the backwash after the production cycle.

3.7.3 Chemical Pump

Chemical pumps will be used to inject chlorine or citric acid into the permeate header. In conjunction with the backwash pumps, they will push the chemical solution into the membranes during maintenance and recovery cleans. These pumps are normally timed diaphragm pumps and will not use a VFD.

3.7.4 RAS pump

The RAS pump will draw mixed liquor from the membrane tanks discharge it back to the aeration tank. RAS pumps will pump mixed liquor at 3-4 times the flow rate of the permeate. These will operate continuously as long as a train is in operation. Alternatively, the RAS pumps can draw mixed liquor from the aeration tank and pump it into the membrane tank, which is known as a "Pump-To" design. RAS pumps are normally centrifugal and may be submersible. They are controlled by a VFD.

3.7.5 Tank Drain Pump

Each membrane tank will normally have the ability to be drained with a tank drain pump. Tank draining will normally only happen for recovery cleans. The mixed liquor or cleaning solution from the membrane tanks will usually be discharged into the RAS channel when a tank is drained.

3.8 Description of Permeation Cycle

The FibrePlate™ MBR system operates in production cycles and not in a continuous mode. A production cycle consists of a period of membrane permeation (or production), followed by a period of either back pulse or relaxation. Production cycle is sometimes referred to as a permeation cycle. For detailed operation of a FibrePlate™ system, please see the Control Narrative and corresponding P&ID for the system.

The production cycle includes a permeation step and either a back pulse or relaxation step. These steps are described below.

- PERMEATION: A slight negative pressure is applied to the inside of the FibrePlate™ membrane resulting in water (permeate) being extracted from the mixed liquor, through the membrane. Permeate is drawn from the mixed liquor which is recirculating through the membrane tank from the bioreactor, and as such the net effect is a concentration of solids in the mixed liquor, due to the removal of clean water. Buildup of solids is mitigated due to mixed liquor recirculation flow (often 4-5 times the permeate flow), as well as the introduction of membrane aeration to assist in the membrane surface scour effect.
- BACKPULSE (or RELAX): This step of the production cycle is a regularly occurring step to mitigate solids buildup on the membrane surface as well as membrane pore fouling. Periodically, a positive pressure is applied so flow direction is reversed through the membrane, and clean water (permeate) is pushed from the inside-out. During this step there is a net flow of mixed

liquor away from the membrane surface due to the introduction of clean water, a positive pressure from the inside-out on the membrane surface as well as aeration.

The total time of the production cycle is the permeation time plus either the back pulse or relaxation time, as well as any time attributed to valve change-over and pump ramp-up/ramp-down.

Error! Reference source not found. shows the range of acceptable and recommended durations for permeation, relaxation, and back pulse. Selected durations are dependent on application and wastewater quality. Relaxation durations would the same as the backpulse durations

Table 3-9 Permeate cycle durations

Operating Mode	Acceptable Range	Recommended Duration
Permeation	5 – 10 minutes	5 minutes
Backpulse	25 – 60 seconds	30 seconds

All FibrePlateTM MBR plants are designed with the capability to perform either back pulse or relaxation. While relaxations are possible while operating at low fluxes, back pulses are usually required for normal to high fluxes and poor sludge conditions. Poor sludge conditions are typically determined by evaluating sludge filterability, usually through time to filter (TTF) testing.

3.8.1 Backpulse Design

FibrePlate™ MBR plant is designed with the following capabilities for back pulse:

- Flux: Equivalent to 30% to 65% of the instantaneous permeation flux of the last production cycle
- TMP: Maximum back pulse TMP of 4 psi (27.5kPa). Should normally be limited to 2 psi with a warning alarm.

The back pulse system is also utilized to perform membrane cleaning functions, which will be discussed in following sections. As such, the back pulse system must be capable of operating at the membrane cleaning flux, which is typically 8.5 gfd (14.45 lmh).

3.8.2 Relax

Relax mode is a startup/maintenance mode and should be used only when specified. This mode is speficically designed and use to ensuring air is not forced into the membranes. When Relax mode is selected by the operator, the backpulse function is disabled and the system will "rest" for the duration for the backpulse. RELAX mode should be set for 120 seconds at a low flux and selected only for the following situations:

- Starting up a new plant or train. The system should be operated for 2 hours of run time then switched over to backpulse mode.
- After any maintenance event where a train or cassette would be completely drained of water.

3.9 Net and Instantaneous Flux

Net flux is the resultant flux which considers the total permeate production over a prolonged period of time, typically a day. This will take into account that permeate is not being produced during times in which back pulse, relaxation or maintenance cleaning is being performed, as well as during valve change-over and pump ramp up and down.

Instantaneous flux refers to the flux applied to membranes instantaneously during the permeation step of the production cycle.

Typically MBR plants are designed on the basis of net flux, hence production cycle regimen must account for the time dedicated to non-permeation steps, and make up for this downtime by factoring an instantaneous factor. Equipment and piping sizing will account for the instantaneous flow.

3.10 Operational Characteristic Changes for Seasonal Operation

The FibrePlate™ membrane system is designed to operate successfully year around. A few operating characteristics will change depending on the ambient and mixed liquor temperatures.

3.10.1 Trans-membrane Pressure (TMP)

The temperature of the mixed liquor will have an effect on the TMP. As temperatures drop, TMP will increase. This is partially due to the increased viscosity of the water at low temperatures. The TMP sensor will provide an actual TMP reading for the operators, and the PLC will also calculate the temperature corrected TMP using the temperature of the mixed liquor, which is read from sensors in the aeration tank. This TMP will be corrected to 20°C based on the following equation:

$$Temperature\ Corrected\ TMP = (Actual\ TMP)x\ 1.023^{Temperature\ °C}$$

3.10.2 Flux

Maximum operating fluxes will decrease as temperatures drop. Typically the FibrePlate™ system will be designed for the lowest temperature, so that the system can meet the required capacity year round.

3.10.3 Other Seasonal Operating Characteristics

During winter months it is important to avoid potential freezing of pipes and instruments. All equipment must be rated for winter use. From an operations perspective, when trains are shut off for maintenance, permeate piping should be drained if the shutdown is longer than a few minutes.

3.11 General Operating Parameters

The following table outlines the general operating parameters for FibrePlate™ membrane systems. For more details on particular items see the respective sections in this manual.

Table 3-10 General Operating Parameters

Parameter	Value	For more detail:
Production Cycle Duration	300 seconds	Section 3.8
Backpulse Duration	30 seconds	Section 3.8
Production Flow	Determined by design of plant	Section 3.8
Backpulse Flow	30%-60% of Production flow	Section 3.8
Membrane Aeration	Continuous – except for aeration pauses for aerator rewetting	Section 3.5
Membrane Aeration Flow	Plant specific – See design values	
Membrane Aerator Re-wetting Frequency	1 per hour	Section 3.5
Rewetting duration	Min 5 seconds – just long enough for aerators to flood for 2-3 seconds	Section 3.5
MLSS Concentration in aeration tank*	8,000-12,000 mg/L[1]	Section 5.1
Maintenance Frequency	Every 3-7 days	Section 6.2.1
Recovery Clean Frequency	Every 6-8 months	Section 6.2.2

[1]At MLSS concentrations above 10,000 mg/L, fluxes may need to be reduced

4 Maintenance and Operating Instructions

4.1 Membrane Storage and Handling

Membranes are received impregnated with glycerin in a sealed bag with a 1% wt. sodium metabisulfite preservative solution. Once the packaging has been removed the modules need to be handled carefully to prevent any damage. Below are handling and storage guidelines. If there are any concerns or uncertainties, contact the manufacturer for further guidance.

4.1.1 Unpacking Cassettes Procedure

A. Tooling Requirements:

- Claw Hammer
- Cordless Drill
- Roberson #2 drill bit
- Two 8 ft. Step Ladders
- Forklift with extension forks or overhead crane.
- Mop and bucket with soapy water

B. Planning and resources

- Two Persons
- Approximately ½ hour/ crate

C. Procedure

1. Within the crate, the Fibreplate™ modules are partially protected within the plastic wrapped cassette however, a dropped crate top, side, or tools could damage the membrane coating on the modules within the packaging.

2. The crate can be dismantled by removing the screws from the top then remove the top.

3. Remove any support braces that are underneath the top. Take care not to drop these onto the modules within the cassette.

4. The sides can be unscrewed and removed one by one. Again, care should be taken not too damage the module's membrane coating when removing these.

5. Once the sides of the crate have been removed, the plastic wrapping can be carefully cut away from the cassette.

6. The cassette can be lifted off of the skid with an overhead crane or forklift that are rated for at least 7000 lbs.

D. Personal Safety

Hazards:

- *Fall Hazard:* Crate disassembly is carried out while standing on a ladder. Improper ladder use can result in falling and injury.

- *Slip Hazard*: The Fibreplate™ modules are wetted in a 50% glycerin/water solution (see MSDS) and some residual glycerin may be on the bottom of the bag. Glycerin can be very slippery particularly on a smooth cement floor and care and good housekeeping practices should be observed.

- *Chemical*: Fibreplate™ modules are received preserved in a glycerin/water solution with a 1% wt. metabisulfite solution added to prevent mildew growth. The appropriate MSDS should be thoroughly reviewed before working with any chemicals.

E. Do's and Don'ts

- Fibreplate™ modules are received impregnated with a glycerin solution. The uncrated Fibreplate™ modules in cassettes can be left open, but care should be taken to not get the modules wet (i.e. from rainfall, spraying water etc.). This could rinse away the glycerin solution and if then allowed to dry, the membrane may not fully rewet and a substantial loss in permeability is possible (see following sections on handling and storage).

- Modules should be kept at a temperature > 0°C and < 35°C.

- Care should be taken not to damage the membrane coating from scratching when removing crates and cutting the plastic wrapping away.

- Set the cassette onto the ground gently. Do not drop or bang the cassette onto the ground.

4.1.2 Handling Procedure

A. Tooling:

N/A

B. Planning and Resources:

N/A

C. Procedure:

Below is a general procedure for handling of the Fibreplate™ module as an individual unit or within the cassette. Membrane coatings can be scratched and must be handled carefully.

- Modules can be received either already installed in a cassette in which case they are largely protected within the cassette, or they can be received as an individual module packaged in a plastic bag and need to be installed into the cassette.

- Care should be taken when removing the plastic packaging that the membrane coated sheets are not cut, and when removing the plastic the membranes are not scratched by dragging or forcing the plastic over the membrane surface.

- Modules received in cassettes are secure in the cassette which can be moved as a unit. Care must be taken to avoid accidental damage to the membrane coatings from contact with tools and equipment, and shock to the modules from dropping the cassette.

- If a module within a cassette has been damaged it can be removed as described in sections 4.15.2 and repaired or can be repaired in place if the damage is accessible (*i.e.* outside sheet in the cassette can usually be repaired in place). Damaged modules must be repaired or replaced before installation into the membrane tank

- Individual modules can be laid onto a clean, smooth, flat surface but care must be taken to not drag the membrane sheets across any surface where they could be scratched. If a small scratch does occur the membrane can be repaired following the membrane repair procedure in section 4.15.3.

- For temporary storage several modules can be stacked on top of each other as long as a smooth separating sheet is placed between each module to protect the module underneath (See Figure 4-1 below)

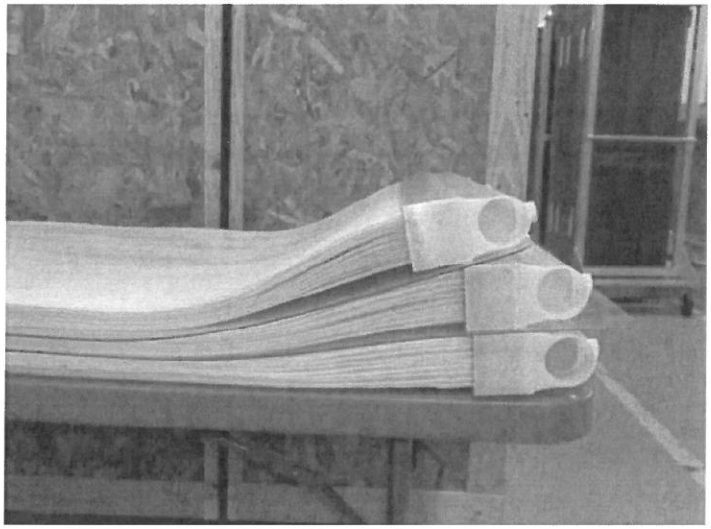


Figure 4-1 Safely stacked modules with plastic sheets in between each other

- Individual modules can be carried by two persons holding the permeate headers. A bow in the membrane between the permeate headers in the length direction is acceptable, but should be kept to a minimum and care taken not to crease the sheets

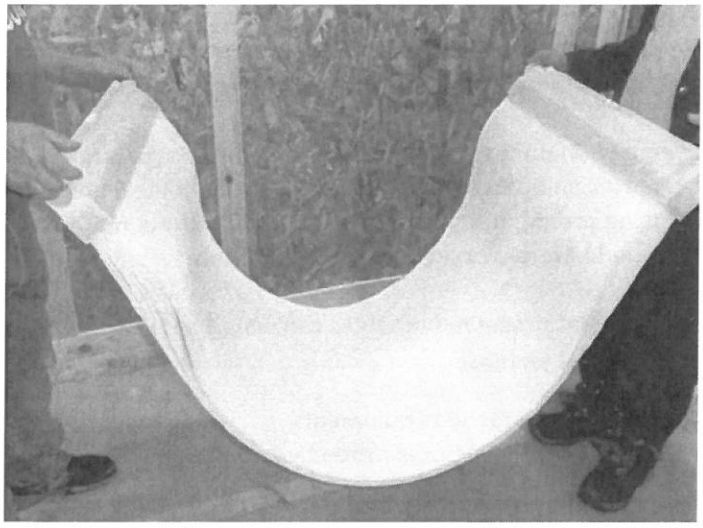


Figure 4-2 Acceptable bow in the sheets while handling a module

- Do not twist the permeate headers in relation to each other to avoid creasing in the sheets. (See Figure 4-3 Incorrect handling of modules below).

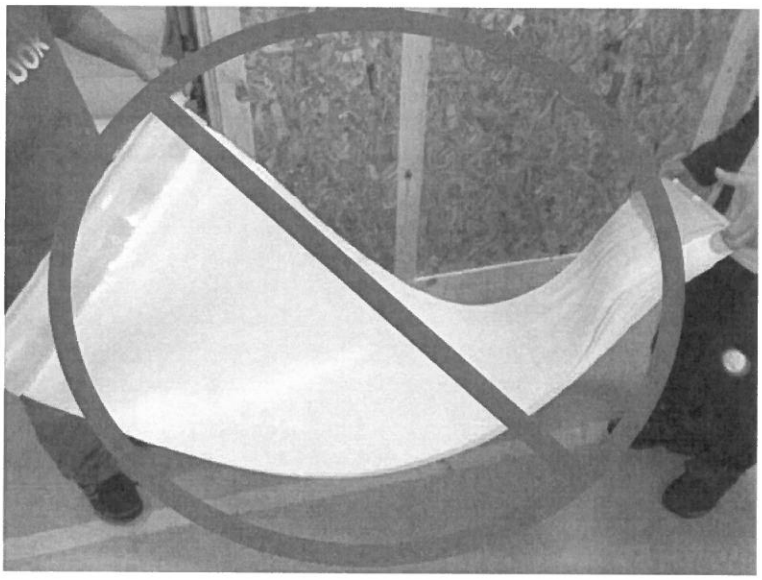


Figure 4-3 Incorrect handling of modules

D. Personal Safety

Hazards:

- *Slip Hazard*: new modules are impregnated with a glycerin solution which can create a slippery floor. Good housekeeping practices should be observed.

- *Chemical*: Modules are received preserved in a glycerin/water solution with a 1% wt. metabisulfite solution added to prevent mildew growth. Wear gloves when handling sodium metabisulphite. The appropriate MSDS should be thoroughly reviewed before working with any chemicals.

- *Lifting:* Wet preserved modules can weigh between 11-34 kg (25-75 lbs) depending on degree of wetness.

Personal Protective Equipment:
The following personal protective equipment is recommended:

- Eye protection
- Safety shoes or boots appropriate for use on ladders

E. Dos and Don'ts:

- Care must be taken when removing any packaging that the module's membrane sheets are not scratched or cut.

- Care must be taken when moving any material or tools around the modules that the membrane coating is not scratched or torn.

- Do not lay individual modules onto a rough surface, or drag on a surface as damage to the coating of the membrane sheet could occur.

- When lifting individual modules, they can tolerate a folding in the length direction, but care should be taken to ensure there is a bow kept in the membrane sheets and not a sharp fold. Twisting of the sheets or folding in the width direction of the modules should be kept to a minimum.

4.1.3 Storage

Fibreplate™ modules are received impregnated with a glycerin solution with a 1% wt. sodium metabisulfite preservative added. If removed from the original packaging and the glycerin solution has been flushed out, the modules must be kept wet and cannot be allowed to dry out. In the section below, different storage options are discussed.

A. Tooling

- Garden hose with spray nozzle that generates fine, wide, spray pattern.
- Plastic storage bags.
- Plastic sheeting.
- Forklift with extension forks or overhead crane.
- Mop and bucket with soapy water, floor squeegee, and shop vacuum set up for wet use.

B. Planning and Resources

- Two persons
- Storage location with a temperature $> 0°C < 35°C$
- Storage tank sized to hold modules or cassettes filled with water.
- Depending on the length of time and how the modules are to be stored, a glycerin impregnation solution and 1% wt. sodium metabisulfite preservative solution.

C. Procedure

Storage of new modules:

- New modules can be stored in the in the original packaging for periods of up to one year from when received at which time they should be inspected and fresh preservative solution added (see below for details on preservative) to minimize any mildew build up.

- Ideal storage of modules that have been in use.

- If storage is required for modules that are within a cassette that have been in use, it is recommended that they are kept in the process tanks filled with water, and permeated and maintenance cleans done on a regular schedule. Temperatures should be monitored to make sure they do not exceed the operational range.

- Short term storage of modules that have been in use and removed from tanks.

- Ideally, modules that have had the glycerin solution removed should be stored temporarily in a water tank taking care to follow handling procedures above in section 4.1.2.

- Modules removed from tanks and are exposed to air for periods of time more than 30 minutes they must be kept wet.

- Modules can be kept wet by spraying with a wide fan spray from a garden hose. Care should be taken to only spray membranes with a wide, gentle, spray pattern. Too strong a water spray could possibly delaminate the membrane coating. A direct concentrated spray onto the module's membrane sheet edges should be avoided.

- Modules should be kept out of direct sunlight.

- Modules stored for less than 24 hours can be sealed in a plastic bag. Two contractor size garbage bags work well and can be sealed with a water resistant tape.

- The modules should be spray rinsed with clean water to remove any solids and if possible cleaned in a recovery clean prior to storage. Again, modules should be kept within the specified temperature.

- Intermediate storage of modules that have been removed from tanks (24 hours to a week).

- If stored for longer than 24 hours and less than a week a preservative solution (1% wt. sodium metabisulfite in water) should be added to the bag and the bag sealed air tight.

For long term storage of modules:

If storage is required for modules that are within a cassette that have been in use, it is recommended that they are kept in the process tanks filled with water, and

permeated and maintenance cleans done on a regular schedule. Temperatures should be monitored to make sure they do not exceed the operational range. If long term storage of individual modules is required:

- Modules should be fully cleaned with a recovery clean.
- Once removed from the tank, clean the modules with water to remove all sludge and debris
- Modules must be impregnated with a 50% glycerin/water solution by permeating the solution through the membrane. If glycerin cannot be permeated into the modules, a minimum 18 hour soak in the glycerin should be done. If membranes are going to be stored in airtight bags immediately after glycerin impregnation, they may be soaked for less time, 4-6 hours.
- Modules can then be stored in an airtight bag with one cup of 1% metabisulfite solution added to the bag.
- Modules should be inspected for signs of mildew every three months and fresh preservative added. Consult the manufacturer for more details if long term storage is required.

D. Do's and Don'ts:

- Do not allow a module that has not been glycerin impregnated to dry out.
- Do not wet modules with a powerful water spray such as a fire hose, power washer, or a focused spray from a garden hose.
- Non-glycerin impregnated modules can be kept for short periods out of water or sludge (< 30 Minutes), but should be kept wet with a gentle spray of water from a garden hose and be kept out of direct sunlight.

4.2 Installation Preparation

This section must be read by engineers, project supervisors, and operators prior to beginning the installation of a FibrePlate™ system. Proper safety precautions should be taken at all times. Failure to follow the installation guidelines can result in damage to property and/or reduced membrane performance.

4.2.1 Cassette Inspection

Cassettes are inspected before shipping to site, however an inspection must be performed before installation in case shipping conditions affected the cassettes and modules. After uncrating and removing the two sheets of plastic of 10x12' and the wraps of foam 3/16" pink sill plate, check the following before installing the cassette:

1. Check all 30 mm bolts are tight.
2. Check all plugs are installed on bottom stack of permeate headers.
3. Check all receiver bolts are tight.
4. If the cassette is partially populated check permeate plug holders are in place on top receiver row.
5. If necessary, adjust all header bolts to a 0.230" gap between frame and SS washer. Do not adjust gap by loosening the bolt. If adjustment is less than 0.230" loosen bolt and allow 1 minute for rubber washer to relax then retighten in the tightening direction.

4.2.2 Site Preparation

Overhead crane must be in working order and inspected. Must also have proper strapping and connections for cassette lifting points. Area must be clear between cassette storage area and membrane tank that the cassette will be installed into. Ensure all tools and installation hardware are available. Before installation, Appendix B, Membrane Pre-Installation Checklist must be completed to ensure the contractors have completed all works involved with the membrane system.

4.3 Cassette Mounting Position Check

Before assembling the hanging support and permeate manifolds to the cassette blocks, it is recommended to check the positioning of the hanging support brackets to ensure they will correctly line up in the membrane tank. The hanging support should be lifted using the crane.

A. Tooling Requirements

- Crane
- Proper strapping rated for correct weight

B. Planning and Resources

- 3 Persons
- 30 minutes per cassette hanger

C. Procedure

1. Lift the hanging support from four points as shown in **Error! Reference source not found.**. Follow cassette lifting procedure
2. Lower the hanging support into position slowly
3. Check for the correct fit and look for any possible interferences. Check that the tie points line up in the correct position.
4. Remove the cassette hanging support
5. Correct any issues if necessary
6. Repeat steps 2-5 until the hanging support fits into the membrane tank correctly.

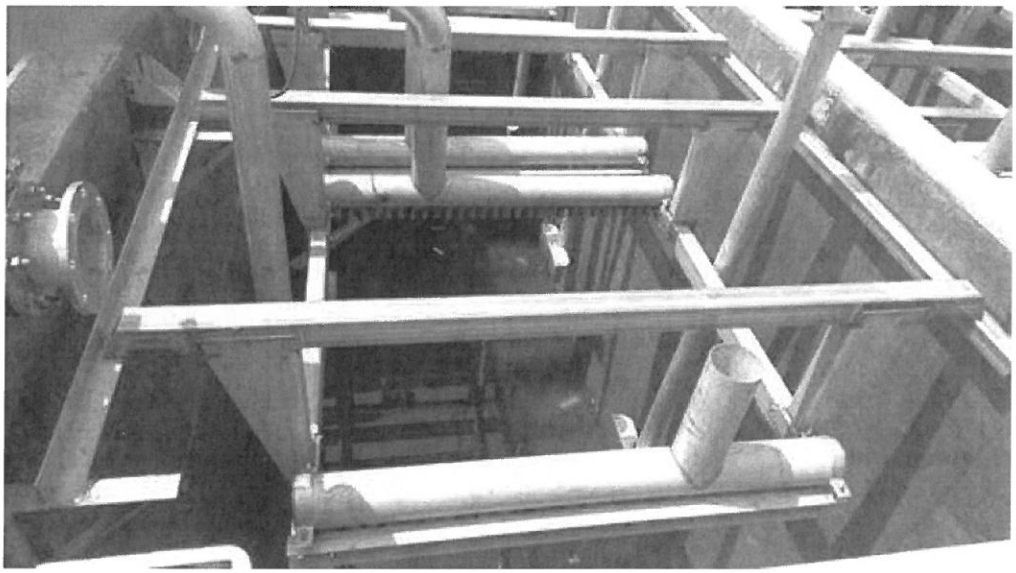


Figure 4-4 Cassette hanging supports in position before full cassettes are assembled and installed.

D. Personal Safety

Falling Hazard: Caution must be taken around open membrane tanks to avoid falling in. Do not approach the edge unless absolutely necessary.

Crane Hazard: Stand clear of path of the crane. Make sure strapping is tied to lifting lugs safely and securely.

Personal Protective Equipment:

- Fall arrest harness and lanyard must be worn at all times when working over membrane tank
- Hard hats must be worn when working with overhead crane.

4.4 Cassette Assembly

Cassettes will be shipped from Fibracast's manufacturing plant with the membrane modules pre-installed. However, most of the time due to shipping height restrictions, cassettes will be shipped with the hanging support, permeate manifolds, and aerator frame separated from the main cassette blocks. If the cassettes to be installed are one or two stacks high, Fibracast will make every effort to ship the entire cassette assembly in one piece if shipping height restrictions allow it. When the cassettes to be installed are three stacks high, then it is likely that the entire cassette will be too high to be shipped with hanging supports and aerator frame installed. In this case, follow the instructions below to assemble the cassettes. **Error! Reference source not found.** below shows the cassette and its named parts.

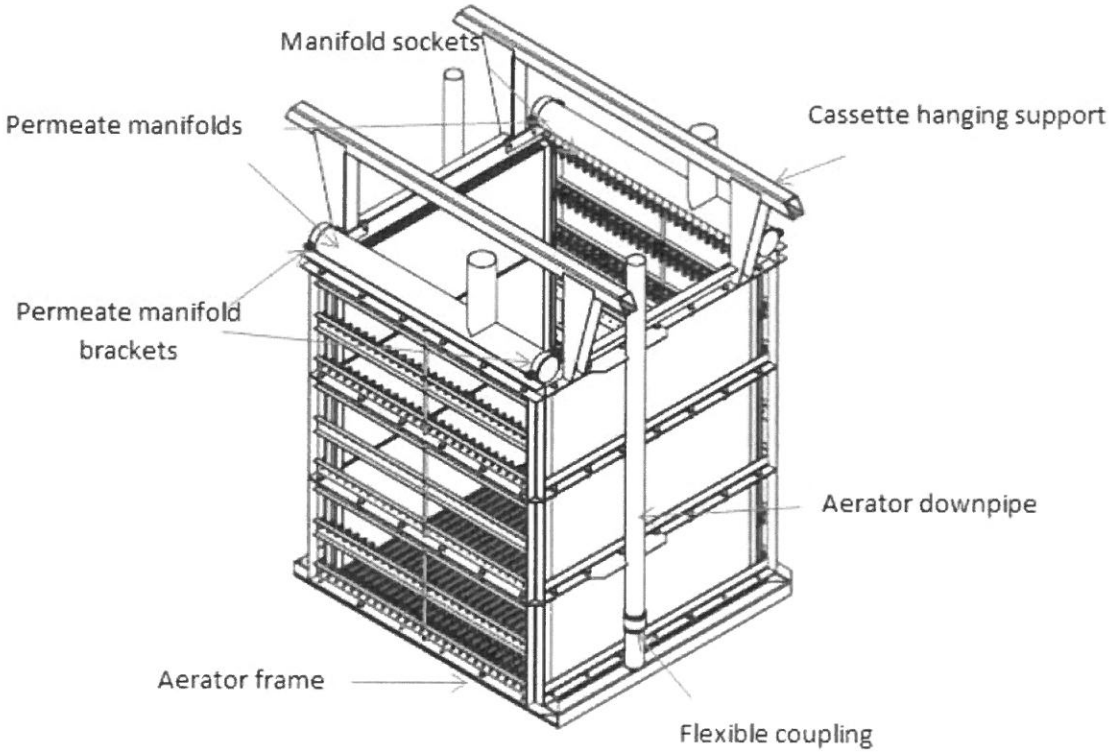


Figure 4-5 FibrePlateTM FPC500 Cassette

4.4.1 Cassette Assembly Procedure

The following is the procedure for assembling the hanging support and aerator frame to the cassette blocks.

A. <u>Tooling Requirements</u>

- Overhead crane or forklift with extended forks
- Proper strapping
- 20 mm wrench
- 12 mm socket wrench
- 2 x Flat screw driver
- O-ring lubricant compatible with Buna Nitrile material

B. <u>Planning and Resources</u>

- Three operators including one certified to operate forklift or crane
- 2 hours
- Area to work around cassette and store cassette components

C. Procedure

4.4.2 Cassette Hanging Support Installation

1. Remove the two permeate manifold pipes from the cassette hanging support. These will be installed separately after the hanging support is in place

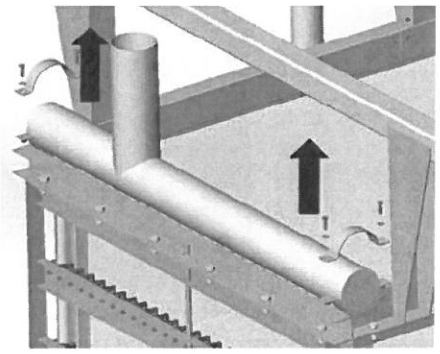


Figure 4-6 Removing permeate manifold

2. Lift top hanging support onto cassette using a crane or forklift, lining up the two alignment pins on the top of the cassette frame with the two holes on the hanging support. Once those are aligned, also align the bolt holes on the hanging support with the holes on the top of the cassette, as you continue to lower the hanging support.

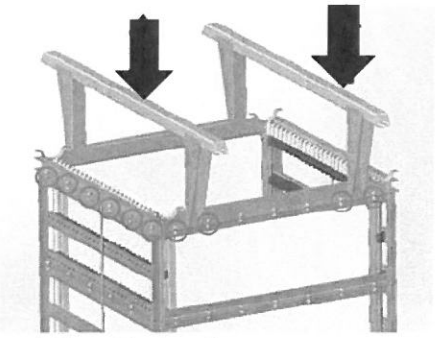


Figure 4-7 Installing hanging support

3. Bolt the hanging support to the cassette using the M20 bolts, lock washers, flat washers, and nuts. Do not install the 3 bolts on each side where the aerator down pipes will be installed.

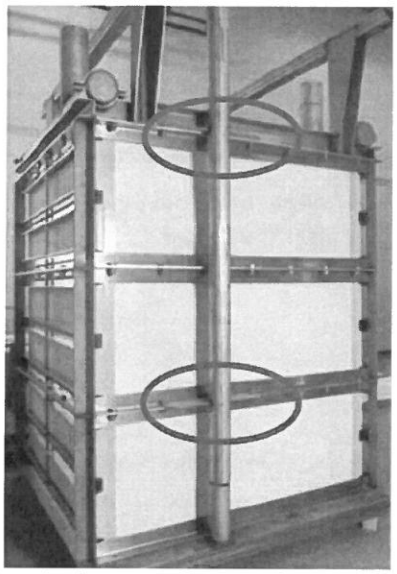


Figure 4-8 Mounting locations of aerator downpipes

The holes where these 3 bolts go will be used once the aerator down pipe is installed.

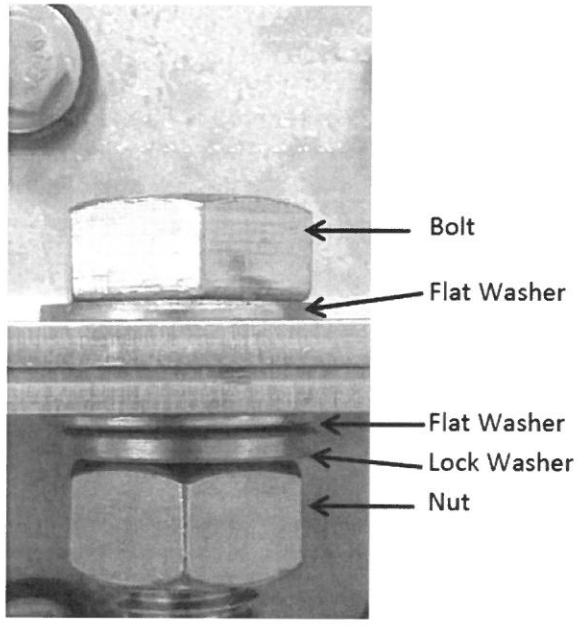


Figure 4-9. Bolt assembly for permeate manifolds

4. Apply a thin layer of O-ring lubricant to each membrane permeate spigot coating both o-rings evenly. Apply a thin layer on the inside of the receiving spigot on the permeate manifold. Ensure no dirt or grit is included to prevent o-ring damage.
5. Lift and lower the permeate manifold pipes onto the module headers. Make sure the manifold is lowered evenly.
6. Make sure the manifold lines up with all of the module headers.
7. Push down on both sides of the manifold evenly and slowly, ensuring that all of the module spigots are entering the manifold sockets.

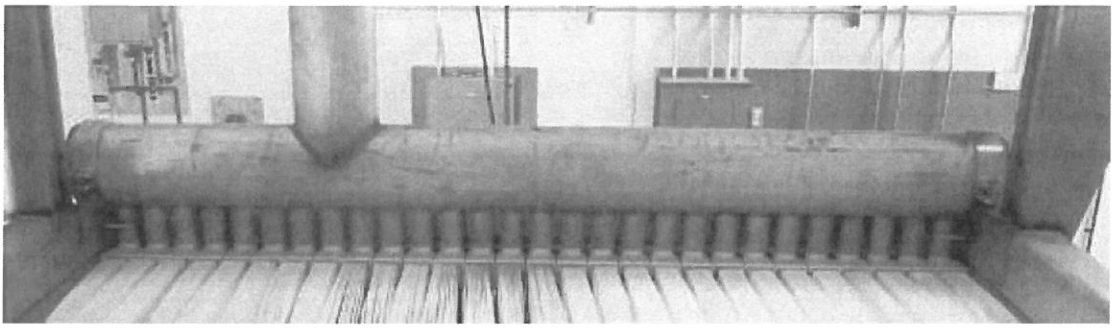


Figure 4-10 Permeate Manifold lined up and installed onto the 28 module spigots

8. Push down until the manifold is on all the way and you can no longer see the two O-rings on each module spigot.
9. Bolt on both of the permeate manifold brackets at the same time. Tighten them at the same time evenly and this will lower the manifold onto the module spigots until the manifold is fully seated as shown in **Error! Reference source not found.**10.
10. Repeat Steps 4 to 7 for the second permeate manifold.

CAUTION: LIFT FROM BOTH SIDES. LIFTING PERMEATE MANIFOLD FROM ONE SIDE MAY DAMAGE MODULES.

4.4.3 Aerator Installation

1. Lift cassette onto aerator frame using the crane or the forklift according to Section 4.6 Cassette Lifting Instructions. Line up bolt holes on the bottom cassette block with the holes on the aerator frame

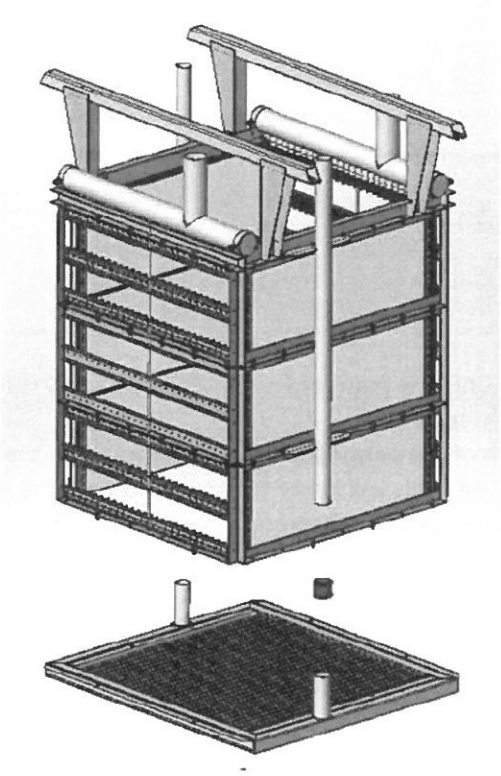


Figure 4-11 Attaching the aerator frame

2. Bolt the aerator frame to the cassette using the M20 bolts, lock washers, flat washers, and nuts as shown below:

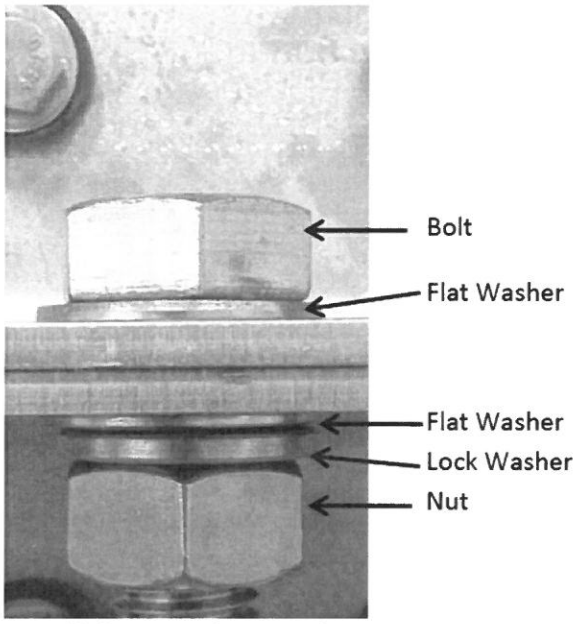


Figure 4-12 Bolt assembly for aerator frame attachment

3. Install the flexible couplings onto the bottom section of the aerator down pipes using a water soluble lubricant.
4. Bolt on the aerator down pipes to the cassette and connect the down pipes using the flexible couplings. Alignment tolerance is a maximum of 5 mm. Use the flat head screw driver to tighten the flexible couplings.

4.5 Maneuvering a Cassette with a Forklift

The cassette can be moved from the storage or assembly location to the crane lifting area with a forklift. The forklift must be rated for the correct weight, and must have extended forks that are also rated correctly (cassette weights shown in Table 3-7 Cassette Weights). The cassette can be lifted from the bottom and then lowered on to four blocks that allow the forks to be removed. Ensure the forks are all the way under and sticking out of the bottom of the cassette. The cassette can also be lifted from the hanging support beams if these are fully installed and bolted on if using long forks and a forklift.

4.6 Cassette Lifting Instructions

Lifting the cassette should be done with a crane. The crane should be rated for the following weights depending on if installing new, dry cassettes or cassettes that have been wet.

A. Tooling Required:

- Crane with rate lifting capacity of at least 10,000 lbs (Cassette weights shown in Table 3-7 Cassette Weights)
- Proper lifting devices rated for appropriate load
- Spreader bar

B. Resources and Planning

- 2 persons

C. Procedure

1. Connect lifting devices to four points on cassette hanging support as shown below

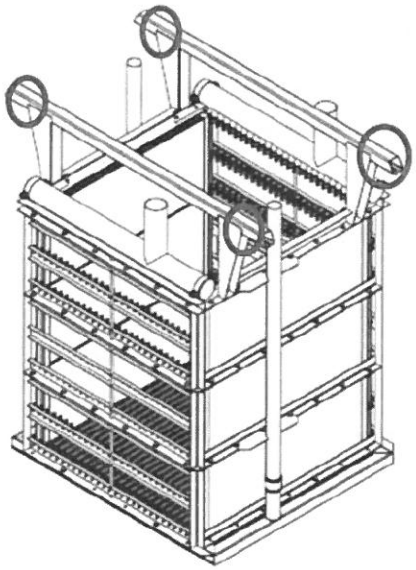


Figure 4-13 Four point lifting locations

2. Lift cassette according to crane operating procedures. Make sure cassette is being lifted evenly. If cassette is being lifted unevenly, lower cassette and readjust the lifting devices.

4.7 Installing Cassettes into the Membrane Tank

Once the cassette is unpacked, inspected, and assembled, it is ready to be installed in the tank. Cassettes should be installed into an empty tank. Water should not be added until after the cassettes are fully installed because once they are wetted the membranes must remain submerged.

Installation of membrane cassettes will require the following:

A. Tooling Requirements

- Overhead crane with enough rate lifting capacity
- Forklift with 8 foot extended forks
- All necessary tools to connect permeate and air piping
- Hardware for anchoring cassettes

B. Resources and Planning

- Installation will be done by contractor
- Fibracast Field Service Representatives will be on site

C. Procedure

1. Position the cassette in the lifting area.
2. Connect chains or straps to the four lifting lugs on the cassette and follow Cassette Lifting Instructions

3. Lift the cassette slowly and lower it so that the connection points on the hanging support beams line up with the locations of the support brackets or I-beams in the membrane tank.
4. There are multiple methods that the cassette can be anchored in the tank. Follow construction drawings to determine the correct method described in A, or B below.

A. Anchor cassette to the Fibracast proprietary wall mounted supports as shown on construction drawings. The supports will have a levelling feature that must be used to ensure the cassette is level. Aerators must be level within 2 mm.

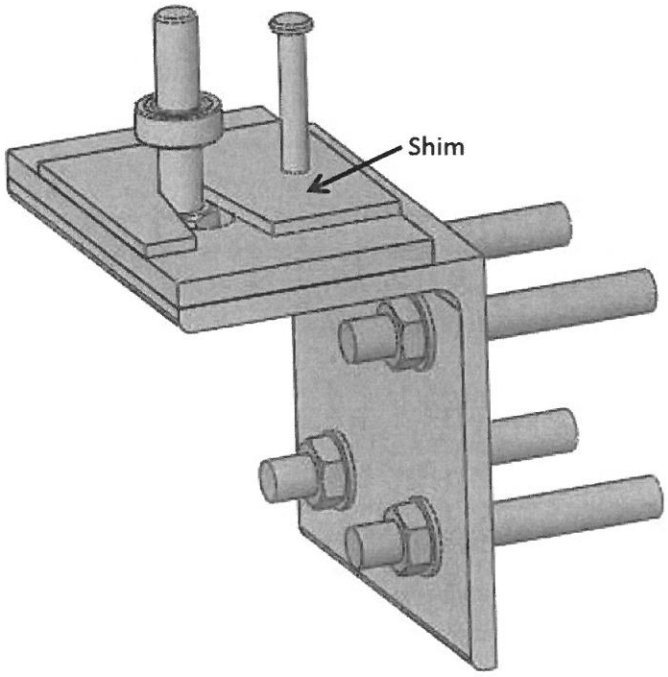


Figure 4-14 Leveling Feature

Use shims to level the cassette. The shims will fit under the cassette hanger on top of the bracket as shown above. Tighten the locking nut to hold the cassette hanger in place once the shims are in place and the cassette is level.

B. Anchor cassette to top of concrete tank wall or I beam support as shown on construction drawings. Cassette must be levelled using shims. The shims should be circular and wrap around the cassette's anchor bolts.

5. Connect the two aeration pipes to aeration header. Do not tighten connections until after all air and permeate pipes are attached
6. Connect the two permeate pipes to main permeate header.
7. Tighten all permeate and air connections

D. Personal Safety

Membrane tanks can be very deep, and as such, when working above or near the top of them, fall arrest equipment including properly functioning and certified harness and lanyard must be worn. As always when working with overhead cranes, hard hats and safety shoes must also be worn. If entering any confined spaces, the individual must have the proper confined space training.

E. Do's and Don'ts

- Do not attempt to install cassettes without a licensed crane operator.
- Do not install cassettes into a tank filled with water unless it is certain that they will not need to be removed again.

4.8 Clean Water Test Procedure

Once the cassette has been installed and all equipment is ready to operate, a test with clean water should be performed. The purpose of the test will be to check for leaks in any piping. It will also provide a chance to verify that the aerators and cassette are level.

A. Tooling Required

- N/A

B. Planning and Resources

- Fibracast Field Service Representative on-site
- Three operators
- Source of clean water with adequate volume to fill a membrane tank in three hours or less
- Power available to control system
- All electrical and controls work completed

C. Procedure

1. Fill the membrane tank with clean water. Make sure there is enough water to fill over the top of the membranes. WARNING: Once the membranes have been wetted, the glycerin that they are preserved in will be rinsed off. Once the glycerin is rinsed off, the membranes must remain submerged or they will dry out.
2. Turn membrane aeration blower on and check for even aeration across the entire cassette. If there are more air bubbles coming up from one side of the cassette, the cassette needs to be leveled.
3. Put the permeate pump in recirculation mode so that the permeate re-enters the membrane tank.

4. Initiate a Prime mode or use air ejector system to prime the permeate system and remove air.
5. Turn permeate pump on at a flux no greater than 10 GFD
6. Run 3-4 permeation cycles, allowing enough time to check all connection points for leaks and run through clean water test checklist. Do not run a backwash cycle unless all air has been purged from the permeate piping and cassettes.
7. Turn permeate pump off
8. Turn aeration off
9. Leave clean water in membrane tank above the membranes to keep them wet until normal operation is to be started.

Each Train should go through a clean water test and comply with the checklist found in Appendix B: Membrane Pre-Installation Checklist

Any items in the checklist that do not pass must be corrected and re-tested until there are no failures.

4.9 Start-up

After clean water test is complete and all components are working, the train is ready to treat mixed liquor. The membranes are preserved in glycerin and for wastewater applications the glycerin can be rinsed off with the process mixed liquor. If a clean water test has been done, the glycerin will be washed off from the water. Always ensure air has left the permeate system before starting backwashes. Relaxation mode must be used until air is completely removed whenever starting or restarting the FibrePlate™ system. Use air ejector system to prime the permeate system before starting production.

1. Open the sluice gate leading to the membrane tank
2. Ensure recirculation pump is turned on. Once membrane tank is full, proceed to next step.
3. Put the train on Standby mode so that the recirculation pumps and membrane air scour blowers are on automatically.

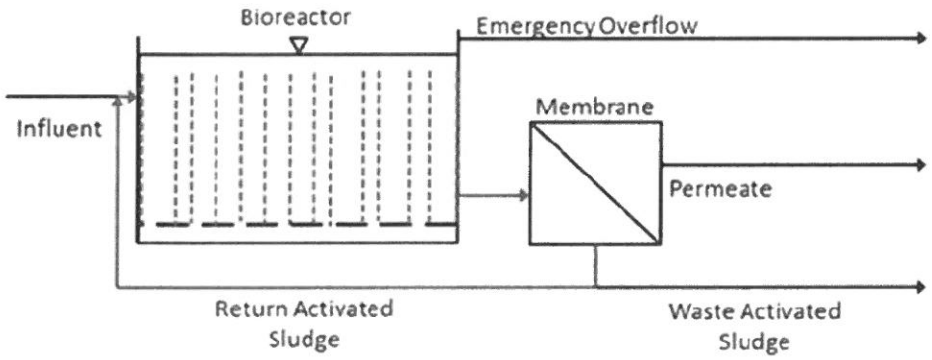


Figure 4-15 Standby mode includes recirculation and membrane aeration, but no permeation

4. Start Priming Mode to remove air from the permeate pipes and cassettes.
5. Turn the train to Permeation mode, with Relaxation enabled. The permeate pump and membrane blower will turn on. Do not exceed 10 GFD during first hour of operation or until air has left system.
6. Do not do any backpulsing until any air in the permeate lines has been removed. Use ejector system again if necessary.
7. Once the air has left the permeate system, turn off Relaxation mode and allow the train to backpulse. Removing all the air from the membranes and permeate piping may take a few hours in some cases.

4.10 Proper Adjustments after Start-Up

4.10.1 4.10.1 Even Airflow

It is critical to FibrePlate™ cassettes to get even aeration across the cassette. Failure to do so will result in inadequate air scouring and possible areas for solids accumulation in the modules. During the clean water test and soon after starting up, make sure there is an even amount of air bubbles coming up through all areas of each cassette. If there are more bubbles coming up from one area than another, the cassette needs to be leveled.

4.10.2 4.10.2 Air in System

Occasionally air will take longer than a few permeation cycles to get all of the air out of the permeate lines. An air ejector can be used to draw air out of the cassettes and permeate piping. Ejectors use a Venturi-style system powered by water or a compressed air. The ejector can be run continuously to get the air out. Air in the system will cause the permeate pump to run inefficiently and can cause incorrect TMP and turbidity readings. If there is air in the system, do not do backpulsing until the air is removed as this can also cause unsafe backpulse TMP's. If the permeate pump is not running, but the permeate pipes are full of water, the TMP reading should be 0 psi. If it is not 0 psi, this can indicated that there is air in the pipes. Some Fibracast systems are programmed to automatically detect air this way. Detecting air in the system by the TMP reading when the permeate pump is off can be programmed into the PLC so that if there is air in the system, before the permeate pump turns on, PRIME mode will start automatically. If this is not programmed to occur automatically, the operator must always initiate a Prime to rid the permeate pipes of air before starting production.

4.10.3 TMP Sensor Offset

Trans Membrane Pressure (TMP) is calculated from a pressure sensor on the permeate header. This value is then corrected to take into account the position of the sensor relative to the water level using the following formula:

$$TMP = Pressure\,from\,Sensor + (A \times C)$$

Where

A = distance from water level in membrane tank to the pressure sensor

C = Conversion factor for inches of water to kPa

Distance A must be verified after startup and must be programmed into the PLC to ensure the correct TMP value is being displayed.

4.11 Operating Modes

For detailed instructions on the SCADA operation of the FibrePlate™ system, please see the system's Control Narrative.

AutoRelax: Is an operator selectable mode where the system will go into standby twice per day for the specified period of time. This mode is used on facilities experiencing excess solids and plants that are running at or above maximum capacity. This mode provide the opportunity for solids to be removed from the membrane bundle as a proactive and preventative cleaning strategy.

Maintenance Clean Mode: Maintenance clean mode will involve back pulsing chlorine into the membranes and allowing them to soak for a period of time. This normally occurs every 5 to 7 days. Please see Section 6.2.1 Maintenance cleans for details.

To enable MC: Maintenance Cleans are scheduled by the operator using the SCADA system to occur at a certain day and time. They can also be initiated immediately by an operator.

Off Mode: In Off mode, the permeate pump for the train will be shut off. The aeration valve for membrane aeration will close for that train, and the inlet sluice gate will close. Precautions must be taken when the train is to be turned off for long periods as no equipment will be operating in this mode.

Production Mode: Production Mode is the normal operating mode that will usually be occurring when the train is to be run permeating.

The permeate pump is on and runs to match the influent coming to the MBR system. Permeate is pumped from the membranes to the disinfection stage. Recirculation pumps and membrane tank aeration are on and run at set points. Permeation mode runs for 5 to 10 minutes and then switches to Backpulse or Relaxation mode for 30-60 seconds.

In Production Mode, the membrane aeration valve to the aeration header is programmed to close every 30 minutes for 5 seconds, and a blow off valve will open. The purpose of this brief aeration re-route is to rewet the aerators which prevents them from drying and clogging.

Prime Mode: In Prime mode, the air ejector system is activated to remove air entrapped in the cassettes, permeate pipes, and/or permeate pumps. Specific operation of ejector systems can vary depending on the type of system installed, see Control Narrative for details. Generally a vacuum is created by running water through a venturi ejector, and the air in the permeate system is drawn out through the ejector. Prime mode must be initiated before putting the system into Production mode. It should occur automatically before going to Production if the system was previously not permeating. Prime can also be initiated manually if air is trapped in the permeate piping system.

Recovery Clean Mode: Recovery Clean mode will involve draining the membrane tank and refilling with chlorine and then citric acid solutions. The chemical solutions will also be back pulsed through the membranes. Recovery Clean mode will be initiated manually by an operator and should occur 1-2 times per year. Please see Section 6.2.2 for details.

To enable RC: Recovery Cleans are scheduled by the operator using the SCADA system to occur at a certain day and time. They can also be initiated immediately by an operator.

Shutdown Mode: If a shutdown alarm is triggered, the system will enter SHUTDOWN mode. All pumps will shut off and all valves will close for the train. The membrane blower will also turn off. The train will also shutdown if the E-stop is enabled.

To exit Shutdown mode:

1. The alarm causing the shutdown must be cleared.
2. Press either ON or OFF in the MODE screen.

Standby Mode: Is activated if the operator selects it, or if there is insufficient demand to run a train or the plant. Individual trains can be in Standby mode while others are in any other mode including production. The recirculation pumps will continue to pump water from the membrane tank to the bioreactor based on a multiplier of the permeate flow, usually 3-4 times. Blowers to the bioreactor and membrane tank are both running. No membrane permeation will occur, so the permeate pump will be shut off. In the case that the system needs to be isolated, or routine maintenance performed, the system is to be put into standby mode.

4.12 General Set Points Page

A table similar to **Error! Reference source not found.** should be filled out during design or commissioning when operating set points for the plant are determined. Some recommended setpoints have been filled in and any that are blank are project specific. The table below is an example and actual setpoints tables will vary from plant to plant.

Table 4-1 Operating Set Points

GENERAL		
Membrane Area		sqft
Production/Backpulse		
Production Duration	300	s
BP Duration	30	s
TMP Snapshots		
SNAP-BEF BEFORE BP TRIGGER	10	s
SNAP-DUR DURING BP TRIGGER	20	s
SNAP-AFT AFTER BP TRIGGER	60	s
Turbidity		
AAHH-TRB-3 TURBIDITY HIGH HIGH	2	NTU

AAH-TRB-3 TURBIDITY HIGH	1	NTU
KY1-TRB-3 HIGH ALARM DELAY	30	s
KY2-TRB-3 HIGH HIGH ALARM DELAY	30	s
Waste		
WST-SP1-1 WASTING VOLUME		gal
Maintenance Clean		
MC-INJ DUR	25	s
Pump Start Speeds		
Permeate PROD		%
Permeate-BP		%
Permeate-MC		%
Temperature		
TAH-TIT-1 TEMEPERATURE HIGH	40	C
TAL-TIT-1 TEMPERATURE LOW	5	C

Flow Setpoints Page:

Flow Setpoints		
Process Flow Rates		
BP FLOW SP	35	%
MC FLOW SP		gpm
RAS FLOW SP- IN PRODUCTION		gpm
RAS FLOW - IN STANDBY		gpm
Permeate Flow		
FAHH-FIT-3 FLOW HIGH HIGH		gpm
FAH-FIT-3 FLOW HIGH		gpm
FALL-FIT-3 FLOW LOW		gpm
FALL-FIT-3 FLOW LOW LOW		gpm
FAHH-BP FLOW HIGH HIGH		gpm
FAHH-BP FLOW HIGH		gpm
FAL-BP FLOW LOW		gpm
FAL BP FLOW LOW LOW		gpm
Feed Flow		
FAHH-FIT-1 FLOW HIGH HIGH		gpm
FAH-FIT-1 FLOW HIGH		gpm
FAL-FIT-1 FLOW LOW		gpm
FALL-FIT-1 FLOW LOW LOW		gpm
RECIRC FLOW		
FAHH-FIT-2 FLOW HIGH HIGH		gpm
FAH-FIT-2 FLOW HIGH		gpm
FAL-FIT-2 FLOW LOW		gpm
FALL-FIT-2 FLOW LOW LOW		gpm

Waste		
FAHH-FIT-4 FLOW HIGH HIGH		gpm
FAH-FIT-4 FLOW HIGH		gpm
FAL-FIT-4 FLOW LOW		gpm
FALL-FIT-4 FLOW LOW LOW		gpm

Aeration Setpoints Page:

Aeration Setpoints		
Membrane Blower		
SC2-B-2 Blower Speed (in Auto)		%
Dissolved Oxygen		
AYH-AIT-1 DO SETPOINT		ppm
AAL-AIT-1 DO LOW ALARM		ppm
Membrane Blower Off Cycling		
B-2 Off Duration	30	sec
B-2 OFF FREQUENCY	1	hr

Level Setpoints Page:

Level Setpoints		
Bioreactor		
LY3-LIT-1 LEVEL SETPOINT		in
LAHH-LIT-1 LEVEL HIGH HIGH		in
LAH-LIT-1 LEVEL HIGH		in
LAL-LIT-1 LEVEL LOW		in
LALL-LIT-1 LEVEL LOW LOW		in
Membrane Tank		
LAHH-LIT-2 LEVEL HIGH HIGH		in
LAH-LIT-2 LEVEL HIGH		in
LAL-LIT-2 LEVEL LOW		in
LALL-LIT-2 LEVEL LOW LOW		in
Permeate Tank		
LAHH-LIT-3 LEVEL HIGH HIGH		in
LAH-LIT-3 LEVEL HIGH		in
LAL-LIT-3 LEVEL LOW		in
LALL-LIT-3 LEVEL LOW LOW		in

Pressure Setpoints Page:

Pressure Setpoints	
Trans-Membrane Pressure	

TMP-HH TMP HIGH HIGH		psi
TMP-H TMP HIGH		psi
TMP-L TMP LOW	0.2	psi
TMP-LL TMP LOW LOW	0.1	psi
TMP-BP-HH BP TMP HIGH HIGH	3	psi
TMP-BP-H BP TMP HIGH	2	psi
TMP-BP-L BP TMP LOW	0.1	psi
TMP BP-LL BP TMP LOW LOW	0	psi

4.13 Procedure for Shutdown

Trains will be turned off from time to time for maintenance and when flows coming to the plant are low. When trains are taken offline due to reduced flow demand, they will be placed into an Off mode where permeation, recirculation and aeration are stopped. Once manually initiated by an operator, train shutdown procedure will happen automatically through the PLC. Shutting down a train will consist of the following steps:

1. Turn off permeate pump for the train
2. Close permeate valve
3. a. Turn off blower for membrane aeration OR

   b. If membrane blower is common between other trains, close valve to stop aeration to the train being shut down, and reduce blower speed accordingly.
4. Close gate valve to the train to stop mixed liquor flow from entering the membrane tank.

While in the standby mode, it is important to prevent the mixed liquor from settling and maintain aerobic conditions within the membrane tank. In order to do so, aeration and recirculation needs to occur from time to time. The recommended frequency for aeration is 5 minutes of aeration every 30 minutes and the recommended frequency for recirculation is 5 minutes every 1 to 4 hours. The frequency of recirculation will be a function of the speed and ease at which the entry and/or exit valves of the Off train can be opened and closed to allow for the recirculation.

Ejector systems assist with priming the permeation system. Ejectors should also be cycled periodically to allow the trains to maintain prime and ensure a smooth transition when placing the train back into operation. The recommended frequency for priming is 5 minutes out of every 2 hours.

When multiple trains are in standby or trains have been Off for prolonged periods of time, trains in operation should be cycled with the trains in Off. In general, the train that has been in Off the longest should be replaced with a train in operation every 1 to 5 hours. Typically in winter weather, trains should remain in Off mode as little as possible to prevent freezing, so if trains are to be cycled on and off, cycle times should be short.

Table 4-2 Aeration, recirculation, and ejector frequency during shutdown

Aeration		Mixed Liquor Recirculation		Ejector	
Duration	Frequency	Duration	Frequency	Duration	Frequency
5 mins	Every 30 mins	5 mins	Every 1-4 hours	5 mins	Every 2 hours

For periods of shutdown longer than 7 days, the membrane tank should be drained of mixed liquor and refilled with clean water. The water can be permeate. The water should be chlorinated with 2-5 ppm of chlorine to prevent biological growth on the membranes. The chlorine concentration should be checked and maintained daily by an operator.

4.14 Test Procedures

4.14.1 Sampling

It is important to test the wastewater and permeate regularly to ensure they are within required parameters. Testing frequency and parameters as required by the EPA or other governing body should be followed. Testing raw influent and mixed liquor should be done daily for TSS to ensure parameters are within the system's operating window.

4.14.2 Time to Filter Test Procedure

The time to filter test should be done at least once a week. This test is an excellent indicator of the filterability of the mixed liquor. The lower the time to filter, the easier the sludge is to filter and this will indicate a healthy sludge. If the time to filter is high (>2 minutes), this may indicates issue an with SRT or the F:M ratio of the bioreactor. A higher time to filter will cause the TMP to be high as well, and the membranes will foul more quickly.

A. Tooling/Equipment

- Erlenmeyer flask with sidearm
- Stopper
- Buchner Funnel – 9 cm diameter
- Filter Paper – Whatman No. 1 90mm diameter
- Vacuum hand pump
- Stopwatch
- 500 ml sample container

B. Planning and Resources

- One operator, 5 minutes

C. Procedure

1. Fill a container with at least 500 ml of mixed liquor from the sample port.
2. Attach stopper and funnel to the top of the flask.
3. Place one sheet of filter paper into the funnel, using finger to ensure a good seal.
4. Fill the funnel with the mixed liquor from the container.
5. Start pumping the hand pump and immediately start the stopwatch. Pump the hand pump until a pressure of 380 mmHg (15 mbar) is achieved.
6. Record the time it takes to filter 100ml of mixed liquor.
7. Pour out remaining MLSS from the funnel and the water in the flask to a drain
8. Remove filter paper and discard. Clean the funnel and flask with paper towel.

D. Personal Safety

Be sure to wear gloves and goggles during the test while handling mixed liquor. Use caution when handling glassware and ceramic funnel as they can easily break if dropped.

4.15 Repair and Replacement Procedures

Under normal circumstances, the FibrePlate™ modules should not need repairs for their lifetime and cassettes should not need to be removed. However, in case of an upset or mechanical damage to a membrane (i.e. items dropped into tank, or prefilter screen failure causing damaging debris to enter tank), removal and disassembly procedure has been included. At the end of their useful life, membranes modules will need to be replaced by removing cassettes and modules. Manufacturer must be consulted before starting this procedure.

4.15.1 Cassette Disassembly

If a cassette needs to be dissembled, follow procedure below:

A. Tooling Required

- Forklift or crane, capacity of 10,000 lbs
- 10 feet of heavy duty strapping for use with forklift or crane
- 20 mm wrench
- Socket wrench set
- Cassette jacks (set of 4) – not standard equipment. Must be requested from manufacturer.

B. Resources and Planning

- Notify supplier before disassembling a cassette
- Three operators should be on hand, including one certified to operate crane or forklift
- Space to store cassette blocks away from sun
- Water source to keep membranes wetted

Definitions

Figure 4-16 Labelled diagram of a cassette

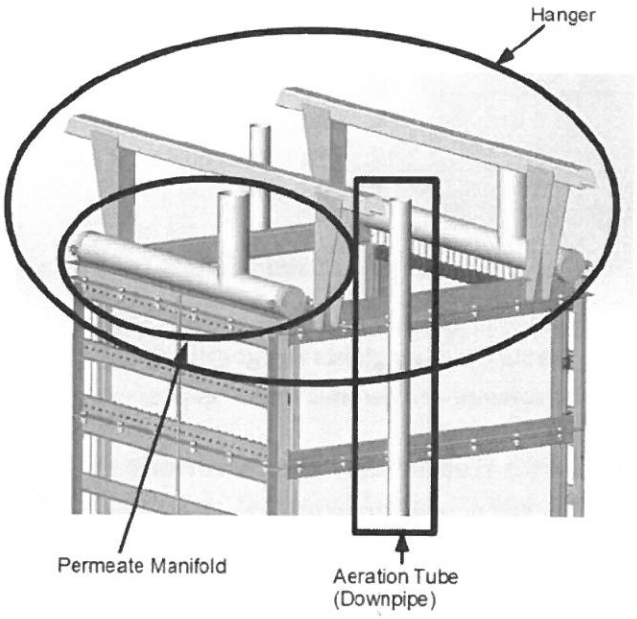


Figure 4-17 Labelled diagram of the hanger, permeate manifold and aeration downpipe

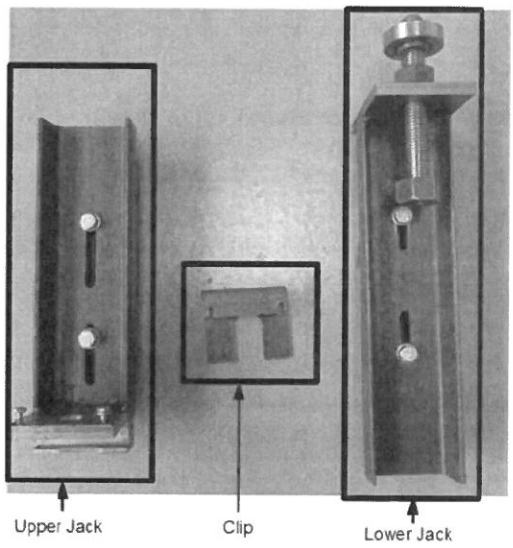


Figure 4-18 Labelled diagram of the upper and lower jacks and the clip

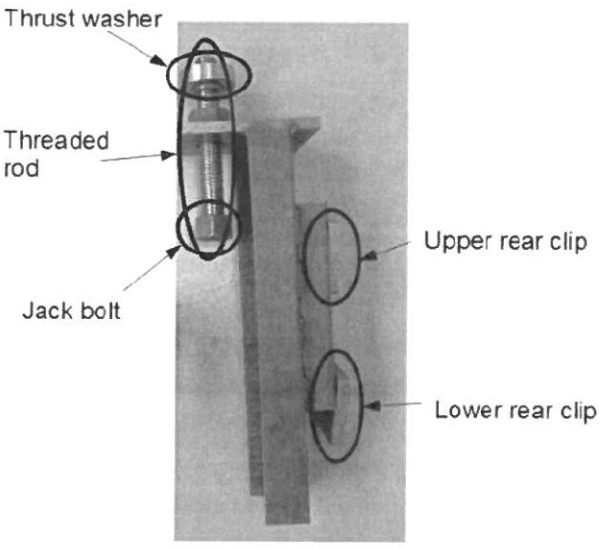


Figure 4-19 Labelled lower clip.

Separating Blocks

1. Remove 2 bolts on front side of the permeate manifold and remove the clamp. Repeat on rear for 4 bolts total. Repeat this process on the other manifold.

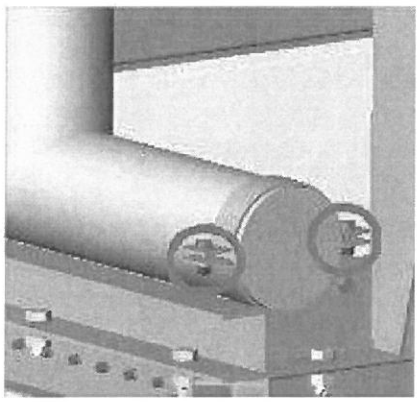


Figure 4-20 Permeate manifold clamp bolts

2. Lift the permeate manifold out vertically.

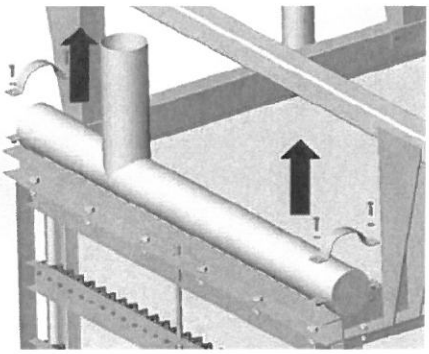


Figure 4-21. Removal of permeate manifold

CAUTION: LIFT FROM BOTH SIDES. LIFTING FROM ONE SIDE MAY DAMAGE MODULES.

3. Remove the two (2) aeration tubes first removing the coupling (Circled in Blue) then by

removing the six

4. (6) bolts (Circled in red) for each tube. Lift the tube out.

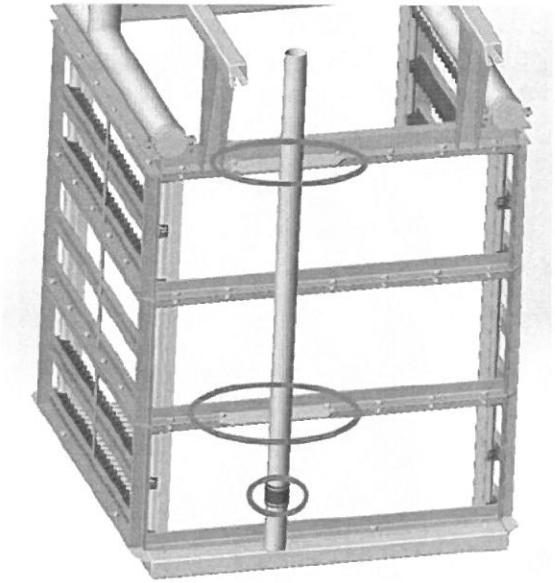


Figure 4-22 Aeration tube bolts

5. Remove the twenty (20) remaining bolts attaching the hanger to the cassette. Lift the hanger off the cassette.

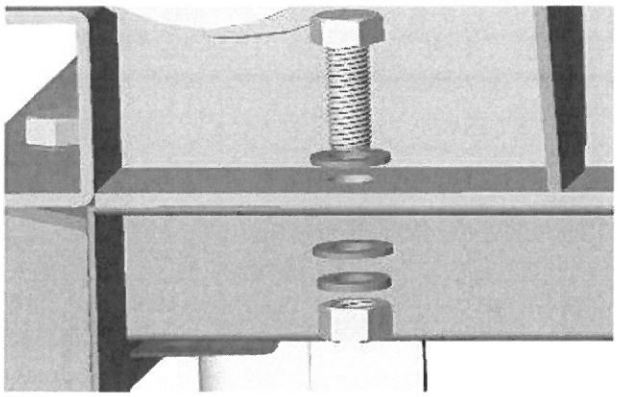


Figure 4-23 Bolt assembly

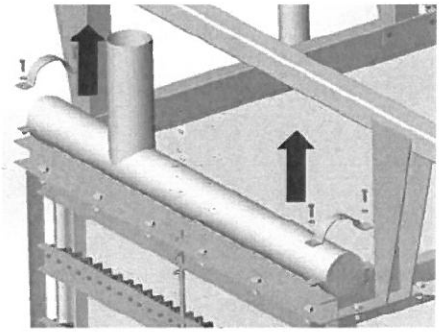


Figure 4-24. Remove the 10 bolts circled in red and the 10 bolts on hidden faces (not shown)

6. Attach lower jack to the bottom block 20" (500mm) from the side of the cassette by placing the jack, positioning the rear clips and tightening the bolts on the front of the jack.

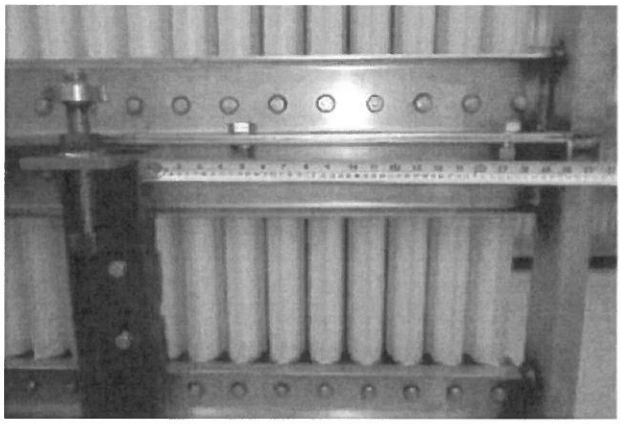


Figure 4-25. Jack location from side of block

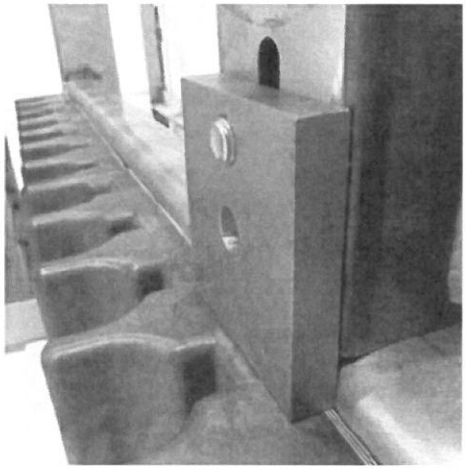


Figure 4-26. Rear clip tightened to the block frame

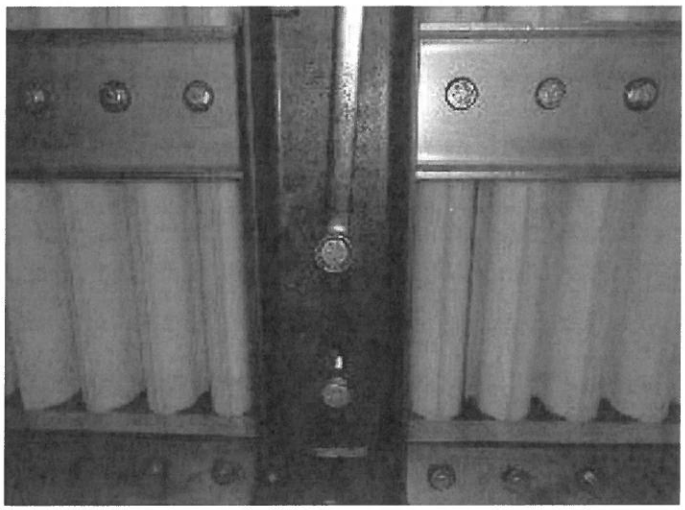


Figure 4-27. Bolts must be tightened to engage the rear clips

7. Attach the upper jack as described in section 5 for the lower jack. Before tightening bolts fully, position such that the hole at the base of the upper jack is lined up over the threaded rod of the lower jack. After alignment is confirmed, tighten clip bolts on the upper jack as was done for the lower jack.

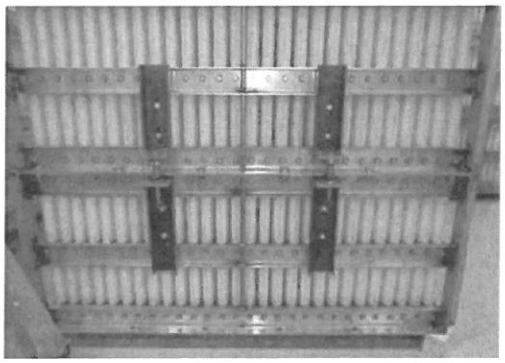


Figure 4-28. Both sides of the cassette should have two jacks attached.

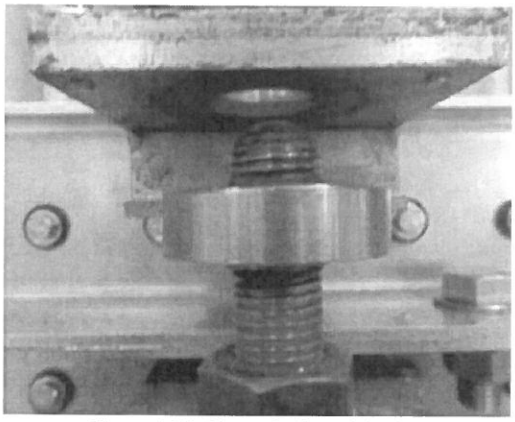


Figure 4-29. Upper jack positioning

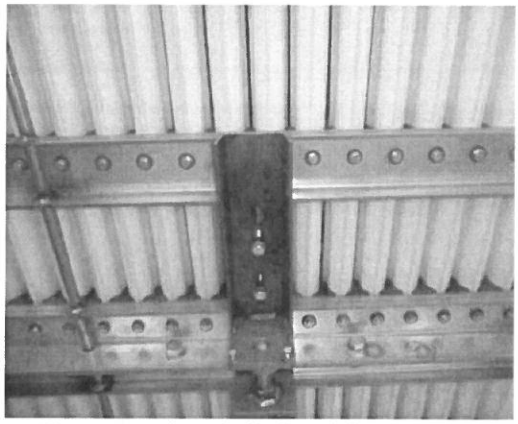


Figure 4-30. Threaded bolt and thrust washer lowered and lined up with upper jack

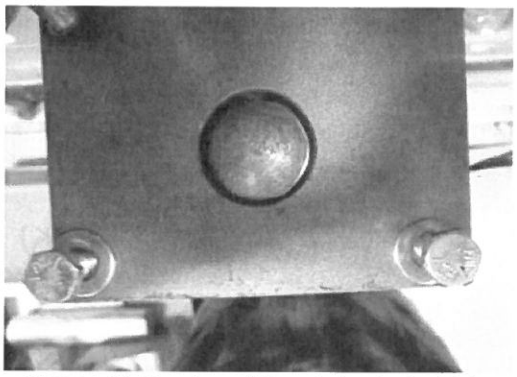


Figure 4-31. Top view of threaded rod raised into aligned position on upper jack

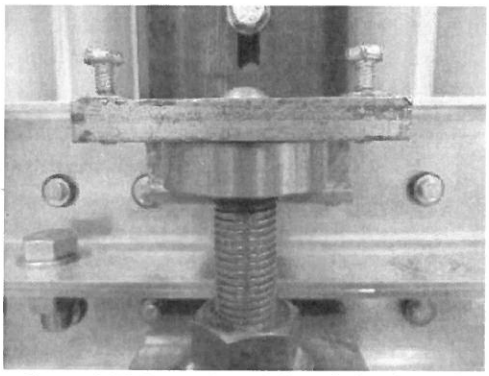


Figure 4-32. Front view of threaded rod raised into aligned position on upper jack

8. Repeat steps 4, 5 and 6 until 2 upper jacks and 2 lower jacks are placed on either side of the cassette, for a total of 4 Cassette Jack pairs.

9. Turn the jack bolt, lifting the threaded rod and thrust washer, until the thrust washer is touching the upper jack's base. Repeat for each jack pair.

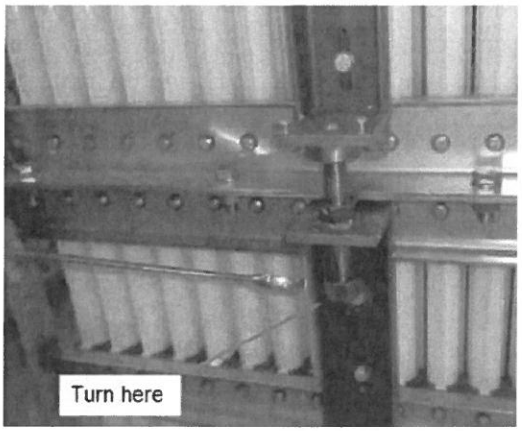


Figure 4-33. Jack bolt location

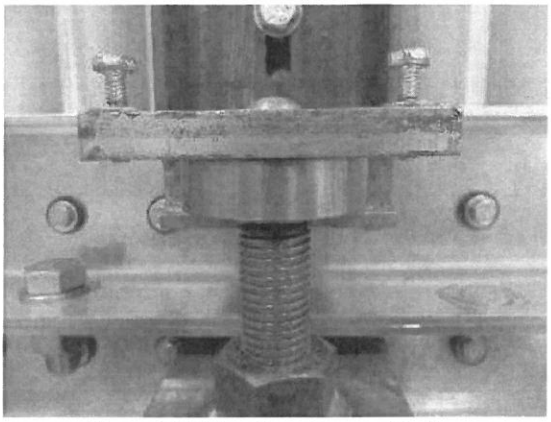


Figure 4-34. Thrust washer positioning

10. Use a wrench to turn the jack bolts to lift the blocks apart. Do only 1 full turn (lift of 1/8", 3mm) on a jack before moving to the next jack in the sequence A>B>C>D. Repeat this pattern until the module spigots are separated.

NOTE: TURNING OUTSIDE OF THIS PATTERN OR IN EXCESS OF 1 TURN (1/8", 3MM) AT A TIME MAY CAUSE PERMANENT DAMAGE.

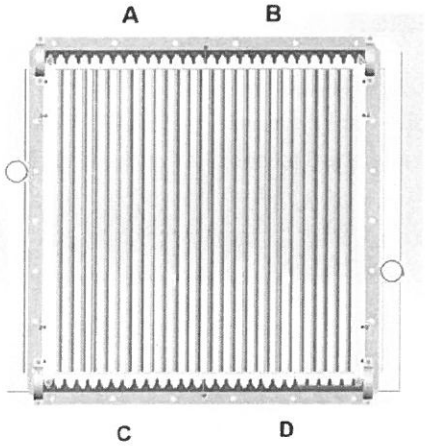


Figure 4-35. Top Down view of the cassette with the four jack positions labeled A, B, C and D.

11. Attach lifting eye bolts to the top of the top block.

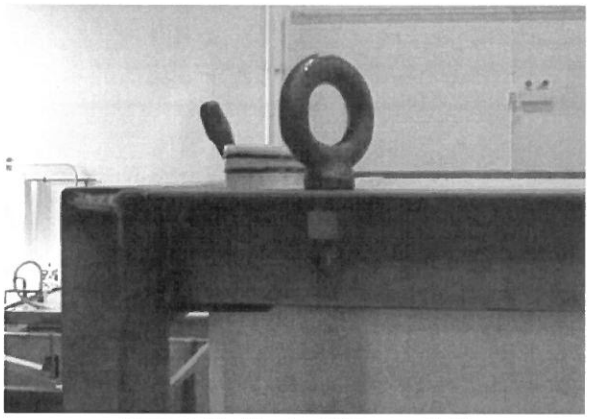


Figure 4-36. Attached lifting eye bolt

12. Remove the upper block(s) with the help of a crane or forklift and place in a safe location on wooden blocking at the four corners of the cassette block

4.15.2 Module Removal from Cassette

Individual modules can be removed manually. Notify the Supplier when removing modules from cassettes. Use caution when using the spreader bar to prevent it from impacting and potentially damaging the membrane surfaces.

A. Tooling Required

- 2 x 13 mm socket wrenches
- Spreader Bar – not standard equipment. Request from manufacturer.
- Overhead crane sized to handle the weights listed in Table 3-4 Module weights:

B. Planning and Resources

- Two operators
- Water source to keep membranes wet
- Tank or plastic bag if storing module that is removed

C. Definitions

Spreader Bar – Tool used to insert and remove modules from the cassette. See list of materials at end of Maintenance Section.

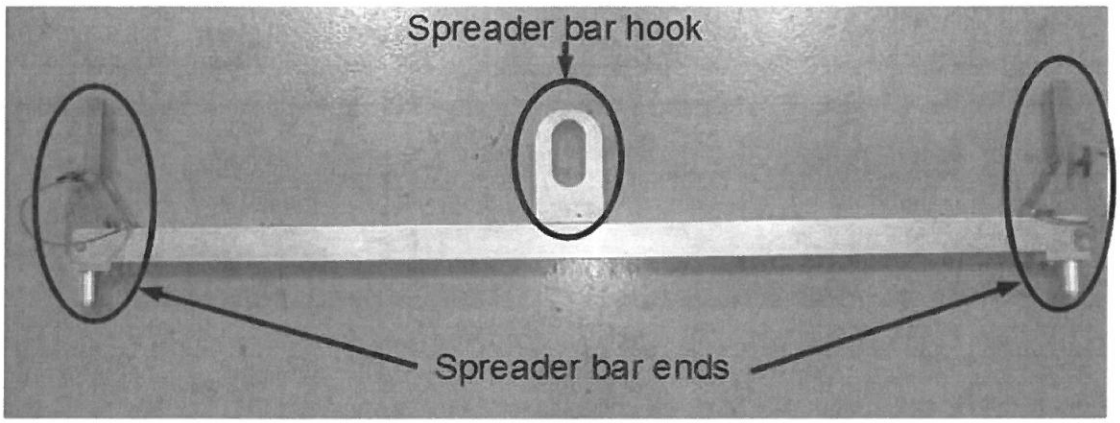


Figure 4-37. Spacer bar with large features labelled

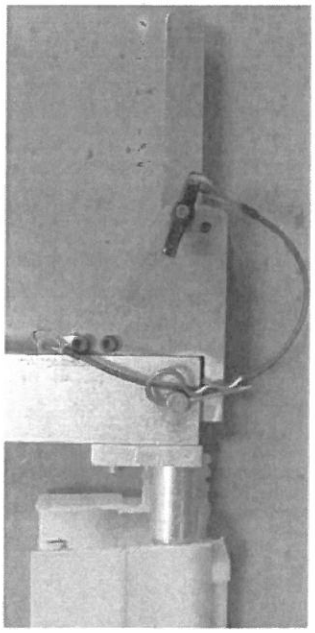


Figure 4-38. Spacer bar in unlocked position

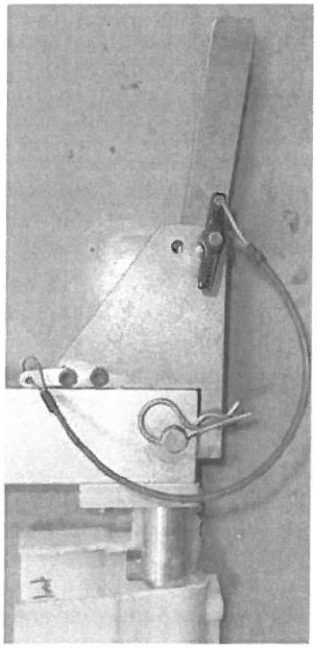


Figure 4-39. Spacer bar in locked position

Note how the locked position causes the bottom portion of the spreader bar end to extend and secure against the inside of the module header.

D. Procedure

Attaching the Spreader Bar

1. Ensure module spigots are clear and that the entire module has an unobstructed lift path.

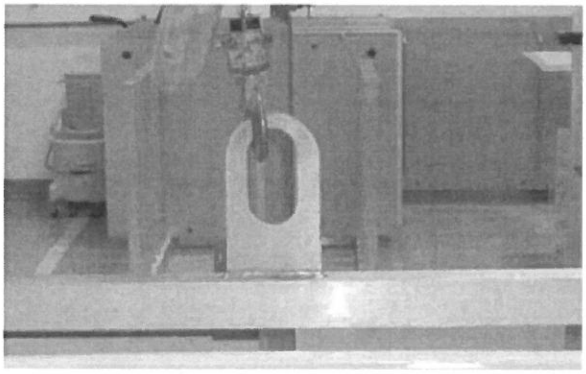


Figure 4-40. Crane hook attached to spreader bar hook

2. Attach crane to spreader bar hook.

3. Lower spreader bar over module to be moved. Ensure spreader bar ends are lined up with the module's spigots.

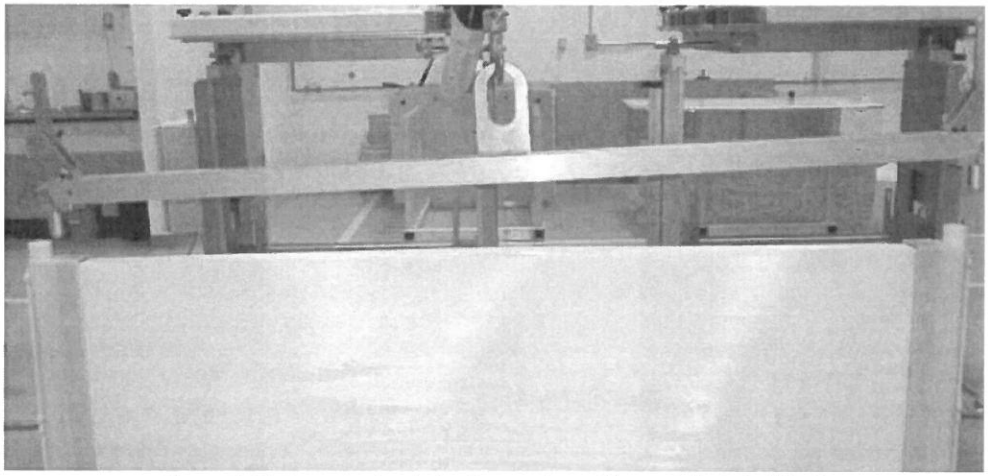


Figure 4-41. Spreader bar being lowered over the module to be lifted

4. Lower spreader bar ends into module spigots.

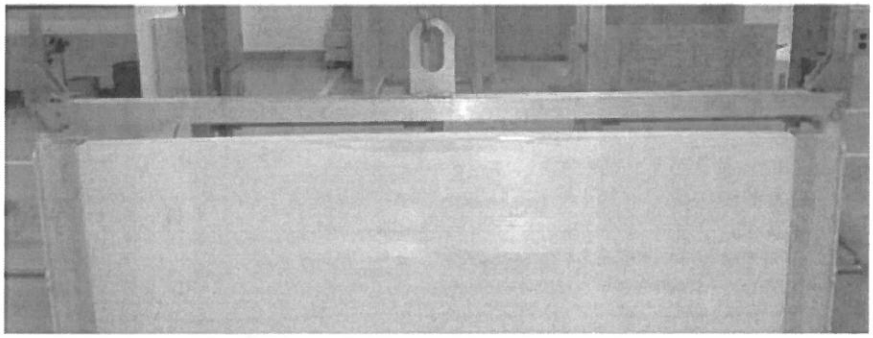


Figure 4-42. Spreader bar inserted in module

5. Remove the lock pins from both ends of the spreader bar (one pin per side).

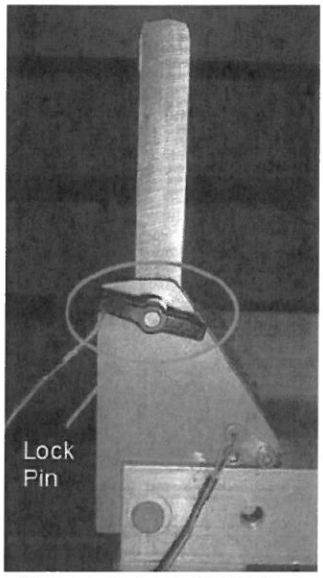


Figure 4-43. Lock pin location

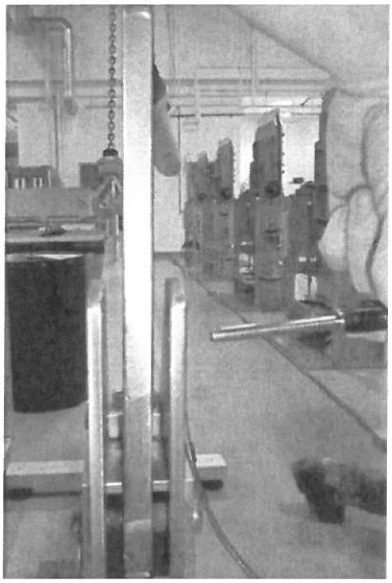


Figure 4-44. Removing the lock pin

6. Pull the handles into the locked position and insert the lock pins on both sides (one pin per side).

NOTE: ENSURE BOTH LOCK PINS ARE SECURE OR DAMAGE MAY RESULT

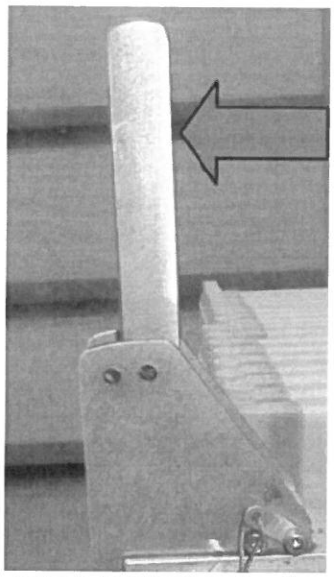


Figure 4-45. Direction of motion for the stretcher bar end handles

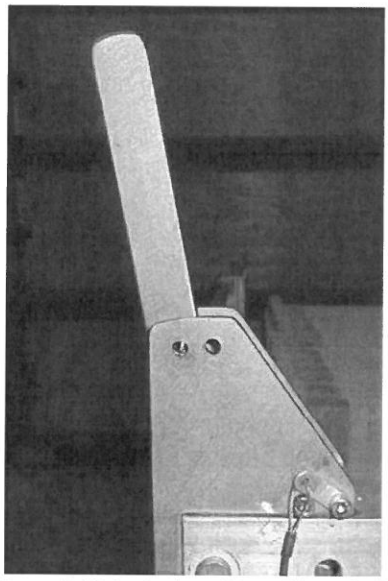


Figure 4-46. Locked position without lock pin

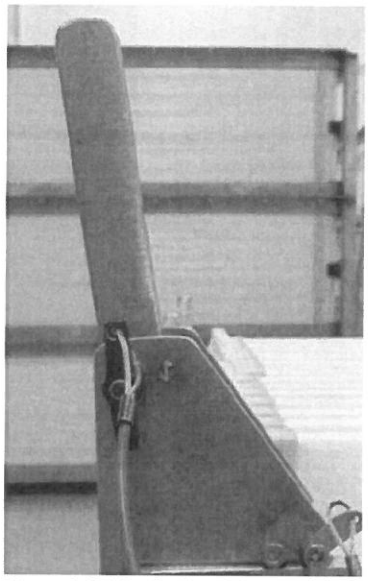


Figure 4-47. Locked position with lock pin in place

7. Remove the three bolts holding the module header to each side of the cassette, 6 bolts total
8. When both ends are locked, lift the module using the crane attached to the spreader bar hook. Use hands to guide the module as you move it around and prevent it from spinning/tipping excessively

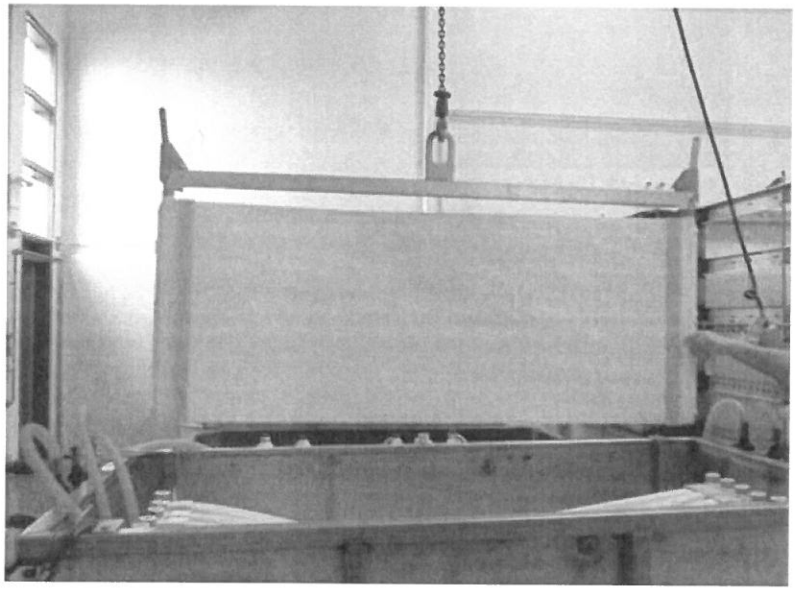


Figure 4-48. Lifting a module with the spreader bar

9. Place or remove the module in the desired location.

Detaching the spreader bar

10. Ensure module is securely placed somewhere safe and there is no load on the crane.
11. Remove lock pins from both ends of the spreader bar.

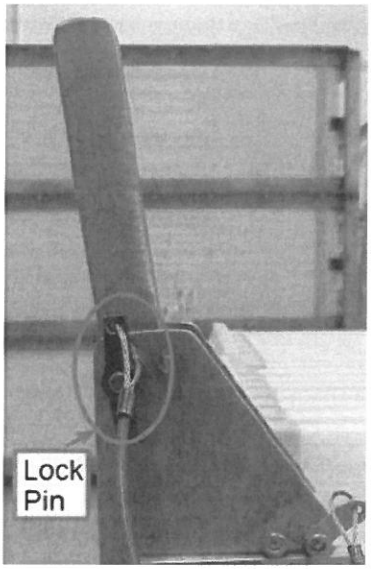


Figure 4-49. Lock pin location

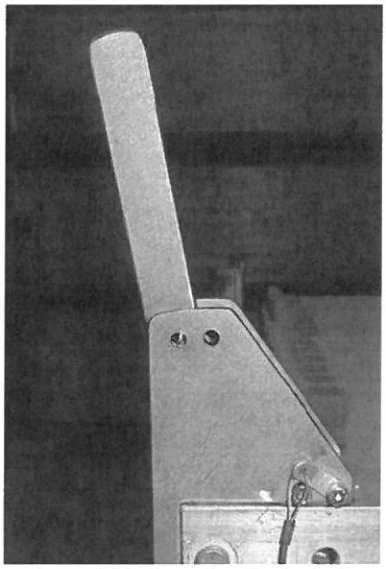


Figure 4-50. Removing the lock pin

12. Place both spreader bar handles into the unlocked position and insert the lock pins on both sides (one per side).

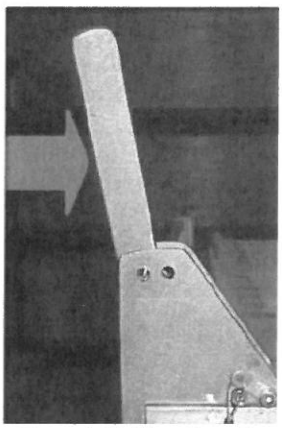


Figure 4-51. Direction of motion for spreader bar handles

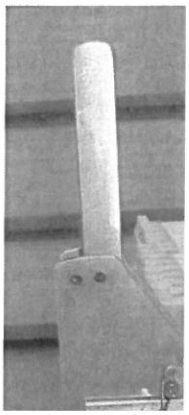


Figure 4-52. Unlocked handle position without pin

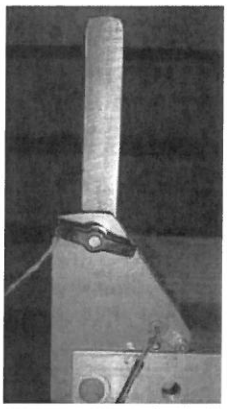


Figure 4-53. Unlocked handle position with pin

NOTE: ENSURE PINS ARE SECURE BEFORE PROCEEDING OR PERMANENT DAMAGE MAY RESULT.

13. Lift the spreader bar using a crane attached to the spreader bar hook. Guide the spreader bar with your hands to keep it level while removing it from the module.

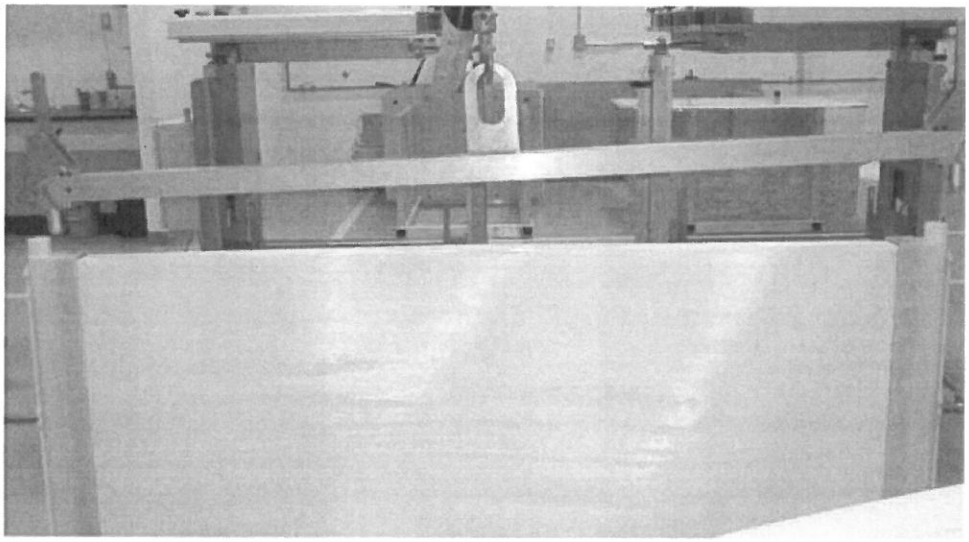


Figure 4-54. Removing the spreader bar

E. Personal Safety

Hard hats and safety shoes should be worn when working with overhead cranes

F. Do's and Don'ts

Do not lift module with the spreader bar until both sides are securely in place and locked

Do not move the spreader bar around when only one side is locked into the module spigot. Doing so can damage the module.

4.15.3 Membrane Repairs

A. Tooling Requirements

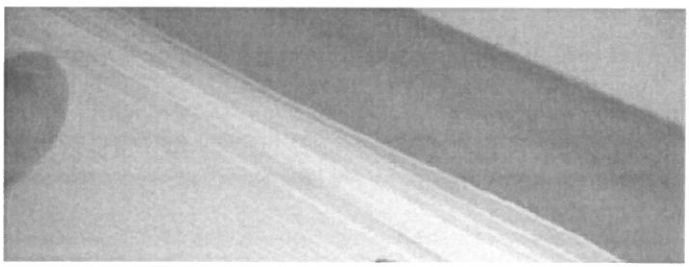
- UV Adhesive
- UV Lamp
- UV Eye Protection
- Syringe Needles
- Syringe Plunger

B. Planning and Resources

- Tank appropriate working area where module can remain wet

C. Procedure

1. Identify the location of the fault in the membrane, if required mark it with a pen.



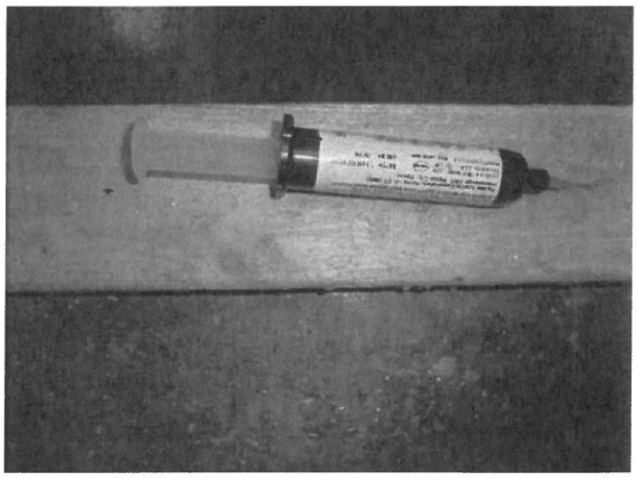
The defect is defined and circled by pen

Figure 4-55. Defect circled in pen

Note: Big defects normally can be detected visually. However, in manufacturing facility an integrity test is carried out to define defects or other associated problems with modules and subsequently if required repair is carried out.

2. Prepare syringe of 3924 UV Adhesive as per the directions included in the packaging, and attach a needle to the end of the adhesive syringe, Figures 4-57 a and b.

Figure 4-56 a. Loctite UV adhesive



4-57 b. Needle attached to adhesive syringe

3. Remove the module from the tank.
4. Dry and clean the area around the fault in the membrane, Figure 4-58.

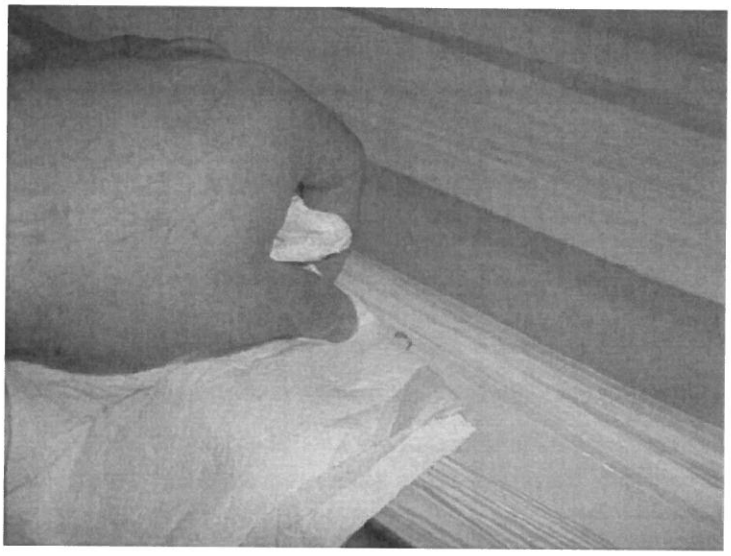


Figure 4-58. Drying the defected area

5. Apply and spread evenly a small bead of UV adhesive to the fault, as shown in Figure 4-59.

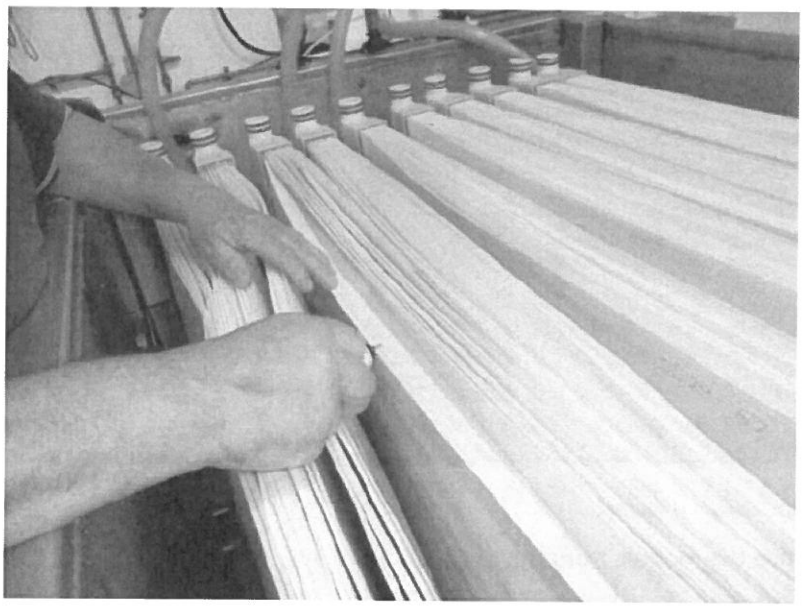


Figure 4-59. Applying UV adhesive

6. Apply UV light using the UV lamp until the glue sets, minimum of 30 seconds. If repairing larger defects make sure the whole glued area is exposed with UV light, and therefore, it requires more time for UV light exposure, figures 60.

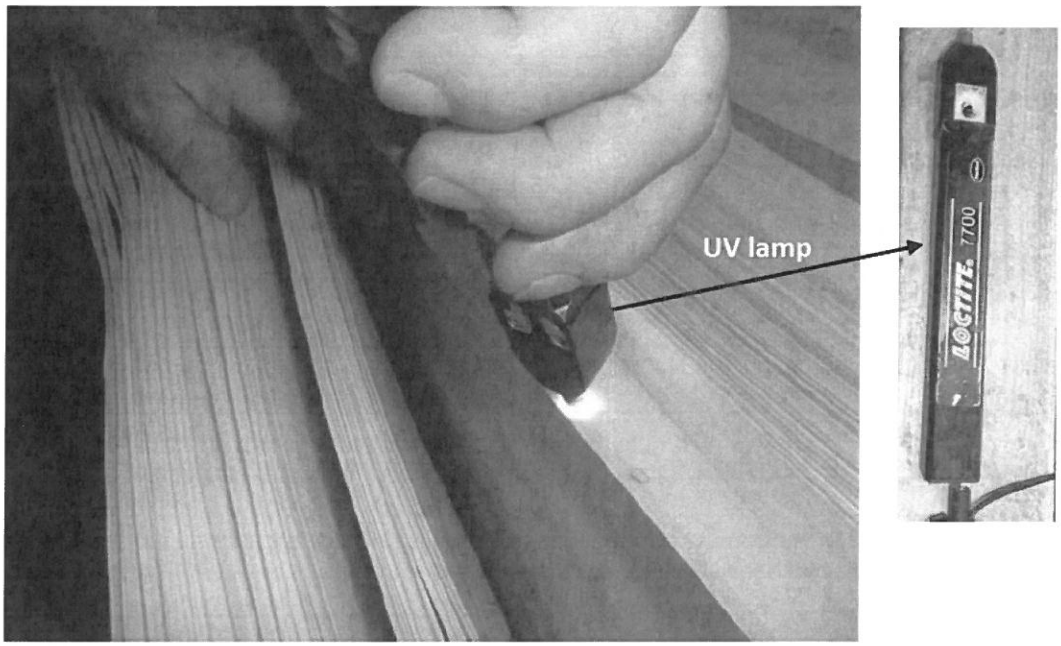


Figure 4-60. UV Lamp

Important note: Protect your eyes with UV protection glasses when using UV lamp.

5 Data, Parameters, and Controls

5.1 Required Mixed Liquor Parameters

Mixed Liquor Suspended Solids that are filtered by FibrePlate™ membranes from upstream biological process must meet the criteria included in Table 5-1 Mixed Liquor Parameters. The MBR system performance is dependent on the design and operation of the whole MBR system, including the pretreatment and biological treatment processes. Note that these criteria are developed for municipal wastewater treatment applications; other/additional criteria may apply to industrial wastewater treatment applications. Operating FibrePlate™ membranes outside of these parameters can result in decreased capacity and damage to property. Warranty will also be voided if the parameters are not adhered to.

Table 5-1 Mixed Liquor Parameters

Mixed Liquor Parameter [1]	Acceptable Operating Range
MLSS in Aeration Tank	≤12,000 mg/L [2]
Operating Temperature	5 – 40°C [3]
Soluble ammonia [4]	< 1 mg/L
Soluble BOD_5	< 5 mg/L
Soluble COD	< 50 mg/L[5]
Dissolved oxygen [6]	> 1.5 mg/L
pH	6 – 8
Total hardness (as $CaCO_3$)	Not scaling
Alkalinity (as $CaCO_3$)	50 - 300 mg/L; not scaling
TTF (preferred) [7]	< 60 Seconds
Trash content	< 2 mg/L (material > 2mm)
MLVSS	>65% for mlss>6000 >80% if mlss<6000
Colloidal TOC (cTOC)[8]	< 10 mg/L
Fats, Oil & Grease (FOG) (Emulsified) Mineral or Non-Biodegradable Oil Free Oil	< 150 mg/L in MBR feed < 10 mg/L in MBR feed 0 mg/L in MBR Feed

[1] Refers to the mixed liquor in the membrane tank(s), unless otherwise specified.

[2] Other limits on MLSS may apply based on SMF or net hydraulic flux considerations. However, in all cases, the MLSS in the membrane tank cannot exceed 15,000 mg/L under any operating conditions for any duration.

[3] Membranes must not be allowed to freeze.

[4] Soluble ammonia may be measured in the permeate

[5] Soluble COD in mixed liquor for industrial wastewater MBR's may be higher.

[6] Dissolved oxygen in the aerobic zone(s) must also be > 1.5 mg/L.

[7] Refer to TTF procedure

[8] Colloidal TOC is the difference between the TOC measured in the filtrate passing through a 1.5 µm filter paper and the TOC measured in the membrane permeate.

5.2 Data and Performance Monitoring

In order to ensure the long term life of the FibrePlateTM system, there are several key parameters that should be monitored during operation. The data from these parameters should be logged and tracked. This will allow historical tracking over long periods and allow operators to determine if a maintenance or repair activity is required. They key performance indicators to monitor are the following:

5.2.1 TMP

Trans-membrane pressure (TMP) is the pressure required to draw permeate through the membrane. The higher the TMP, the more the permeate pump must work to separate the permeate from the mixed liquor. TMP data should be recorded continuously each second. TMP trends should be stable, and only increase slightly because of temperature changes. TMP will also change as the flow through the membranes changes. TMP should drop after a cleaning activity like back pulses, maintenance cleans, and recovery cleans. In addition to being recorded each second, a "snapshot" TMP data point should be regularly recorded before, during, and after each back pulse cycle. This will create three trends to monitor and will provide an easy way to monitor longer term TMP trends over several hours or days. An example of this TMP: The TMP during back pulse should always be lower than the TMP during the production cycles as the back pulse flow will be 30-60% the permeate flow. During the production cycle, TMP may increase slightly until the next back pulse. This increase should not be more than 20% from the After-back pulse TMP.

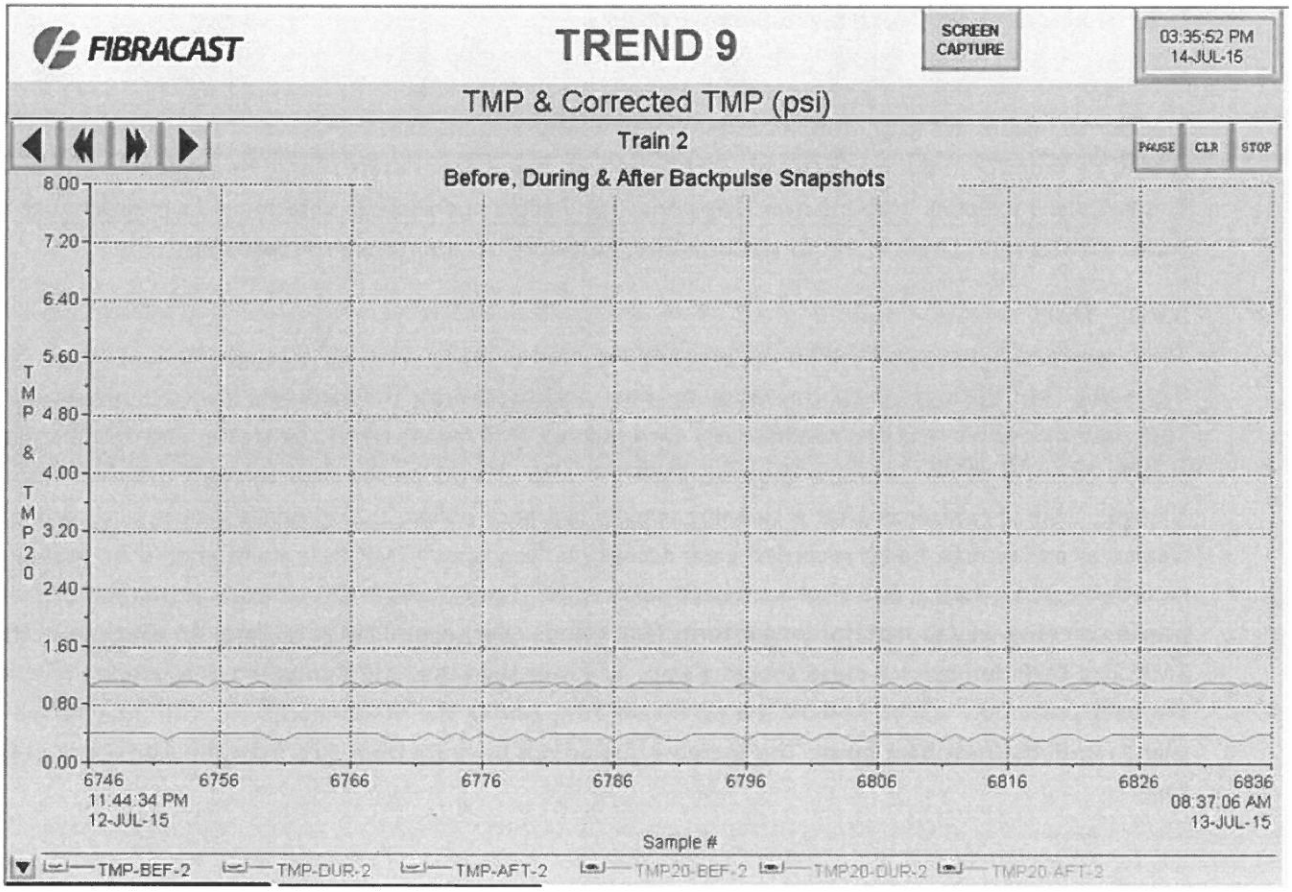


Figure 5-1. Example of a TMP Snapshot trend screen.

Gradual increases in before-backpulse and after-backpulse TMP can indicate the need for maintenance or recovery cleanings.

5.3 Turbidity

An in-line turbidimeter should record turbidity of the permeate in units of NTU at least every 15 seconds. Spikes in turbidity can be caused by air bubbles in the turbidimeter. Turbidity should be closely monitored as increases in it can indicate damaged membranes where suspended solids could be getting through. If the turbidity is higher than normal, an investigation can begin to determine the source of the break by isolating individual cassettes in the train one at a time.

5.4 Control Narrative

The control narrative for the FibrePlate™ system will outline how a specific FibrePlate™ plant will work, referencing pumps, valves, and instrumentation from the corresponding P&ID for the plant. Please see the Control Narrative for your specific system for information on operating the SCADA controls and how to operate the system in more detail.

6 Preventative Maintenance Program

6.1 Ancillary Equipment

For Maintenance programs for all equipment excluding FibrePlate™ membranes and cassettes, please see their attached respective O&M manuals.

6.2 Membranes

Maintenance requirements for FibrePlate™ cassettes and membranes are minimal and most are controlled by a PLC, requiring little of the operator's time. The following table summarizes the typical maintenance activities required by the FibrePlate™ membrane system.

Table 6-1 Summary of Maintenance Activities for FibrePlateTM membranes and cassettes.

Activity	Type (manual/manually initiated/automatic)	Duration	Frequency	Description
Maintenance Clean with Chlorine	Automatic	40 minutes	1 every 5-7 days	The membranes are cleaned with a chlorine solution to prevent membrane fouling. This is initiated automatically and the PLC controls a sequence of steps where chlorine is backpulsed into the membranes and the membranes are soaked in the solution. This is repeated 4 times. The system resumes normal operation automatically when the maintenance clean is complete.
Recovery Clean	Manually Initiated	12 hours	1 every 6-8 months	The membranes are cleaned with citric acid and chlorine. The operator initiates this at the HMI and the PLC controls a sequence of

				steps where citric acid is back pulsed into the membrane tank and the membranes are soaked in the solution.
Desludging	Manually Initiated	12 hours	Only if required after accidental sludging event	The train is put into standby mode, where the permeation is stopped but the RAS recirculation and membrane air scour remains on.
Disinfecting Permeate Storage Tank	Manual	10 minutes	Once per day or as needed	In systems with backwash tanks, add 5 ppm sodium hypochlorite to the tank to prevent any biological growth (algae, etc) from forming.
Inspection of Membrane Aeration Pattern	Manual	5 minutes per cassette	Once per Week	Inspect aeration pattern for irregularities. Aeration should be even across the top of the cassette. Uneven aeration may indicate blockage or solids accumulation.

There are two types of chemical cleans employed for FibrePlate™ MBR systems: Maintenance Cleans and Recovery Cleans. While cleaning requirements are application and project specific, the typical membrane cleaning recommendations are summarized in .

Table 6-2 Maintenance and Recovery Cleaning

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Table 6-2 Maintenance and Recovery Cleaning

	Maintenance Cleaning		Recovery Cleaning	
	Sodium Hypochlorite	Citric Acid	Sodium Hypochlorite	Citric Acid
Frequency	1 every 5-7 days	1[1] every 5-7 days	1 – 2 per year	1 – 2 per year
Dosing Concentration	300 mg/l	2000 mg/l	1100 mg/l	2200 mg/l
Soaking Concentration	N/A	N/A	1000 mg/l	2000 mg/l

[1] If there is Coagulant addition upstream and the effluent alkalinity less than 70 mg/L, citric acid MC is not required.

6.2.1 Maintenance Clean

Maintenance cleaning is a regularly scheduled, low concentration clean that helps minimize membrane fouling, prolong membrane life, and enables the system to handle hydraulic peaks. At the time of plant commissioning, a maintenance cleaning schedule is programmed in the plant control system, and cleans will occur automatically. Typically this schedule is set so cleans occur during low flow time periods.

Membranes are backpulsed with a cleaning solution which is prepared by injecting chemical into the backpulse line to achieve the desired chemical concentration. The design flux for maintenance cleans is 8.5 gfd (14.5 lmh). The detailed procedure for membrane maintenance cleaning is summarized in Table 6-3 Maintenance Cleaning Procedure<u>Tooling Requirements</u>

N/A

A. <u>Resources and Planning</u>

1 Operator to initiate or schedule the clean and ensure enough cleaning chemical is available for the entire clean

B. <u>Procedure</u>

Maintenance cleans can be started by the operator at any time or pre-scheduled to occur at a specific day and time. It is recommended to schedule maintenance cleans during periods of low flow since the

train will be taken off line and the remaining trains will have to increase their fluxes accordingly. The PLC will control the system to perform the maintenance clean automatically according to the steps in **Error! Reference source not found.**.

Table 6-3 Maintenance Cleaning Procedure

Step Number	Action
1	• Stop permeating from the membrane train to be cleaned • Continue to aerate membranes and recirculate mixed liquor for 5 minutes to 1 hour to dislodge any accumulated solids
2	• Backpulse the chemical solution at MC flux through the membranes for 1 minute (via injecting the chemical into the backpulse line to achieve the desired chemical concentration after mixing with permeate), and relax the membranes for 4.5 minutes (no backpulse, no aeration) ✓ For sodium hypochlorite (NaOCl) a concentration of 300 ppm is recommended Note: Initial pulse duration may vary based on the length of piping between the chemical injection point and the membrane cassettes.
3	• Backpulse the chemical solution at MC flux for 15-30 seconds and then relax for 4.5 minutes. Pulse duration should be adjusted accordingly for larger systems.
4	• Repeat step 4 for a total of 4 to 16 chemical pulses and relax for 4.5 minutes
5	• Backpulse clean permeate without chemicals at MC flux through the membranes for 1 minute. Pulse duration should be adjusted accordingly for larger systems. • Note: this final backwash is used to purge the remaining chemical solution from the headers and membrane into the membrane tank where it will be readily consumed by the mixed liquor without affecting performance
6	• Open appropriate isolation valves. • Aerate train and resume mixed liquor recirculation for 5-10 minutes
7	• Train resumes normal operation.

6.2.2 Recovery Clean

Recovery cleaning is designed to be an infrequent cleaning mechanism to restore membrane permeability and ensure long term performance and ability to handle hydraulic peaks. In general, Recovery Cleans (RC) should be utilized when a gradual decline of membrane permeability has been seen over an extended time, and full recovery of permeability is not seen through backpulse and maintenance cleaning functions.

Membrane trains are soaked in a high concentration cleaning solution. Design flux for recovery clean is 8.5 gfd (14.5 lmh). The procedure for membrane recovery cleaning is summarized Table 6-4. Recovery

cleans must be initiated by the plant operator, however once initiated will be controlled automatically by the plant PLC.

Ensure adequate cleaning chemical volume is available to perform the entire recovery clean. For some industrial wastewater applications with very high alkalinity, a stronger acid may be needed to bring the pH down to 2 (in addition to citric acid).

A. Tooling Requirements

N/A

B. Resources

- One operator for 1-2 days
- Adequate citric acid to fill membrane tank with 2000 mg/L of citric acid solution
- Adequate chlorine to fill membrane tank with 1000 ppm chlorine solution
- Adequate permeate volume or other clean water source to fill membrane tank twice

C. Procedure

Recovery cleans can be started by the operator at any time or pre-scheduled to occur at a specific day and time. It is recommended to schedule recovery cleans during periods of low flow since the train will be taken off line and the remaining trains will have to increase their fluxes accordingly. The PLC will control the system to perform the recovery clean automatically according to the steps in **Error! Reference source not found.**, but an operator should be on hand to make sure everything works correctly.

Table 6-4 Recovery Cleaning Procedure

Step Number	Action
1	• Stop permeating from the membrane train to be cleaned • Continue to aerate membranes and recirculate mixed liquor for a minimum of 30 minutes to dislodge any accumulated solids
2	• Isolate membrane compartment and shut off aeration and mixed liquor recirculation
3	• Drain membrane tank by transferring mixed liquor to another train(s)/channel, bioreactor or waste
4	• Fill membrane tank with a mix of chlorine and permeate or other fresh water, either with plant service water or through a tank fill valve on the permeate header. Please note that for plants with inadequate permeate storage or other operating trains, permeate will need to be replaced with either plant service water, or potable water

	Use chemical pump to add chlorine to the fresh water and fill the tank to 90% of the cleaning level with 1000 ppm chlorine solution. Note: In some cases if you are manually filling the tank with service water, manually adding chlorine to the tanks may be a more practical option.
6	• Backpulse more chlorine solution at 8.5 GFD and 1000 ppm through the membranes in 2-4 30 seconds intervals followed by 60 second relaxes. The final backpulse must be done without chlorine until the membrane tank is filled to the cleaning level.
7	• Allow the membranes to soak in the chlorine solution for 2 to 4 hours
8	• Drain the tank
9	• Refill the tank with mixed liquor and recirculate for 5 minutes. The purpose of this step is to rinse away any remaining chlorine.
10	• Drain the tank
11	• Fill membrane tank with a mix of citric and permeate or other fresh water, either with plant service water or through a tank fill valve on the permeate header. Please note that for plants with inadequate permeate storage or other operating trains, permeate will need to be replaced with either plant service water, or potable water Use chemical pump to add citric to the fresh water and fill the tank to 90% of the cleaning level with pH of 2 citric acid solution. • Note: In some cases if you are manually filling the tank with service water, manually adding citric acid to the tanks may be a more practical option.
12	• Backpulse more citric acid solution at 8.5 GFD and through the membranes in 2 to 4 30 second intervals followed by 60 second relaxes.
13	• Backpulse the membranes at RC flux, without chemical addition, to completely submerge the membrane fiber to 100% of the cleaning level and reach the required soak concentration
14	• Allow membranes to soak in residual chemical concentration (2,000 mg/L for citric acid) for 6-24 hours. After 1 hour of soak check concentrations and adjust if necessary • Membrane cassettes can be aerated intermittently, typically 1-2 minutes every hour, during the soak step to keep the solution mixed.
15	• Appropriately neutralize the cleaning chemical solution if required. Sometimes spent chemical solution can be sent somewhere in the plant. Note: Typical approach is to neutralize cleaning solution using mixed liquor however chemical neutralization can also be used. (This is done by re-starting mixed liquor recirculation).

16	Open appropriate isolation valves of the membrane tank being cleaned and commence mixed liquor recirculation through the cleaned membrane tank for a period of 15-30 minutes.
17	Re-start membrane aeration and continue to recirculate mixed liquor with aeration on for 15-30 minutes.
18	Resume normal operation

D. Personal Safety

- Proper precautions must be taken to ensure safe use and handling of chemicals during all cleaning events. See MSDS for chlorine and citric acid attached. Goggles and gloves must be worn when handling these chemicals
- If membrane tanks are not covered, caution must be taken when walking around them
- ALWAYS RINSE AWAY CHLORINE FROM MEMBRANE TANK BEFORE ADDING CITRIC ACID. DO NOT MIX CHLORINE WITH ACID AS THIS WILL FORM CHLORINE GAS

6.2.3 Inspections

Membranes are to be submerged constantly and the tanks are often covered. However, 1 to 2 times per year during the recovery clean process, it is important to visually inspect the cassettes and membranes for deterioration.

- Visually inspect the top of the membrane tanks when they are not covered. Ensure aeration is even across the top of each cassette and that each cassette is getting equal aeration.
- Visually inspect membranes for any signs of deterioration or debris build up. These inspections should be done when the membrane tanks are drained for recovery cleans or any other time the tank is drained.
- Check all air and permeate couplings to each cassette to make sure there are no leaks

6.2.4 Individual Module Inspection

Under normal operation with the system functioning properly and meeting the required water quality, membrane inspection is not required. In cases where water quality is not being met and other troubleshooting (connections and valves etc.) did not show any issues (see troubleshooting section in manual), the modules can be inspected. Cassettes can be bubble tested in place in a tank of clean water and can be inspected to a certain extent visually with the tank drained. If required, an individual module can be removed and tested as shown in Section 4.15 Membrane Integrity Testing

6.2.5 Desludging

FibrePlate™ membranes are design to operate at high fluxes for their entire expected lifetime without accumulating solids that will decrease their throughput. However there can be events where a mechanical or process failure leads to solids accumulation in the modules. These types of failures can be inadequate membrane aeration or MLSS concentrations well above FibrePlate's operating limits. An increasing TMP and particularly a significant increase between after-backpulse TMP and before-backpulse TMP can indicate solids accumulation in the sheets. If this occurs, follow the desludging procedure below

A. Tooling

N/A

B. Resources

- 1 operator controlling from the SCADA system

C. Procedure

- Put the train that is showing signs of solids accumulation in Standby mode. Standby mode will turn off the permeate pumps, but continue to allow RAS recirculation and membrane air scouring in the tank. This will break up the solids in the modules.

a. Leave the train in standby for 12 hours
b. Resume normal operation after 12 hours
c. If there is still signs of sludging, repeat the procedure for longer than 12 hours

6.3 Spare Parts

The following replaceable expandable materials are used in the FibrePlate™ membrane cassette. Parts are not expected to require replacement for at least one year.

Table 6-5. Spare Parts

Spare Parts	Part Number	Recommended Spare Quantity per Cassette
O-rings	RG-0001	20
4" Flex Coupling (for aeration pipe)	RC-0044	2

For recommended spare parts for all other equipment please their respective O&M manuals

6.3.1 Special Tools

- **Cassette Jacks-Used for disassembling/reassembling cassette blocks**
  - **4x Lower Jack**
  - **4x Upper Jack**
  - **1x Clip**

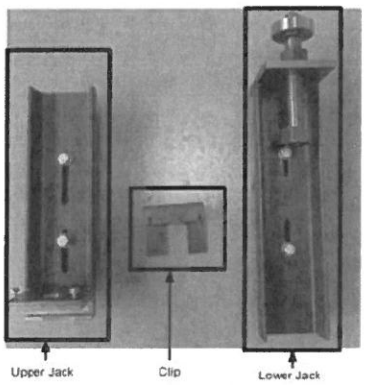

Figure 6-1. Cassette Jacks

- **1x Spreader Bar-used to remove/install individual modules**

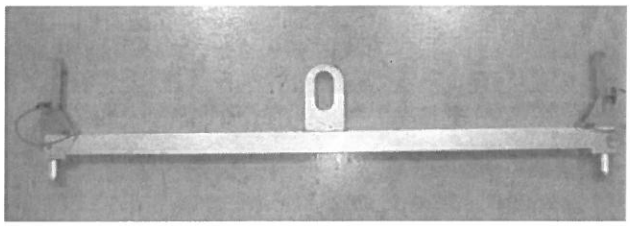

Figure 6-2. Speader Bar

6.3.2 Membrane Repair Kit

While it is not expected that FibrePlate™ modules will need repair during their expected life, if they are slightly damaged by foreign objects entering the membrane tank they can be repaired using the following repair kit.

Table 6-6 Membrane Repair kit

Part	Supplier Information	QTY
UV Adhesive	Loctite AA3924 LC, part # 434105	1
UV Lamp	Loctite 770 LEO Lightsource II, Part # 98793	1
UV Eye Protection	Loctite part # 98452	1
Syringe Needles	Jensen Global	5-10

7 Appendix A: Ancillary Equipment O&M Manuals

8 Appendix B: Membrane Pre-Installation Checklist

FIBRACAST

Membrane Pre-Installation Checklist

To Be Completed Prior To Membrane Installation

Name of Project:

Purpose:

The purpose of this document is to obtain written confirmation from the contractor that the necessary tasks have been completed to ensure safe and successful installation of the Fibracast Membranes.

The flowing tasks MUST be completed, signed off, and forwarded to Fibracast project manager for approval before the installation of membranes is to take place.

1) Mechanical construction work, not including membrane installation requirements above or near the membrane tanks is completed.

Contractor Initials _____ Date Completed _____

2) Electrical work above or near the membrane tanks is completed.

Contractor Initials _____ Date Completed _____

3) Membrane support I-beams installed in each tank and bolted down as per drawings.

Contractor Initials _____ Date Completed _____

4) Hoist has been load tested and is fully functional for membrane installation.

Contractor Initials _____ Date Completed _____

5) Feed lines thoroughly flushed free of debris (weld and PVC shavings, oils, etc.). Where applicable, feed line strainer or temporary screen is fully functional.

Contractor Initials	Date Completed

Membrane Pre-Installation Checklist

To Be Completed Prior To Membrane Installation

6) Permeate header flushed with clean water. (To be completed with Need to be from Fibracast Field Service Representative FSR).

Contractor Initials	Date Completed

7) Blower piping purged with air and free of debris. (To be completed with Need to be from Fibracast FSR)

Contractor Initials	Date Completed

8) Compressed air lines for valves purged to ensure no debris present.

Contractor Initials	Date Completed

9) Grading and handrails are installed on tank to ensure a safe working environment during membrane installation and no further modifications are required to the grading or handrails.

Contractor Initials	Date Completed

10) Membrane and backpulse tanks cleaned and are free of debris before filling with potable water for membrane installation.

	Contractor Initials	Date Completed
Membrane Pre-Installation Checklist Complete		

Contractor Signature	Date

FIBRACAST

Membrane Pre-Installation Checklist To Be Completed Before Introducing Wastewater to the System

Purpose:

The purpose of this document is to obtain written confirmation from the contractor that the system does not have any leaks after being tested with clean water.

The flowing items MUST be checked, signed off, and forwarded to Fibracast project manager for approval before the wastewater is introduced to the system.

1) Permeate pump connections have no leaks

Contractor Initials _____ Date Completed _____

2) Each cassette connection to main permeate header has no leaks

Contractor Initials _____ Date Completed _____

3) TMP sensor is operating correctly

Contractor Initials _____ Date Completed _____

4) Permeate flowmeter is working correctly

Contractor Initials _____ Date Completed _____

5) Turbidimeter is working correctly

Contractor Initials _____ Date Completed _____

FIBRACAST	*Membrane Pre-Installation Checklist* *To Be Completed Prior To Membrane Installation*

6) Backwash pump connections have no leaks

Contractor Initials	Date Completed

7) Backwash TMP and flow is within correct operating range

Contractor Initials	Date Completed

Clean Water Test Checklist Complete

Contractor Signature	Date

9 Appendix C: Warranty Documentation

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Delphos, OH WWTP Operation Reports for Fibracast Membrane

September 2016 – October 2017

Project Number: 81235.02

The Chazen Companies
January 12, 2018
Revised April 27, 2018

Ohio EPA - Daily Discharge Monitoring Report - Form 4500

SUBMISSION ID:		**STATUS:**	Draft
FACILITY:	Delphos WWTP	**PERMIT NUMBER:**	***2PD00029*RD***
LOCATION:	24793 Pohlman Rd	**STATION CODE:**	001
	Delphos, OH 45833	**MONITORING PERIOD :**	2017-10-01 To: 2017-10-31
COUNTY:	Allen	**REPORTING LAB:**	Delphos WWTP, Alloway
DISTRICT:	NWDO	**ANALYST:**	DT,MSH
		NO DISCHARGE INDICATOR:	

PARAMETER	Water Temperature	Dissolved Oxygen	Flow Rate	pH, Maximum	pH, Minimum	Total Suspended Solids	Nitrogen, Ammonia (NH3)
PARAMETER CODE	00010	00300	50050	61941	61942	00530	00610
UNITS	C	mg/l	MGD	S.U.	S.U.	mg/l	mg/l
FREQUENCY	1/Day	1/Day	1/Day	1/Day	1/Day	3/Week	3/Week
SAMPLING TYPE	Maximum Indicating Thermometer	Multiple Grab	Continuous	Multiple Grab	Multiple Grab	24hr Composite	24hr Composite
2017-10-01	22.7	11.0	1.04	7.8	7.7		
2017-10-02	22.4	11.0	1.09	8.0	7.5	AA 4.0	AA 0.20
2017-10-03	23	10.9	0.84	8.0	7.7		
2017-10-04	24.3	10.6	0.91	8.0	7.6	AA 4.0	AA 0.20
2017-10-05	24.4	10.5	0.88	8.0	7.7		
2017-10-06	24.3	10.4	0.84	8.2	7.7	AA 4.0	AA 0.20
2017-10-07	24.1	10.4	0.76	8.1	7.6		
2017-10-08	23.6	10.6	1.21	7.6	7.5		
2017-10-09	23.5	10.6	1.24	7.7	7.5	AA 4.0	AA 0.20
2017-10-10	23.8	10.6	0.78	7.9	6.3		
2017-10-11	23.8	10.5	1.24	7.7	7.6	5.6	AA 0.20
2017-10-12	23.1	10.6	.05	7.8	7.6		
2017-10-13	23.4	10.6	1.11	7.9	7.6	AA 4.0	AA 0.20
2017-10-14	23.3	10.7	1.05	7.7	7.6		
2017-10-15	22.7	10.7	1.06	7.7	7.6		
2017-10-16	22.1	11.0	1.10	7.8	7.5	AA4.0	AA 0.20
2017-10-17	22.1	11.0	1.05	7.8	7.6		
2017-10-18	22.1	11.0	0.89	7.9	7.8	AA 4.0	AA 0.20
2017-10-19	22.4	10.9	1.08	7.9	7.7		
2017-10-20	22.3	10.9	1.03	7.8	7.7	AA 4.0	AA 0.20
2017-10-21	22	11.0	1.05	7.8	7.7		
2017-10-22	21.3	11.1	0.97	7.7	7.6		
2017-10-23	21.8	11.0	.03	7.8	7.9	AA 4.0	AA 0.20
2017-10-24	21.8	10.9	1.26	7.8	7.6		
2017-10-25	21.3	11.0	0.94	7.8	7.7	AA 4.0	AA 0.20
2017-10-26	21.1	11.1	1.05	7.9	7.1		
2017-10-27	20.7	11.1	0.88	8.2	7.8	AA 4.0	AA 0.20
2017-10-28	20.9	11.1	1.18	7.8	7.7		
2017-10-29	20.7	11.2	0.85	8.2	7.8		
2017-10-30	19.8	11.2	0.79	8.0	7.8		
2017-10-31	19.9	11.4	0.82	8.1	7.8		

Minimum	19.8	10.4	0.03	7.6	6.3	0.0	0.0
Maximum	24.4	11.4	1.26	8.2	7.9	5.6	0.0
Average	22.40968	10.85806	0.93774	7.88387	7.6	0.46667	0
Count	31	31	31	31	31	12	12

Name of Responsible Official or Authorized Representative	I certify under the penalty of law that I have personally examined and am familiar with the information submitted herein and based on my inquiry of those individuals immediately responsible for obtaining the information, I believe the submitted information is true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.	Signature of Responsible Official or Authorized Representative	Submission Date/Time

Ohio EPA - Daily Discharge Monitoring Report - Form 4500

SUBMISSION ID:		**STATUS:**	Draft
FACILITY:	Delphos WWTP	**PERMIT NUMBER:**	***2PD00029*RD***
LOCATION:	24793 Pohlman Rd	**STATION CODE:**	001
	Delphos, OH 45833	**MONITORING PERIOD :**	2017-10-01 To: 2017-10-31
COUNTY:	Allen	**REPORTING LAB:**	Delphos WWTP, Alloway
DISTRICT:	NWDO	**ANALYST:**	DT,MSH
		NO DISCHARGE INDICATOR:	

PARAMETER	E. coli	CBOD 5 day	Phosphorus, Total (P)	Oil and Grease, Hexane Extr Method	Nitrogen Kjeldahl, Total	Nitrite Plus Nitrate, Total	Orthophosphate, Dissolved (as P)
PARAMETER CODE	31648	80082	00665	00552	00625	00630	00671
UNITS	#/100 ml	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
FREQUENCY	3/Week	3/Week	1/Week	1 / 2 Weeks	1/Month	1/Month	1/Month
SAMPLING TYPE	Grab	24hr Composite	24hr Composite	Grab	24hr Composite	24hr Composite	Grab
2017-10-01							
2017-10-02	AA 1	AA 2.0	0.48	AA 5.0			
2017-10-03							
2017-10-04	AA 1	AA 2.0					
2017-10-05							
2017-10-06	AA 1	AA 2.0					
2017-10-07							
2017-10-08							
2017-10-09	AA 1	2.8	0.10				
2017-10-10							
2017-10-11	AA 1	43					
2017-10-12							
2017-10-13	AA 1	2.4	0.76				
2017-10-14							
2017-10-15							
2017-10-16	AA 1	AA 2.0		AA 5.0			
2017-10-17							
2017-10-18	AA 1	AA 2.0					
2017-10-19							
2017-10-20	AA 1	AA 2.0	0.10				
2017-10-21							
2017-10-22							
2017-10-23	1	2.5					
2017-10-24							
2017-10-25	AA 1	AA 2.0					
2017-10-26							
2017-10-27	AA 1	AA 2.0	0.10		0.51	3.99	0.14
2017-10-28							
2017-10-29							
2017-10-30							
2017-10-31							

Minimum	0.0	0.0	0.1	0.0	0.51	3.99	0.14
Maximum	1.0	43.0	0.76	0.0	0.51	3.99	0.14
Average	0.08333	4.225	0.308	0	0.51	3.99	0.14
Count	12	12	5	2	1	1	1

Name of Responsible Official or Authorized Representative	I certify under the penalty of law that I have personally examined and am familiar with the information submitted herein and based on my inquiry of those individuals immediately responsible for obtaining the information, I believe the submitted information is true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.	Signature of Responsible Official or Authorized Representative	Submission Date/Time

Ohio EPA - Daily Discharge Monitoring Report - Form 4500

SUBMISSION ID:
FACILITY: Delphos WWTP
LOCATION: 24793 Pohlman Rd
Delphos, OH 45833
COUNTY: Allen
DISTRICT: NWDO

STATUS: Draft
PERMIT NUMBER: *2PD00029*RD*
STATION CODE: 001
MONITORING PERIOD : 2017-09-01 To: 2017-09-30
REPORTING LAB: Delphos WWTP, Alloway
ANALYST: DT,JWF
NO DISCHARGE INDICATOR:

PARAMETER	Water Temperature	Dissolved Oxygen	Flow Rate	pH, Maximum	pH, Minimum	Total Suspended Solids	Nitrogen, Ammonia (NH3)
PARAMETER CODE	00010	00300	50050	61941	61942	00530	00610
UNITS	C	mg/l	MGD	S.U.	S.U.	mg/l	mg/l
FREQUENCY	1/Day	1/Day	1/Day	1/Day	1/Day	3/Week	3/Week
SAMPLING TYPE	Maximum Indicating Thermometer	Multiple Grab	Continuous	Multiple Grab	Multiple Grab	24hr Composite	24hr Composite
2017-09-01	24	10.5	1.45	8.0	7.2	AA 4.0	AA 0.20
2017-09-02	23.8	10.5	1.45	7.9	7.7		
2017-09-03	22.8	10.6	1.45	7.8	7.6		
2017-09-04	22.8	10.6	1.42	7.9	7.7		
2017-09-05	23.5	10.5	1.42	7.8	7.6		
2017-09-06	23.6	10.5	1.38	7.8	7.7	AA 4.0	AA 0.20
2017-09-07	23.4	10.6	1.42	7.8	7.7	AA 4.0	AA 0.20
2017-09-08	23.1	10.7	1.45	7.9	7.6	AA 4.0	AA 0.20
2017-09-09	23	10.8	1.46	7.9	7.7		
2017-09-10	22	11.0	1.42	8.0	7.5		
2017-09-11	22.4	10.9	1.41	7.8	7.6	AA 4.0	AA 0.20
2017-09-12	22.5	10.7	1.45	7.8	7.7		
2017-09-13	23.5	10.6	1.17	7.9	7.8	AA 4.0	AA 0.20
2017-09-14	23.6	10.5	1.19	7.9	7.8		
2017-09-15	23.8	10.6	1.18	7.9	7.7	AA 4.0	AA 0.20
2017-09-16	23.8	10.5	1.07	7.9	7.8		
2017-09-17	24.1	10.5	0.77	7.9	7.7		
2017-09-18	24.5	10.4	0.94	7.9	7.5	AA 4.0	AA 0.20
2017-09-19	24.7	10.3	1.08	8.0	7.6		
2017-09-20	24	10.5	1.27	7.7	7.6	AA 4.0	AA 0.20
2017-09-21	24.8	10.4	1.10	7.8	7.6		
2017-09-22	25.2	10.3	1.18	7.8	7.6	AA 4.0	AA 0.20
2017-09-23	25.1	10.3	1.02	8.0	7.7		
2017-09-24	24.7	10.4	1.04	7.8	7.6		
2017-09-25	24.5	10.4	1.04	7.7	7.5		
2017-09-26	24.8	10.3	1.04	7.8	7.5	6.0	AA 0.20
2017-09-27	25.1	10.3	1.06	7.8	7.6	AA 4.0	AA 0.20
2017-09-28	24.9	10.4	1.07	7.7	7.6		
2017-09-29	24	10.6	0.99	7.8	7.6		
2017-09-30	23.1	10.8	1.02	7.7	7.6		
Minimum	22.0	10.3	0.77	7.7	7.2	0.0	0.0

Maximum	25.2	11.0	1.46	8.0	7.8	6.0	0.0
Average	23.83667	10.53333	1.21367	7.84667	7.62333	0.5	0
Count	30	30	30	30	30	12	12

Name of Responsible Official or Authorized Representative	I certify under the penalty of law that I have personally examined and am familiar with the information submitted herein and based on my inquiry of those individuals immediately responsible for obtaining the information, I believe the submitted information is true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.	Signature of Responsible Official or Authorized Representative	Submission Date/Time

Ohio EPA - Daily Discharge Monitoring Report - Form 4500

SUBMISSION ID:		**STATUS:**	Draft
FACILITY:	Delphos WWTP	**PERMIT NUMBER:**	***2PD00029*RD***
LOCATION:	24793 Pohlman Rd	**STATION CODE:**	001
	Delphos, OH 45833	**MONITORING PERIOD :**	2017-09-01 To: 2017-09-30
COUNTY:	Allen	**REPORTING LAB:**	Delphos WWTP, Alloway
DISTRICT:	NWDO	**ANALYST:**	DT,JWF
		NO DISCHARGE INDICATOR:	

PARAMETER	E. coli	CBOD 5 day	Phosphorus, Total (P)	Oil and Grease, Hexane Extr Method	Nitrogen Kjeldahl, Total	Nitrite Plus Nitrate, Total	Orthophosphate, Dissolved (as P)
PARAMETER CODE	31648	80082	00665	00552	00625	00630	00671
UNITS	#/100 ml	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
FREQUENCY	3/Week	3/Week	1/Week	1 / 2 Weeks	1/Month	1/Month	1/Month
SAMPLING TYPE	Grab	24hr Composite	24hr Composite	Grab	24hr Composite	24hr Composite	Grab
2017-09-01	AA 1	AA 2.0	0.96				
2017-09-02							
2017-09-03							
2017-09-04							
2017-09-05							
2017-09-06	AA 1	5.5					
2017-09-07	AA 1	AA 2.0					
2017-09-08	AA 1	AA 2.0	1.81				
2017-09-09							
2017-09-10							
2017-09-11	AA 1	2.9	1.69	AA 5	AA 0.50	8.50	1.74
2017-09-12							
2017-09-13	AA 1	AA 2.0					
2017-09-14							
2017-09-15	AA 1	2.9					
2017-09-16							
2017-09-17							
2017-09-18	AA 1	2.0	1.75				
2017-09-19							
2017-09-20	AA 1	AA 2.0					
2017-09-21							
2017-09-22	AA 1	2.3	2.65				
2017-09-23							
2017-09-24							
2017-09-25	AA 1			AA 5.0			
2017-09-26	AA 1	3.9					
2017-09-27	1	AA 2.0					
2017-09-28							
2017-09-29							
2017-09-30							
Minimum	0.0	0.0	0.96	0.0	0.0	8.5	1.74

Maximum	1.0	5.5	2.65	0.0	0.0	8.5	1.74
Average	0.07692	1.625	1.772	0	0	8.5	1.74
Count	13	12	5	2	1	1	1

Name of Responsible Official or Authorized Representative	I certify under the penalty of law that I have personally examined and am familiar with the information submitted herein and based on my inquiry of those individuals immediately responsible for obtaining the information, I believe the submitted information is true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.	Signature of Responsible Official or Authorized Representative	Submission Date/Time

Ohio EPA - Daily Discharge Monitoring Report - Form 4500

SUBMISSION ID:		**STATUS:**	Draft
FACILITY:	Delphos WWTP	**PERMIT NUMBER:**	***2PD00029*RD***
LOCATION:	24793 Pohlman Rd	**STATION CODE:**	001
	Delphos, OH 45833	**MONITORING PERIOD :**	2017-08-01 To: 2017-08-31
COUNTY:	Allen	**REPORTING LAB:**	City of Delphos, Alloway
DISTRICT:	NWDO	**ANALYST:**	DT , JWF
		NO DISCHARGE INDICATOR:	

PARAMETER	Water Temperature	Dissolved Oxygen	Flow Rate	pH, Maximum	pH, Minimum	Total Suspended Solids	Nitrogen, Ammonia (NH3)
PARAMETER CODE	00010	00300	50050	61941	61942	00530	00610
UNITS	C	mg/l	MGD	S.U.	S.U.	mg/l	mg/l
FREQUENCY	1/Day	1/Day	1/Day	1/Day	1/Day	3/Week	3/Week
SAMPLING TYPE	Maximum Indicating Thermometer	Multiple Grab	Continuous	Multiple Grab	Multiple Grab	24hr Composite	24hr Composite
2017-08-01	24.6	10.4	1.11	8.0	7.7		
2017-08-02	24.9	10.3	0.98	8.0	7.8	AA 4.0	AA 0.20
2017-08-03	31.3	10.1	0.54	8.5	7.2		
2017-08-04	25.5	10.2	0.34	8.1	7.9	AA 4.0	AA 0.20
2017-08-05	25.6	10.1	0.41	8.2	7.9		
2017-08-06	24.9	10.3	0.83	8.2	8.0		
2017-08-07	24.1	10.5	0.81	8.0	7.9	AA 4.0	AA 0.20
2017-08-08	23.6	10.5	0.31	7.9	7.9		
2017-08-09	23.5	10.5	0.00	7.9	7.9	AA 4.0	AA 0.20
2017-08-10	25.4	10.4	0.32	8.2	7.7		
2017-08-11	24.9	10.3	0.77	8.0	7.9	AA 4.0	AA 0.20
2017-08-12	25.1	10.2	0.73	8.1	8.0		
2017-08-13	25.1	10.2	0.73	8.1	8.0		
2017-08-14	24.7	10.3	0.71	8.0	7.9	AA 4.0	AA 0.20
2017-08-15	24.5	10.3	0.53	8.3	7.8		
2017-08-16	24.9	10.2	0.85	7.9	6.8	AA 4.0	AA 0.20
2017-08-17	25.6	10.2	0.91	8.0	7.9		
2017-08-18	25.8	10.0	0.81	8.1	8.0	AA 4.0	AA 0.20
2017-08-19	25.8	10.0	0.70	8.2	7.7		
2017-08-20	25.5	10.2	1.09	7.8	7.8		
2017-08-21	24.7	10.3	1.10	7.8	7.7	AA 4.0	AA 0.20
2017-08-22	25.4	10.1	1.41	7.9	7.6		
2017-08-23	25	10.2	1.44	7.8	7.7	AA 4.0	AA 0.20
2017-08-24	24.9	10.3	1.44	7.9	7.7		
2017-08-25	24.8	10.4	1.42	7.9	7.8	AA 4.0	AA 0.20
2017-08-26	24.4	10.4	1.46	7.8	7.7		
2017-08-27	24	10.5	0.06	7.9	7.6		
2017-08-28	23.9	10.4	1.40	7.8	7.7	AA 4.0	AA 0.20
2017-08-29	24.6	10.3	1.44	7.8	7.7		
2017-08-30	24.6	10.4	1.43	7.8	7.7		
2017-08-31	24.5	10.3	1.13	8.0	7.7		

Minimum	23.5	10.0	0.0	7.8	6.8	0.0	0.0
Maximum	31.3	10.5	1.46	8.5	8.0	0.0	0.0
Average	25.03548	10.28387	0.87774	7.99677	7.75161	0	0
Count	31	31	31	31	31	12	12

Name of Responsible Official or Authorized Representative	I certify under the penalty of law that I have personally examined and am familiar with the information submitted herein and based on my inquiry of those individuals immediately responsible for obtaining the information, I believe the submitted information is true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.	Signature of Responsible Official or Authorized Representative	Submission Date/Time

Ohio EPA - Daily Discharge Monitoring Report - Form 4500

SUBMISSION ID:		**STATUS:**	Draft
FACILITY:	Delphos WWTP	**PERMIT NUMBER:**	***2PD00029*RD***
LOCATION:	24793 Pohlman Rd	**STATION CODE:**	001
	Delphos, OH 45833	**MONITORING PERIOD :**	2017-08-01 To: 2017-08-31
COUNTY:	Allen	**REPORTING LAB:**	City of Delphos, Alloway
DISTRICT:	NWDO	**ANALYST:**	DT , JWF
		NO DISCHARGE INDICATOR:	

PARAMETER	E. coli	CBOD 5 day	Phosphorus, Total (P)	Oil and Grease, Hexane Extr Method	Nitrogen Kjeldahl, Total	Nitrite Plus Nitrate, Total	Orthophosphate, Dissolved (as P)
PARAMETER CODE	31648	80082	00665	00552	00625	00630	00671
UNITS	#/100 ml	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
FREQUENCY	3/Week	3/Week	1/Week	1 / 2 Weeks	1/Month	1/Month	1/Month
SAMPLING TYPE	Grab	24hr Composite	24hr Composite	Grab	24hr Composite	24hr Composite	Grab
2017-08-01							
2017-08-02	AA 1	4.1					
2017-08-03							
2017-08-04	AA 1	AA 2.0					
2017-08-05							
2017-08-06							
2017-08-07	AA 1	3.4	2.47	AA 5.0	AA 0.50	3.4	1.93
2017-08-08							
2017-08-09	AA 1	AA 2.0					
2017-08-10							
2017-08-11	AA 1	AA 2.0					
2017-08-12							
2017-08-13							
2017-08-14	AA 1	AA 2.0	1.29				
2017-08-15							
2017-08-16	AA 1	AA 2.0					
2017-08-17							
2017-08-18	AA 1	AA 2.0					
2017-08-19							
2017-08-20							
2017-08-21	AA 1	AA 2.0	0.45	AA 5.0			
2017-08-22							
2017-08-23	AA 1	AA 2.0					
2017-08-24							
2017-08-25	AA 1	AA 2.0					
2017-08-26							
2017-08-27							
2017-08-28	AA 1	4.2	0.65				
2017-08-29							
2017-08-30							
2017-08-31							

Minimum	0.0	0.0	0.45	0.0	0.0	3.4	1.93
Maximum	0.0	4.2	2.47	0.0	0.0	3.4	1.93
Average	0	0.975	1.215	0	0	3.4	1.93
Count	12	12	4	2	1	1	1

Name of Responsible Official or Authorized Representative	I certify under the penalty of law that I have personally examined and am familiar with the information submitted herein and based on my inquiry of those individuals immediately responsible for obtaining the information, I believe the submitted information is true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.	Signature of Responsible Official or Authorized Representative	Submission Date/Time

Ohio EPA - Daily Discharge Monitoring Report - Form 4500

SUBMISSION ID:		**STATUS:**	Draft
FACILITY:	Delphos WWTP	**PERMIT NUMBER:**	***2PD00029*RD***
LOCATION:	24793 Pohlman Rd	**STATION CODE:**	001
	Delphos, OH 45833	**MONITORING PERIOD :**	2017-07-01 To: 2017-07-31
COUNTY:	Allen	**REPORTING LAB:**	Delphos WWTP, Alloway
DISTRICT:	NWDO	**ANALYST:**	DT, JDF
		NO DISCHARGE INDICATOR:	

PARAMETER	Water Temperature	Dissolved Oxygen	Flow Rate	pH, Maximum	pH, Minimum	Total Suspended Solids	Nitrogen, Ammonia (NH3)
PARAMETER CODE	00010	00300	50050	61941	61942	00530	00610
UNITS	C	mg/l	MGD	S.U.	S.U.	mg/l	mg/l
FREQUENCY	1/Day	1/Day	1/Day	1/Day	1/Day	3/Week	3/Week
SAMPLING TYPE	Maximum Indicating Thermometer	Multiple Grab	Continuous	Multiple Grab	Multiple Grab	24hr Composite	24hr Composite
2017-07-01	23.5	10.5	1.22	7.9	7.9		
2017-07-02	23.6	10.5	1.19	8.1	7.9		
2017-07-03	23	10.7	1.21	7.9	7.8	AA 4.0	AA 0.20
2017-07-04	23.7	10.6	1.16	7.9	7.8		
2017-07-05	23.2	10.7	1.20	7.8	7.7	AA 4.0	AA 0.20
2017-07-06	23.4	10.7	1.17	8.0	7.8		
2017-07-07	23.8	10.5	1.19	8.0	7.9	AE	AA 0.20
2017-07-08	23.8	10.5	1.22	8.0	7.9		
2017-07-09	23.5	10.6	1.16	8.0	7.9		
2017-07-10	22.9	10.8	1.20	7.9	7.8	AA 4.0	AA 0.20
2017-07-11	23	10.7	1.20	7.8	7.8		
2017-07-12	23.7	10.6	1.22	7.8	7.7	AA 4.0	AA 0.20
2017-07-13	24.6	10.4	1.14	7.8	7.7		
2017-07-14	25.3	10.2	1.07	7.8	7.6	AA 4.0	AA 0.20
2017-07-15	25.6	10.2	1.06	8.0	7.7		
2017-07-16	25.3	10.3	1.06	8.0	7.8		
2017-07-17	24.3	10.5	1.15	7.9	7.8	AA 4.0	AA 0.20
2017-07-18	23.3	10.6	1.16	7.9	7.8		
2017-07-19	23.8	10.6	1.16	8.0	7.9	AA 4.0	AA 0.20
2017-07-20	24.2	10.5	1.16	8.0	7.9		
2017-07-21	24.7	10.4	1.12	8.0	7.9	AA 4.0	AA 0.20
2017-07-22	24.9	10.3	0.97	8.3	7.9		
2017-07-23	24.8	10.2	1.15	8.1	7.8		
2017-07-24	24.7	10.2	1.23	7.8	7.6	AA 4.0	AA 0.20
2017-07-25	24.9	10.2	1.08	7.9	7.5		
2017-07-26	24.9	10.3	1.15	7.9	7.7	AA 4.0	AA 0.20
2017-07-27	24.5	10.4	1.11	7.9	7.8		
2017-07-28	24.2	10.3	1.15	7.9	7.9	AA 4.0	AA 0.20
2017-07-29	24.4	10.3	1.11	7.9	7.8		
2017-07-30	24.4	10.4	1.15	7.9	7.9		
2017-07-31	23.8	10.5	1.07	8.0	7.8		

Minimum	22.9	10.2	0.97	7.8	7.5	0.0	0.0
Maximum	25.6	10.8	1.23	8.3	7.9	0.0	0.0
Average	24.11935	10.45806	1.14806	7.93871	7.79677	0	0
Count	31	31	31	31	31	11	12

Name of Responsible Official or Authorized Representative	I certify under the penalty of law that I have personally examined and am familiar with the information submitted herein and based on my inquiry of those individuals immediately responsible for obtaining the information, I believe the submitted information is true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.	Signature of Responsible Official or Authorized Representative	Submission Date/Time

Ohio EPA - Daily Discharge Monitoring Report - Form 4500

SUBMISSION ID:		**STATUS:**	Draft
FACILITY:	Delphos WWTP	**PERMIT NUMBER:**	***2PD00029*RD***
LOCATION:	24793 Pohlman Rd	**STATION CODE:**	001
	Delphos, OH 45833	**MONITORING PERIOD :**	2017-07-01 To: 2017-07-31
COUNTY:	Allen	**REPORTING LAB:**	Delphos WWTP, Alloway
DISTRICT:	NWDO	**ANALYST:**	DT, JDF
		NO DISCHARGE INDICATOR:	

PARAMETER	E. coli	CBOD 5 day	Phosphorus, Total (P)	Oil and Grease, Hexane Extr Method	Nitrogen Kjeldahl, Total	Nitrite Plus Nitrate, Total	Orthophosphate, Dissolved (as P)
PARAMETER CODE	31648	80082	00665	00552	00625	00630	00671
UNITS	#/100 ml	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
FREQUENCY	3/Week	3/Week	1/Week	1 / 2 Weeks	1/Month	1/Month	1/Month
SAMPLING TYPE	Grab	24hr Composite	24hr Composite	Grab	24hr Composite	24hr Composite	Grab
2017-07-01							
2017-07-02							
2017-07-03	AA 1	2.0					
2017-07-04							
2017-07-05	AA 1	AA 2.0					
2017-07-06							
2017-07-07	AA 1	AA 2.0	2.13	AA 5.0			
2017-07-08							
2017-07-09							
2017-07-10	AA 1	AA 2.0	0.85				
2017-07-11							
2017-07-12	AA 1	AA 2.0					
2017-07-13							
2017-07-14	AA 1	AA 2.0					
2017-07-15							
2017-07-16							
2017-07-17	AA 1	AA 2.0		AA 5.0			
2017-07-18							
2017-07-19	AA 1	AA 2.0					
2017-07-20							
2017-07-21	AA 1	2.6	0.53	AA 5.0	0.76	1.84	0.08
2017-07-22							
2017-07-23							
2017-07-24	AA 1	2.9	0.61				
2017-07-25							
2017-07-26	AA 1	AA 2.0					
2017-07-27							
2017-07-28	AA 1	2.7					
2017-07-29							
2017-07-30							
2017-07-31							

Minimum	0.0	0.0	0.53	0.0	0.76	1.84	0.08
Maximum	0.0	2.9	2.13	0.0	0.76	1.84	0.08
Average	0	0.85	1.03	0	0.76	1.84	0.08
Count	12	12	4	3	1	1	1

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Ohio EPA - Daily Discharge Monitoring Report - Form 4500

SUBMISSION ID:		**STATUS:**	Draft
FACILITY:	Delphos WWTP	**PERMIT NUMBER:**	***2PD00029*RD***
LOCATION:	24793 Pohlman Rd	**STATION CODE:**	001
	Delphos, OH 45833	**MONITORING PERIOD :**	2017-06-01 To: 2017-06-30
COUNTY:	Allen	**REPORTING LAB:**	Delphos WWTp, Alloway
DISTRICT:	NWDO	**ANALYST:**	DT, JWF
		NO DISCHARGE INDICATOR:	

PARAMETER	Water Temperature	Dissolved Oxygen	Flow Rate	pH, Maximum	pH, Minimum	Total Suspended Solids	Nitrogen, Ammonia (NH3)
PARAMETER CODE	00010	00300	50050	61941	61942	00530	00610
UNITS	C	mg/l	MGD	S.U.	S.U.	mg/l	mg/l
FREQUENCY	1/Day	1/Day	1/Day	1/Day	1/Day	3/Week	3/Week
SAMPLING TYPE	Maximum Indicating Thermometer	Multiple Grab	Continuous	Multiple Grab	Multiple Grab	24hr Composite	24hr Composite
2017-06-01	20.1	11.2	1.19	8.1	8.0		
2017-06-02	20.2	11.3	1.21	8.1	8.0	AA 4.0	AA 0.20
2017-06-03	20	11.3	1.15	8.1	8.0		
2017-06-04	20	11.3	1.18	8.1	8.0		
2017-06-05	19.9	11.3	1.16	8.0	7.9	AA 4.0	AA 0.20
2017-06-06	20.8	11.1	1.17	8.0	7.9		
2017-06-07	21.2	11.0	1.14	8.0	7.9	AA 4.0	AA 0.20
2017-06-08	21.3	11.0	1.20	8.0	8.0		
2017-06-09	21.2	11.0	1.15	8.0	7.9	AA 4.0	AA 0.20
2017-06-10	21.3	11.0	1.18	8.0	7.9		
2017-06-11	21.4	11.0	1.16	8.1	7.9		
2017-06-12	21.2	11.0	1.18	7.9	7.8	AA 4.0	AA 0.20
2017-06-13	22.6	10.8	1.15	7.9	7.8		
2017-06-14	23.7	10.6	1.19	8.0	7.9	AA 6.7	AA 0.20
2017-06-15	23.6	10.5	1.20	8.1	7.9		
2017-06-16	23.3	10.6	1.15	8.1	7.9	AA 4.0	AA 0.20
2017-06-17	22.8	10.6	1.17	7.9	7.9		
2017-06-18	22.6	10.6	1.14	7.9	7.8		
2017-06-19	22.3	10.7	1.18	7.9	7.8	AA 4.0	AA 0.20
2017-06-20	22.5	10.7	1.15	7.9	7.8		
2017-06-21	22.6	10.7	1.18	8.0	7.9	AA 4.0	AA 0.20
2017-06-22	22.6	10.7	1.21	8.0	7.9		
2017-06-23	23.4	10.6	1.20	8.0	7.9	AA 4.0	AA 0.20
2017-06-24	23.4	10.5	1.24	8.0	7.9		
2017-06-25	22.7	10.7	1.22	8.0	7.9		
2017-06-26	21.8	10.9	1.20	8.0	7.9	AA 4.0	AA 0.20
2017-06-27	21.8	10.9	1.16	8.0	7.9		
2017-06-28	22.4	10.8	1.22	8.0	7.9	AA 4.0	AA 0.20
2017-06-29	22.3	10.8	1.16	8.1	8.0		
2017-06-30	23.1	10.7	1.10	8.0	7.9		
Minimum	19.9	10.5	1.1	7.9	7.8	0.0	0.0

Maximum	23.7	11.3	1.24	8.1	8.0	0.0	0.0
Average	21.93667	10.86333	1.17633	8.00667	7.90333	0	0
Count	30	30	30	30	30	12	12

Name of Responsible Official or Authorized Representative	I certify under the penalty of law that I have personally examined and am familiar with the information submitted herein and based on my inquiry of those individuals immediately responsible for obtaining the information, I believe the submitted information is true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.	Signature of Responsible Official or Authorized Representative	Submission Date/Time

Ohio EPA - Daily Discharge Monitoring Report - Form 4500

SUBMISSION ID:		**STATUS:**	Draft
FACILITY:	Delphos WWTP	**PERMIT NUMBER:**	***2PD00029*RD***
LOCATION:	24793 Pohlman Rd	**STATION CODE:**	001
	Delphos, OH 45833	**MONITORING PERIOD :**	2017-06-01 To: 2017-06-30
COUNTY:	Allen	**REPORTING LAB:**	Delphos WWTp, Alloway
DISTRICT:	NWDO	**ANALYST:**	DT, JWF
		NO DISCHARGE INDICATOR:	

PARAMETER	E. coli	CBOD 5 day	Phosphorus, Total (P)	Oil and Grease, Hexane Extr Method	Nitrogen Kjeldahl, Total	Nitrite Plus Nitrate, Total	Orthophosphate, Dissolved (as P)
PARAMETER CODE	31648	80082	00665	00552	00625	00630	00671
UNITS	#/100 ml	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
FREQUENCY	3/Week	3/Week	1/Week	1 / 2 Weeks	1/Month	1/Month	1/Month
SAMPLING TYPE	Grab	24hr Composite	24hr Composite	Grab	24hr Composite	24hr Composite	Grab
2017-06-01							
2017-06-02	AA 1	AA 2.0					
2017-06-03							
2017-06-04							
2017-06-05	AA 1	AA 2.0	0.62				
2017-06-06							
2017-06-07	AA 1	AA 2.0					
2017-06-08							
2017-06-09	AA 1	AA 2.0					
2017-06-10							
2017-06-11							
2017-06-12	AA 1	AA 2.0	0.25	AA 5.0			
2017-06-13							
2017-06-14	AA 1	2.3					
2017-06-15							
2017-06-16	AA 1	AA 2.0					
2017-06-17							
2017-06-18							
2017-06-19	AA 1	AA 2.0	0.63				
2017-06-20							
2017-06-21	AA 1	AA 2.0					
2017-06-22							
2017-06-23	AA 1	AA 2.0					
2017-06-24							
2017-06-25							
2017-06-26	AA 1	AA 2.0	0.32	AA 5.0	0.80	6.47	0.58
2017-06-27							
2017-06-28	AA 1	AA 2.0					
2017-06-29							
2017-06-30							
Minimum	0.0	0.0	0.25	0.0	0.8	6.47	0.58

Maximum	0.0	2.3	0.63	0.0	0.8	6.47	0.58
Average	0	0.19167	0.455	0	0.8	6.47	0.58
Count	12	12	4	2	1	1	1

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Ohio EPA - Daily Discharge Monitoring Report - Form 4500

SUBMISSION ID:		**STATUS:**	Draft
FACILITY:	Delphos WWTP	**PERMIT NUMBER:**	***2PD00029*RD***
LOCATION:	24793 Pohlman Rd	**STATION CODE:**	001
	Delphos, OH 45833	**MONITORING PERIOD :**	2017-05-01 To: 2017-05-31
COUNTY:	Allen	**REPORTING LAB:**	Delphos WWTP, Alloway
DISTRICT:	NWDO	**ANALYST:**	DT, JDF
		NO DISCHARGE INDICATOR:	

PARAMETER	Water Temperature	Dissolved Oxygen	Flow Rate	pH, Maximum	pH, Minimum	Total Suspended Solids	Nitrogen, Ammonia (NH3)
PARAMETER CODE	00010	00300	50050	61941	61942	00530	00610
UNITS	C	mg/l	MGD	S.U.	S.U.	mg/l	mg/l
FREQUENCY	1/Day	1/Day	1/Day	1/Day	1/Day	3/Week	3/Week
SAMPLING TYPE	Maximum Indicating Thermometer	Multiple Grab	Continuous	Multiple Grab	Multiple Grab	24hr Composite	24hr Composite
2017-05-01	16.6	12.0	1.23	8.0	7.9	AA 4.0	AA 0.20
2017-05-02	17	11.8	1.22	8.0	7.9		
2017-05-03	16.9	11.9	1.14	8.1	8.0	AA 4.0	AA 0.20
2017-05-04	16.6	12.1	1.20	8.0	7.9		
2017-05-05	16.7	12.0	1.14	8.1	8.0	AA 4.0	AA 0.20
2017-05-06	15.9	12.3	1.09	8.3	8.0		
2017-05-07	14.2	12.6	1.11	8.0	8.0		
2017-05-08	14	12.7	1.06	8.1	8.0	AA 4.0	AA 0.20
2017-05-09	14.2	12.8	1.00	8.5	8.0		
2017-05-10	15.4	12.5	1.06	8.2	8.1	AA 4.0	AA 0.20
2017-05-11	16.3	12.2	1.20	8.2	8.0		
2017-05-12	16.4	12.2	1.17	8.1	7.9	AA 4.0	AA 0.20
2017-05-13	16.3	12.2	1.03	8.1	8.0		
2017-05-14	16.7	12.0	1.02	8.1	8.1		
2017-05-15	16.9	12.0	1.03	8.1	8.0	AA 4.0	AA 0.20
2017-05-16	17.4	12.0	1.05	8.1	8.0		
2017-05-17	17.9	11.8	1.13	8.1	8.0	AA 4.0	AA 0.20
2017-05-18	18.8	11.6	1.11	8.1	8.0		
2017-05-19	19.2	11.4	1.03	8.2	8.1	14	AA 0.20
2017-05-20	19	11.5	1.15	8.1	8.0		
2017-05-21	18.4	11.7	1.16	8.3	7.7		
2017-05-22	18.3	11.7	1.19	7.9	7.9	AA 4.0	AA 0.20
2017-05-23	18.2	11.7	1.10	8.2	7.9		
2017-05-24	18.6	11.6	1.18	8.2	8.0	AA 4.0	AA 0.20
2017-05-25	19.3	11.3	1.21	8.2	8.0		
2017-05-26	19.4	11.2	1.16	8.1	7.9	AA 4.0	AA 0.20
2017-05-27	19.3	11.4	1.15	8.1	8.0		
2017-05-28	19.8	11.3	1.22	8.0	7.9		
2017-05-29	19.7	11.3	1.21	8.0	7.9		
2017-05-30	19.1	11.5	1.19	8.0	7.9		
2017-05-31	19.6	11.4	1.15	8.0	7.9		

Minimum	14.0	11.2	1.0	7.9	7.7	0.0	0.0
Maximum	19.8	12.8	1.23	8.5	8.1	14.0	0.0
Average	17.4871	11.86129	1.13194	8.1129	7.96452	1.16667	0
Count	31	31	31	31	31	12	12

Name of Responsible Official or Authorized Representative	I certify under the penalty of law that I have personally examined and am familiar with the information submitted herein and based on my inquiry of those individuals immediately responsible for obtaining the information, I believe the submitted information is true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.	Signature of Responsible Official or Authorized Representative	Submission Date/Time

Ohio EPA - Daily Discharge Monitoring Report - Form 4500

SUBMISSION ID:		**STATUS:**	Draft
FACILITY:	Delphos WWTP	**PERMIT NUMBER:**	***2PD00029*RD***
LOCATION:	24793 Pohlman Rd	**STATION CODE:**	001
	Delphos, OH 45833	**MONITORING PERIOD :**	2017-05-01 To: 2017-05-31
COUNTY:	Allen	**REPORTING LAB:**	Delphos WWTP, Alloway
DISTRICT:	NWDO	**ANALYST:**	DT, JDF
		NO DISCHARGE INDICATOR:	

PARAMETER	E. coli	CBOD 5 day	Phosphorus, Total (P)	Oil and Grease, Hexane Extr Method	Nitrogen Kjeldahl, Total	Nitrite Plus Nitrate, Total	Orthophosphate, Dissolved (as P)
PARAMETER CODE	31648	80082	00665	00552	00625	00630	00671
UNITS	#/100 ml	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
FREQUENCY	3/Week	3/Week	1/Week	1 / 2 Weeks	1/Month	1/Month	1/Month
SAMPLING TYPE	Grab	24hr Composite	24hr Composite	Grab	24hr Composite	24hr Composite	Grab
2017-05-01	AA 1	AA 2.0	0.06				
2017-05-02							
2017-05-03	AA 1	AA 2.0					
2017-05-04							
2017-05-05	AA 1	AA 2.0					
2017-05-06							
2017-05-07							
2017-05-08	AA 1	AA 2.0	1.04	AA 5.0	AA 0.50	8.84	1.00
2017-05-09							
2017-05-10	AA 1	AA 2.0					
2017-05-11							
2017-05-12	AA 1	AA 2.0					
2017-05-13							
2017-05-14							
2017-05-15	AA 1	AA 2.0	AH				
2017-05-16							
2017-05-17	AA 1	AA 2.0					
2017-05-18							
2017-05-19	1	AA 2.0					
2017-05-20							
2017-05-21							
2017-05-22	AA 1	AA 2.0	0.35	AA 5.0			
2017-05-23							
2017-05-24	AA 1	AA 2.0					
2017-05-25							
2017-05-26	AA 1	AA 2.0					
2017-05-27							
2017-05-28							
2017-05-29							
2017-05-30							
2017-05-31							

Minimum	0.0	0.0	0.06	0.0	0.0	8.84	1.0
Maximum	1.0	0.0	1.04	0.0	0.0	8.84	1.0
Average	0.08333	0	0.48333	0	0	8.84	1
Count	12	12	3	2	1	1	1

Name of Responsible Official or Authorized Representative	I certify under the penalty of law that I have personally examined and am familiar with the information submitted herein and based on my inquiry of those individuals immediately responsible for obtaining the information, I believe the submitted information is true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.	Signature of Responsible Official or Authorized Representative	Submission Date/Time

Ohio EPA - Daily Discharge Monitoring Report - Form 4500

SUBMISSION ID:		**STATUS:**	Draft
FACILITY:	Delphos WWTP	**PERMIT NUMBER:**	***2PD00029*RD***
LOCATION:	24793 Pohlman Rd	**STATION CODE:**	001
	Delphos, OH 45833	**MONITORING PERIOD :**	2017-04-01 To: 2017-04-30
COUNTY:	Allen	**REPORTING LAB:**	Delphos WWTP, Alloway
DISTRICT:	NWDO	**ANALYST:**	DT, JDF
		NO DISCHARGE INDICATOR:	

PARAMETER	Water Temperature	Dissolved Oxygen	Flow Rate	pH, Maximum	pH, Minimum	Total Suspended Solids	Nitrogen, Ammonia (NH3)
PARAMETER CODE	00010	00300	50050	61941	61942	00530	00610
UNITS	C	mg/l	MGD	S.U.	S.U.	mg/l	mg/l
FREQUENCY	1/Day	1/Day	1/Day	1/Day	1/Day	3/Week	3/Week
SAMPLING TYPE	Maximum Indicating Thermometer	Multiple Grab	Continuous	Multiple Grab	Multiple Grab	24hr Composite	24hr Composite
2017-04-01	14	12.7	0.87	8.2	7.9		
2017-04-02	14	13.1	0.91	8.2	7.9		
2017-04-03	13.3	13.2	0.91	8.1	8.0	AA 4.0	AA 0.20
2017-04-04	12.5	13.0	0.87	8.1	8.0		
2017-04-05	13.1	12.8	0.91	8.3	8.1	AA 4.0	AA 0.20
2017-04-06	13.5	12.7	0.82	8.1	8.1		
2017-04-07	14	12.7	0.92	8.2	8.1	AA 4.0	AA 02.0
2017-04-08	14	13.2	0.87	8.1	8.0		
2017-04-09	11.9	13.4	0.91	8.1	8.1		
2017-04-10	12.9	13.2	0.92	8.1	8.1	AA 4.0	AA 0.20
2017-04-11	14.2	12.8	0.88	8.3	8.1		
2017-04-12	15.1	12.5	0.93	8.1	7.9	AA 4.0	AA 0.20
2017-04-13	15.1	12.6	0.91	8.1	8.1		
2017-04-14	16.3	12.5	0.79	8.5	8.1	AA 4.0	AA 0.20
2017-04-15	15.3	12.5	0.93	8.3	8.2		
2017-04-16	15.5	12.4	0.90	8.3	8.1		
2017-04-17	15.5	12.3	0.94	8.1	8.0	AA 4.0	AA 0.20
2017-04-18	15.6	12.4	0.85	8.2	8.0		
2017-04-19	15.9	12.3	0.88	8.1	8.1	AA 4.0	AA 0.20
2017-04-20	23.1	12.0	0.67	8.6	8.1		
2017-04-21	17.6	11.9	0.84	8.2	8.2	7.2	AA 0.20
2017-04-22	17.7	11.9	0.73	8.2	8.1		
2017-04-23	16.9	12.2	0.73	8.2	8.1		
2017-04-24	15.9	12.3	0.74	8.3	8.1	AA 4.0	AA 0.20
2017-04-25	16.2	12.3	0.74	8.3	8.1		
2017-04-26	17.3	12.0	0.78	8.5	8.1	AA 4.0	AA 0.20
2017-04-27	17.9	11.7	1.06	8.2	8.0		
2017-04-28	18.1	11.5	1.31	8.2	8.0	AA 4.0	AA 0.20
2017-04-29	18	11.7	1.29	8.1	7.8		
2017-04-30	17.7	11.9	1.27	8.0	7.9		
Minimum	11.9	11.5	0.67	8.0	7.8	0.0	0.0

Maximum	23.1	13.4	1.31	8.6	8.2	7.2	0.0
Average	15.60333	12.45667	0.90267	8.21	8.04667	0.6	0
Count	30	30	30	30	30	12	12

Name of Responsible Official or Authorized Representative	I certify under the penalty of law that I have personally examined and am familiar with the information submitted herein and based on my inquiry of those individuals immediately responsible for obtaining the information, I believe the submitted information is true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.	Signature of Responsible Official or Authorized Representative	Submission Date/Time

Ohio EPA - Daily Discharge Monitoring Report - Form 4500

SUBMISSION ID:
FACILITY: Delphos WWTP
LOCATION: 24793 Pohlman Rd
Delphos, OH 45833
COUNTY: Allen
DISTRICT: NWDO

STATUS: Draft
PERMIT NUMBER: *2PD00029*RD*
STATION CODE: 001
MONITORING PERIOD : 2017-04-01 To: 2017-04-30
REPORTING LAB: Delphos WWTP, Alloway
ANALYST: DT, JDF
NO DISCHARGE INDICATOR:

PARAMETER	CBOD 5 day	Phosphorus, Total (P)	Oil and Grease, Hexane Extr Method	Nitrogen Kjeldahl, Total	Nitrite Plus Nitrate, Total	Orthophosphate, Dissolved (as P)	Silver, Total Recoverable
PARAMETER CODE	80082	00665	00552	00625	00630	00671	01079
UNITS	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	ug/l
FREQUENCY	3/Week	1/Week	1 / 2 Weeks	1/Month	1/Month	1/Month	1/Month
SAMPLING TYPE	24hr Composite	24hr Composite	Grab	24hr Composite	24hr Composite	Grab	24hr Composite
2017-04-01							
2017-04-02							
2017-04-03	AA 2.0						
2017-04-04							
2017-04-05	2.2						
2017-04-06							
2017-04-07	AA 2.0	1.68	AA 5.0	AA 0.50	10.4	1.26	AA 1.0
2017-04-08							
2017-04-09							
2017-04-10	AA 2.0	1.49					
2017-04-11							
2017-04-12	AA 2.0						
2017-04-13							
2017-04-14	13						
2017-04-15							
2017-04-16							
2017-04-17	AA 2.0	1.49					
2017-04-18							
2017-04-19	AA 2.0						
2017-04-20							
2017-04-21	3.8						
2017-04-22							
2017-04-23							
2017-04-24	AA 2.0	2.21	AA 5.0				
2017-04-25							
2017-04-26	AA 2.0						
2017-04-27							
2017-04-28	AA 2.0						
2017-04-29							
2017-04-30							
Minimum	0.0	1.49	0.0	0.0	10.4	1.26	0.0

Maximum	13.0	2.21	0.0	0.0	10.4	1.26	0.0
Average	1.58333	1.7175	0	0	10.4	1.26	0
Count	12	4	2	1	1	1	1

Name of Responsible Official or Authorized Representative	I certify under the penalty of law that I have personally examined and am familiar with the information submitted herein and based on my inquiry of those individuals immediately responsible for obtaining the information, I believe the submitted information is true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.	Signature of Responsible Official or Authorized Representative	Submission Date/Time

Ohio EPA - Daily Discharge Monitoring Report - Form 4500

SUBMISSION ID:
FACILITY: Delphos WWTP
LOCATION: 24793 Pohlman Rd
Delphos, OH 45833
COUNTY: Allen
DISTRICT: NWDO

STATUS: Draft
PERMIT NUMBER: *2PD00029*RD*
STATION CODE: 001
MONITORING PERIOD : 2017-03-01 To: 2017-03-31
REPORTING LAB: Delphos WWTP, Alloway
ANALYST: DT, JWF
NO DISCHARGE INDICATOR:

PARAMETER	Water Temperature	Dissolved Oxygen	Flow Rate	pH, Maximum	pH, Minimum	Total Suspended Solids	Nitrogen, Ammonia (NH3)
PARAMETER CODE	00010	00300	50050	61941	61942	00530	00610
UNITS	C	mg/l	MGD	S.U.	S.U.	mg/l	mg/l
FREQUENCY	1/Day	1/Day	1/Day	1/Day	1/Day	3/Week	3/Week
SAMPLING TYPE	Maximum Indicating Thermometer	Multiple Grab	Continuous	Multiple Grab	Multiple Grab	24hr Composite	24hr Composite
2017-03-01	12.6	12.4	1.28	8.1	8.0	AA 4.0	AA 0.20
2017-03-02	11.5	13.3	.82	8.0	7.9		
2017-03-03	10.6	13.8	1.15	7.72	7.4	AA 4.0	2.5
2017-03-04	9.3	14.4	1.16	7.5	7.3		
2017-03-05	11.5	13.6	1.02	7.6	7.4		
2017-03-06	12.6	13.1	1.09	7.7	7.4	AA 4.0	AA 0.20
2017-03-07	13.6	12.7	1.27	8.13	8.08		
2017-03-08	13.7	12.9	0.91	8.2	8.0	AA 4.0	AA 0.20
2017-03-09	13.5	12.9	1.02	8.3	8.0		
2017-03-10	13.8	12.8	0.93	8.2	8.0	AA 4.0	AA 0.20
2017-03-11	13.8	13.1	0.86	8.3	8.1		
2017-03-12	13	13.2	0.92	8.2	8.0		
2017-03-13	12.6	13.2	0.87	8.0	7.9	AA 4.0	AA 0.20
2017-03-14	8.1	13.28	1.33	7.69	7.12		
2017-03-15	12.5	13.3	0.95	8.1	7.9	AA 4.0	AA 3.0
2017-03-16	12.3	12.5	0.92	8.0	7.8		
2017-03-17	12.9	13.1	0.28	8.2	7.8		
2017-03-18	13	13.0	0.61	8.3	7.8		
2017-03-19	13	13.0	1.13	8.1	8.0		
2017-03-20	12.9	13.1	0.98	8.0	7.9	AA 4.0	AA 0.20
2017-03-21	13.4	13.0	0.83	8.3	7.9	AA 4.0	AA 0.20
2017-03-22	13.9	12.8	0.90	8.0	7.9	AA 4.0	AA 0.20
2017-03-23	13.4	13.5	0.78	8.2	7.9		
2017-03-24	11.4	13.9	0.80	8.3	7.9	AA 4.0	AA 2.0
2017-03-25	13.6	13.1	0.85	8.4	8.1		
2017-03-26	14.6	12.7	0.92	8.2	8.1		
2017-03-27	14.5	12.6	0.92	8.1	8.0	AA 4.0	AA 0.20
2017-03-28	14.7	12.6	0.87	8.2	7.9		
2017-03-29	14.8	12.5	0.94	8.0	7.9		
2017-03-30	14.5	12.7	0.85	8.1	8.0		
2017-03-31	14.3	12.6	0.89	8.0	7.9		

Minimum	8.1	12.4	0.28	7.5	7.12	0.0	0.0
Maximum	14.8	14.4	1.33	8.4	8.1	0.0	2.5
Average	12.9	13.05419	0.9371	8.06903	7.84839	0	0.20833
Count	31	31	31	31	31	12	12

Name of Responsible Official or Authorized Representative	I certify under the penalty of law that I have personally examined and am familiar with the information submitted herein and based on my inquiry of those individuals immediately responsible for obtaining the information, I believe the submitted information is true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.	Signature of Responsible Official or Authorized Representative	Submission Date/Time

Ohio EPA - Daily Discharge Monitoring Report - Form 4500

SUBMISSION ID:		**STATUS:**	Draft
FACILITY:	Delphos WWTP	**PERMIT NUMBER:**	***2PD00029*RD***
LOCATION:	24793 Pohlman Rd	**STATION CODE:**	001
	Delphos, OH 45833	**MONITORING PERIOD :**	2017-03-01 To: 2017-03-31
COUNTY:	Allen	**REPORTING LAB:**	Delphos WWTP, Alloway
DISTRICT:	NWDO	**ANALYST:**	DT, JWF
		NO DISCHARGE INDICATOR:	

PARAMETER	CBOD 5 day	Phosphorus, Total (P)	Oil and Grease, Hexane Extr Method	Nitrogen Kjeldahl, Total	Nitrite Plus Nitrate, Total	Orthophosphate, Dissolved (as P)	Silver, Total Recoverable
PARAMETER CODE	80082	00665	00552	00625	00630	00671	01079
UNITS	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	ug/l
FREQUENCY	3/Week	1/Week	1 / 2 Weeks	1/Month	1/Month	1/Month	1/Month
SAMPLING TYPE	24hr Composite	24hr Composite	Grab	24hr Composite	24hr Composite	Grab	24hr Composite
2017-03-01	AA 2.0						
2017-03-02							
2017-03-03	AA 2.0						
2017-03-04							
2017-03-05							
2017-03-06	AA 2.0	1.98					
2017-03-07							
2017-03-08	AA 3.0						
2017-03-09							
2017-03-10	AA 3.0						
2017-03-11							
2017-03-12							
2017-03-13	AA 3.0	1.85	AA 5.0	AA 0.50	16.8	2.32	AA 1.0
2017-03-14							
2017-03-15	AA 4.0						
2017-03-16							
2017-03-17							
2017-03-18							
2017-03-19							
2017-03-20	AA 3.0	1.62	AA 5.0				
2017-03-21	AA 2.0						
2017-03-22	AA 2.0						
2017-03-23							
2017-03-24	AA 0.20						
2017-03-25							
2017-03-26							
2017-03-27	AA 2.0	3.27					
2017-03-28							
2017-03-29							
2017-03-30							
2017-03-31							

Minimum	0.0	1.62	0.0	0.0	16.8		0.0
Maximum	0.0	3.27	0.0	0.0	16.8		0.0
Average	0	2.18	0	0	16.8		0
Count	12	4	2	1	1		1

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Ohio EPA - Daily Discharge Monitoring Report - Form 4500

SUBMISSION ID:
FACILITY: Delphos WWTP
LOCATION: 24793 Pohlman Rd
Delphos, OH 45833
COUNTY: Allen
DISTRICT: NWDO

STATUS: Draft
PERMIT NUMBER: *2PD00029*RD*
STATION CODE: 001
MONITORING PERIOD : 2017-01-01 To: 2017-01-31
REPORTING LAB: Delphos, Allowy
ANALYST: DT,JDF
NO DISCHARGE INDICATOR:

PARAMETER	Water Temperature	Dissolved Oxygen	Flow Rate	pH, Maximum	pH, Minimum	Total Suspended Solids	Nitrogen, Ammonia (NH3)
PARAMETER CODE	00010	00300	50050	61941	61942	00530	00610
UNITS	C	mg/l	MGD	S.U.	S.U.	mg/l	mg/l
FREQUENCY	1/Day	1/Day	1/Day	1/Day	1/Day	3/Week	3/Week
SAMPLING TYPE	Maximum Indicating Thermometer	Multiple Grab	Continuous	Multiple Grab	Multiple Grab	24hr Composite	24hr Composite
2017-01-01	14.1	12.5	1.20	8.0	7.9		
2017-01-02	13.5	12.8	1.13	8.0	7.8		
2017-01-03	13.5	12.8	1.13	8.0	7.8	AA 4.0	AA 0.20
2017-01-04	12.7	13.2	0.90	8.3	7.8	AA 4.0	AA 0.20
2017-01-05	12.3	13.2	1.13	8.1	8.0		
2017-01-06	12.3	13.2	1.00	8.3	8.0	AA 4.0	AA 0.20
2017-01-07	12	13.4	0.96	8.2	8.1		
2017-01-08	12.1	13.4	0.94	8.3	8.0		
2017-01-09	12.4	13.3	0.95	8.1	8.0		
2017-01-10	12.9	12.9	0.96	8.3	7.9	AA 4.0	AA 0.20
2017-01-11	13	13	0.96	8.1	7.9	AA 4.0	AA 0.20
2017-01-12	13.4	12.9	1.06	8.2	7.9		
2017-01-13	12.3	13.5	1.05	8.2	7.9	AA 4.0	AA 0.20
2017-01-14	11.7	13.5	1.05	8.1	8.0		
2017-01-15	11.8	13.4	1.03	8.2	8.0		
2017-01-16	12.3	13.2	1.04	8.0	8.0	AA 4.0	AA 0.20
2017-01-17	12.5	13.2	1.01	8.3	7.9		
2017-01-18	10.6	14.0	0.74	8.3	7.9	AA 4.0	AA 0.20
2017-01-19	8.9	14.3	0.95	8.2	7.8		
2017-01-20	8.7	14.3	0.92	8.3	7.9	AA 4.0	0.20
2017-01-21	10	13.9	0.97	8.1	8.0		
2017-01-22	10.6	13.6	0.95	8.2	7.9		
2017-01-23	10.8	13.5	0.97	8.0	7.9	AA 4.0	AA 0.20
2017-01-24	11	13.5	0.94	8.1	8.0		
2017-01-25	11	13.4	0.96	8.1	8.0	AA 4.0	AA 0.20
2017-01-26	11.8	13.3	0.97	8.1	8.0		
2017-01-27	12.1	13.1	0.93	8.1	8.1	AA 4.0	AA 0.20
2017-01-28	12.1	13.1	0.93	8.1	8.1		
2017-01-29	11.9	13.3	.90	8.0	8.0		
2017-01-30	11.9	13.2	0.95	8.0	7.9		
2017-01-31	11.9	13.2	0.95	8.0	7.9		

Minimum	8.7	12.5	0.74	8.0	7.8	0.0	0.0
Maximum	14.1	14.3	1.2	8.3	8.1	0.0	0.2
Average	11.87419	13.32581	0.98484	8.13871	7.94516	0	0.01667
Count	31	31	31	31	31	12	12

Name of Responsible Official or Authorized Representative	I certify under the penalty of law that I have personally examined and am familiar with the information submitted herein and based on my inquiry of those individuals immediately responsible for obtaining the information, I believe the submitted information is true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.	Signature of Responsible Official or Authorized Representative	Submission Date/Time

Ohio EPA - Daily Discharge Monitoring Report - Form 4500

SUBMISSION ID:
FACILITY: Delphos WWTP
LOCATION: 24793 Pohlman Rd
Delphos, OH 45833
COUNTY: Allen
DISTRICT: NWDO

STATUS: Draft
PERMIT NUMBER: *2PD00029*RD*
STATION CODE: 001
MONITORING PERIOD : 2017-01-01 To: 2017-01-31
REPORTING LAB: Delphos, Allowy
ANALYST: DT,JDF
NO DISCHARGE INDICATOR:

PARAMETER	CBOD 5 day	Phosphorus, Total (P)	Oil and Grease, Hexane Extr Method	Nitrogen Kjeldahl, Total	Nitrite Plus Nitrate, Total	Orthophosphate, Dissolved (as P)	Silver, Total Recoverable
PARAMETER CODE	80082	00665	00552	00625	00630	00671	01079
UNITS	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	ug/l
FREQUENCY	3/Week	1/Week	1 / 2 Weeks	1/Month	1/Month	1/Month	1/Month
SAMPLING TYPE	24hr Composite	24hr Composite	Grab	24hr Composite	24hr Composite	Grab	24hr Composite
2017-01-01							
2017-01-02							
2017-01-03	AA 2.0	1.08					
2017-01-04	AA 2.0						
2017-01-05							
2017-01-06	AA 2.0						
2017-01-07							
2017-01-08							
2017-01-09							
2017-01-10	AA 2.0						
2017-01-11	AA 2.0						
2017-01-12							
2017-01-13	AA 2.0	0.91	AA 5.0	AA 0.50	1.49	1.09	AA 1.0
2017-01-14							
2017-01-15							
2017-01-16	AA 2.0	2.01	AA 5.0				
2017-01-17							
2017-01-18	AA 2.0						
2017-01-19							
2017-01-20	AA 2.0						
2017-01-21							
2017-01-22							
2017-01-23	AA 2.0	1.77					
2017-01-24							
2017-01-25	AA 2.0						
2017-01-26							
2017-01-27	AA 2.0						
2017-01-28							
2017-01-29							
2017-01-30							
2017-01-31							

Minimum	0.0	0.91	0.0	0.0	1.49		0.0
Maximum	0.0	2.01	0.0	0.0	1.49		0.0
Average	0	1.4425	0	0	1.49		0
Count	12	4	2	1	1		1

Name of Responsible Official or Authorized Representative	I certify under the penalty of law that I have personally examined and am familiar with the information submitted herein and based on my inquiry of those individuals immediately responsible for obtaining the information, I believe the submitted information is true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.	Signature of Responsible Official or Authorized Representative	Submission Date/Time

Ohio EPA - Daily Discharge Monitoring Report - Form 4500

SUBMISSION ID:
FACILITY: Delphos WWTP
LOCATION: 24793 Pohlman Rd
Delphos, OH 45833
COUNTY: Allen
DISTRICT: NWDO

STATUS: Draft
PERMIT NUMBER: *2PD00029*RD*
STATION CODE: 001
MONITORING PERIOD : 2016-12-01 To: 2016-12-31
REPORTING LAB: Delphos WWTP, Alloway
ANALYST: DT, JWF
NO DISCHARGE INDICATOR:

PARAMETER	Water Temperature	Dissolved Oxygen	Flow Rate	pH, Maximum	pH, Minimum	Total Suspended Solids	Nitrogen, Ammonia (NH3)
PARAMETER CODE	00010	00300	50050	61941	61942	00530	00610
UNITS	C	mg/l	MGD	S.U.	S.U.	mg/l	mg/l
FREQUENCY	1/Day	1/Day	1/Day	1/Day	1/Day	3/Week	3/Week
SAMPLING TYPE	Maximum Indicating Thermometer	Multiple Grab	Continuous	Multiple Grab	Multiple Grab	24hr Composite	24hr Composite
2016-12-01	17.6	11.6	1.09	8.0	8.0		
2016-12-02	17.6	11.6	1.07	8.0	7.8	AA 4.0	AA 0.20
2016-12-03	17.6	11.7	1.13	8.0	7.9		
2016-12-04	17.5	11.9	1.17	8.0	7.9		
2016-12-05	16.4	12.0	1.17	7.9	7.8	AA 4.0	AA 0.20
2016-12-06	16.7	11.8	1.13	8.0	7.9		
2016-12-07	16.2	12.0	1.09	8.0	7.8	AA 4.0	AA 0.20
2016-12-08	16.2	12.0	1.16	7.9	7.9		
2016-12-09	16.5	12.1	1.12	8.0	7.9	AA 4.0	AA 0.20
2016-12-10	16.5	12.1	1.16	8.0	7.9		
2016-12-11	16	12.3	1.12	8.0	7.9		
2016-12-12	15.5	12.2	1.13	7.9	7.7	AA 4.0	AA 0.20
2016-12-13	15.5	12.2	1.01	8.1	7.8		
2016-12-14	15.3	12.3	1.06	8.0	7.8	8.8	AA 0.20
2016-12-15	15.2	12.4	1.11	8.0	7.9		
2016-12-16	15.2	12.3	1.08	8.1	7.9	AA 4.0	AA 0.20
2016-12-17	15.3	12.1	1.16	8.0	7.8		
2016-12-18	14.4	12.5	1.10	8.1	7.8		
2016-12-19	14.4	12.7	1.11	7.9	7.8		
2016-12-20	14.5	12.6	1.00	8.0	7.9	AA 4.7	AA 0.20
2016-12-21	15.1	12.4	1.02	8.0	7.9	4.4	AA 0.20
2016-12-22	15.3	12.3	1.05	8.0	7.9		
2016-12-23	15.5	12.3	1.02	8.0	7.9	AA 4.0	AA 0.20
2016-12-24	15.5	12.3	1.07	8.0	7.8		
2016-12-25	14.5	12.6	1.12	7.9	7.8		
2016-12-26	14.5	12.5	1.15	7.9	7.8		
2016-12-27	14.2	12.7	1.03	8.2	7.8	AH	AH
2016-12-28	13.6	12.8	1.02	8.1	8.0	AA 4.0	AA 0.20
2016-12-29	13.9	12.5	1.14	8.3	8.0		
2016-12-30	14.2	12.5	1.24	8.2	8.0		
2016-12-31	14.1	12.5	1.20	8.0	7.9		

Minimum	13.6	11.6	1.0	7.9	7.7	0.0	0.0
Maximum	17.6	12.8	1.24	8.3	8.0	8.8	0.0
Average	15.5	12.25161	1.10419	8.01613	7.86774	1.2	0
Count	31	31	31	31	31	11	11

Name of Responsible Official or Authorized Representative	I certify under the penalty of law that I have personally examined and am familiar with the information submitted herein and based on my inquiry of those individuals immediately responsible for obtaining the information, I believe the submitted information is true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.	Signature of Responsible Official or Authorized Representative	Submission Date/Time

Ohio EPA - Daily Discharge Monitoring Report - Form 4500

SUBMISSION ID:		**STATUS:**	Draft
FACILITY:	Delphos WWTP	**PERMIT NUMBER:**	***2PD00029*RD***
LOCATION:	24793 Pohlman Rd	**STATION CODE:**	001
	Delphos, OH 45833	**MONITORING PERIOD :**	2016-12-01 To: 2016-12-31
COUNTY:	Allen	**REPORTING LAB:**	Delphos WWTP, Alloway
DISTRICT:	NWDO	**ANALYST:**	DT, JWF
		NO DISCHARGE INDICATOR:	

PARAMETER	CBOD 5 day	Phosphorus, Total (P)	Oil and Grease, Hexane Extr Method	Nitrogen Kjeldahl, Total	Nitrite Plus Nitrate, Total	Orthophosphate, Dissolved (as P)	Silver, Total Recoverable
PARAMETER CODE	80082	00665	00552	00625	00630	00671	01079
UNITS	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	ug/l
FREQUENCY	3/Week	1/Week	1 / 2 Weeks	1/Month	1/Month	1/Month	1/Month
SAMPLING TYPE	24hr Composite	24hr Composite	Grab	24hr Composite	24hr Composite	Grab	24hr Composite
2016-12-01							
2016-12-02	AA 2.0						
2016-12-03							
2016-12-04							
2016-12-05	AA 2.0	AA 0.04					
2016-12-06							
2016-12-07	AA 2.0						
2016-12-08							
2016-12-09	AA 2.0						
2016-12-10							
2016-12-11							
2016-12-12	AA 2.0	0.04	AA 5.0	AA 0.50	9.77	AA 0.04	AA 1.0
2016-12-13							
2016-12-14	AA 2.0						
2016-12-15							
2016-12-16	2.0						
2016-12-17							
2016-12-18							
2016-12-19							
2016-12-20	AA 8.0	0.06					
2016-12-21	AA 2.0						
2016-12-22							
2016-12-23	AA 2.0						
2016-12-24							
2016-12-25							
2016-12-26							
2016-12-27	AH		AA 5.0				
2016-12-28	AA 2.0	0.33					
2016-12-29							
2016-12-30							
2016-12-31							

Minimum	0.0	0.0	0.0	0.0	9.77		0.0
Maximum	2.0	0.33	0.0	0.0	9.77		0.0
Average	0.18182	0.1075	0	0	9.77		0
Count	11	4	2	1	1		1

Name of Responsible Official or Authorized Representative	I certify under the penalty of law that I have personally examined and am familiar with the information submitted herein and based on my inquiry of those individuals immediately responsible for obtaining the information, I believe the submitted information is true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.	Signature of Responsible Official or Authorized Representative	Submission Date/Time

Ohio EPA - Daily Discharge Monitoring Report - Form 4500

SUBMISSION ID:		**STATUS:**	Draft
FACILITY:	Delphos WWTP	**PERMIT NUMBER:**	***2PD00029*RD***
LOCATION:	24793 Pohlman Rd	**STATION CODE:**	001
	Delphos, OH 45833	**MONITORING PERIOD :**	2016-11-01 To: 2016-11-30
COUNTY:	Allen	**REPORTING LAB:**	Delphos wwtp, Alloway
DISTRICT:	NWDO	**ANALYST:**	DT
		NO DISCHARGE INDICATOR:	

PARAMETER	Water Temperature	Dissolved Oxygen	Flow Rate	pH, Maximum	pH, Minimum	Total Suspended Solids	Nitrogen, Ammonia (NH3)
PARAMETER CODE	00010	00300	50050	61941	61942	00530	00610
UNITS	C	mg/l	MGD	S.U.	S.U.	mg/l	mg/l
FREQUENCY	1/Day	1/Day	1/Day	1/Day	1/Day	3/Week	3/Week
SAMPLING TYPE	Maximum Indicating Thermometer	Multiple Grab	Continuous	Multiple Grab	Multiple Grab	24hr Composite	24hr Composite
2016-11-01	21.1	10.8	1.14	7.9	7.6		
2016-11-02	21.6	10.9	1.12	8.0	7.8	AA 4.0	AA 0.20
2016-11-03	21.7	10.8	1.09	8.0	7.8		
2016-11-04	21.6	11.0	1.15	8.0	7.9	AA 4.0	AA 0.20
2016-11-05	20.8	11.2	1.17	8.2	7.9		
2016-11-06	19.7	11.4	1.21	8.0	7.8		
2016-11-07	19.5	11.4	1.16	7.8	7.6	AA 4.0	AA 0.20
2016-11-08	20.2	11.1	1.15	8.1	7.8		
2016-11-09	20.5	11.1	1.13	8.0	7.8	AA 4.0	AA 0.20
2016-11-10	20.2	11.2	1.16	8.0	7.9		
2016-11-11	19.8	11.2	1.06	8.1	7.9	AA 4.0	AA 0.20
2016-11-12	19.5	11.5	1.17	8.0	8.0		
2016-11-13	18.1	11.8	1.17	8.1	7.8		
2016-11-14	17.5	11.8	1.12	8.0	7.8	AA 4.0	AA 0.20
2016-11-15	18.3	11.5	1.17	8.1	7.9		
2016-11-16	18.7	11.5	1.17	8.1	7.9	AA 4.0	AA 0.20
2016-11-17	18.4	11.5	1.15	8.2	7.9		
2016-11-18	18.2	11.6	1.17	8.0	7.9	AA 4.0	AA 0.20
2016-11-19	18.6	11.4	1.06	8.0	7.8		
2016-11-20	18.5	11.7	1.04	8.1	7.9		
2016-11-21	17.2	11.9	1.12	8.1	7.9	AA 4.0	AA 0.20
2016-11-22	17	12.1	1.19	8.0	7.9	AA 4.0	AA 0.20
2016-11-23	17	12.0	1.12	8.1	7.9	AA 4.0	AA 0.20
2016-11-24	17.4	11.8	1.19	7.9	7.8		
2016-11-25	17.4	11.8	1.08	8.0	7.8		
2016-11-26	17.4	12.0	1.11	8.0	7.8		
2016-11-27	15.8	12.3	1.11	8.0	7.8		
2016-11-28	15.8	12.0	1.11	7.9	7.8	AA 4.0	AA 0.20
2016-11-29	17	11.8	1.08	8.0	7.8		
2016-11-30	17.6	11.5	1.09	8.1	7.9		
Minimum	15.8	10.8	1.04	7.8	7.6	0.0	0.0

Maximum	21.7	12.3	1.21	8.2	8.0	0.0	0.0
Average	18.73667	11.52	1.132	8.02667	7.83667	0	0
Count	30	30	30	30	30	12	12

Name of Responsible Official or Authorized Representative	I certify under the penalty of law that I have personally examined and am familiar with the information submitted herein and based on my inquiry of those individuals immediately responsible for obtaining the information, I believe the submitted information is true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.	Signature of Responsible Official or Authorized Representative	Submission Date/Time

Ohio EPA - Daily Discharge Monitoring Report - Form 4500

SUBMISSION ID:
FACILITY: Delphos WWTP
LOCATION: 24793 Pohlman Rd
Delphos, OH 45833
COUNTY: Allen
DISTRICT: NWDO

STATUS: Draft
PERMIT NUMBER: *2PD00029*RD*
STATION CODE: 001
MONITORING PERIOD : 2016-11-01 To: 2016-11-30
REPORTING LAB: Delphos wwtp, Alloway
ANALYST: DT
NO DISCHARGE INDICATOR:

PARAMETER	CBOD 5 day	Phosphorus, Total (P)	Oil and Grease, Hexane Extr Method	Nitrogen Kjeldahl, Total	Nitrite Plus Nitrate, Total	Silver, Total Recoverable	Cadmium, Total Recoverable
PARAMETER CODE	80082	00665	00552	00625	00630	01079	01113
UNITS	mg/l	mg/l	mg/l	mg/l	mg/l	ug/l	ug/l
FREQUENCY	3/Week	1/Week	1 / 2 Weeks	1/Month	1/Month	1/Month	1/Month
SAMPLING TYPE	24hr Composite	24hr Composite	Grab	24hr Composite	24hr Composite	24hr Composite	24hr Composite
2016-11-01							
2016-11-02	AA 2.0						
2016-11-03							
2016-11-04	AA 2.0						
2016-11-05							
2016-11-06							
2016-11-07	AA 2.0	1.68	AA 5.0	AA 0.50	12.8	AA 1.0	AA 3.0
2016-11-08							
2016-11-09	AA 2.0						
2016-11-10							
2016-11-11	AA 2.0						
2016-11-12							
2016-11-13							
2016-11-14	AA 2.0	0.33					
2016-11-15							
2016-11-16	AA 2.0						
2016-11-17							
2016-11-18	AA 2.0						
2016-11-19							
2016-11-20							
2016-11-21	2.1	5.58	AA 5.0				
2016-11-22	AA 2.0						
2016-11-23	AA 2.0						
2016-11-24							
2016-11-25							
2016-11-26							
2016-11-27							
2016-11-28	AA 2.0	0.14					
2016-11-29							
2016-11-30							
Minimum	0.0	0.14	0.0	0.0	12.8	0.0	0.0

Maximum	2.1	5.58	0.0	0.0	12.8	0.0	0.0
Average	0.175	1.9325	0	0	12.8	0	0
Count	12	4	2	1	1	1	1

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Ohio EPA - Daily Discharge Monitoring Report - Form 4500

SUBMISSION ID:		**STATUS:**	Draft
FACILITY:	Delphos WWTP	**PERMIT NUMBER:**	***2PD00029*RD***
LOCATION:	24793 Pohlman Rd	**STATION CODE:**	001
	Delphos, OH 45833	**MONITORING PERIOD :**	2016-10-01 To: 2016-10-31
COUNTY:	Allen	**REPORTING LAB:**	Delphos WWTP, Alloway
DISTRICT:	NWDO	**ANALYST:**	DT
		NO DISCHARGE INDICATOR:	

PARAMETER	Water Temperature	Dissolved Oxygen	Flow Rate	pH, Maximum	pH, Minimum	Total Suspended Solids	Nitrogen, Ammonia (NH3)
PARAMETER CODE	00010	00300	50050	61941	61942	00530	00610
UNITS	C	mg/l	MGD	S.U.	S.U.	mg/l	mg/l
FREQUENCY	1/Day	1/Day	1/Day	1/Day	1/Day	3/Week	3/Week
SAMPLING TYPE	Maximum Indicating Thermometer	Multiple Grab	Continuous	Multiple Grab	Multiple Grab	24hr Composite	24hr Composite
2016-10-01	23.6	10.4	1.28	8.0	7.9		
2016-10-02	23.1	10.5	1.28	7.9	7.9		
2016-10-03	23.7	10.4	1.22	8.0	7.8	AA 4.0	AA 0.20
2016-10-04	24.1	10.4	1.22	8.1	8.0		
2016-10-05	24.1	10.3	1.01	8.1	8.0	AA 4.0	AA 0.20
2016-10-06	24.9	10.3	1.17	8.1	8.0		
2016-10-07	24.8	10.3	1.11	8.1	8.0	AA 4.0	AA 0.20
2016-10-08	24.1	10.5	1.20	8.0	7.9		
2016-10-09	22.5	10.7	1.16	7.9	7.8		
2016-10-10	22.3	10.3	1.16	7.9	7.7	AA 4.0	AA 0.20
2016-10-11	22.7	10.7	1.14	7.9	7.8		
2016-10-12	28.5	10.0	0.38	8.2	7.9	AA 4.0	AA 0.20
2016-10-13	23	10.5	1.21	8.0	7.2		
2016-10-14	22.7	10.7	1.14	8.0	7.9	AA 4.0	AA 0.20
2016-10-15	22.3	10.7	1.20	8.0	7.8		
2016-10-16	21.9	10.7	1.17	7.9	7.6		
2016-10-17	22.9	10.5	1.14	7.9	7.7	AA 4.0	AA 0.20
2016-10-18	23.2	10.5	1.17	7.9	7.8		
2016-10-19	23.3	10.5	1.17	8.0	7.9	AA 4.0	AA 2.0
2016-10-20	23	10.7	1.31	8.0	7.8		
2016-10-21	21.2	10.9	1.43	7.9	7.7	AA 4.0	AA 2.0
2016-10-22	21	10.9	1.39	7.9	7.9		
2016-10-23	21.1	10.9	1.25	8.0	7.8		
2016-10-24	21.8	10.9	1.12	8.0	7.8	AA 4.0	AA 2.0
2016-10-25	21.9	10.9	1.14	8.0	7.9		
2016-10-26	21.8	10.9	1.16	8.0	7.9	AA 4.0	AA 2.0
2016-10-27	21.4	10.9	1.13	8.1	7.9		
2016-10-28	21.5	11.0	1.19	8.0	8.0	AA 4.0	AA 2.0
2016-10-29	21	11.0	1.19	8.0	7.8		
2016-10-30	20.6	11.1	1.17	7.8	7.7		
2016-10-31	20.7	11.1	1.15	7.8	7.7		

Minimum	20.6	10.0	0.38	7.8	7.2	0.0	0.0
Maximum	28.5	11.1	1.43	8.2	8.0	0.0	0.0
Average	22.73226	10.64839	1.16645	7.98065	7.82258	0	0
Count	31	31	31	31	31	12	12

Name of Responsible Official or Authorized Representative	I certify under the penalty of law that I have personally examined and am familiar with the information submitted herein and based on my inquiry of those individuals immediately responsible for obtaining the information, I believe the submitted information is true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.	Signature of Responsible Official or Authorized Representative	Submission Date/Time

Ohio EPA - Daily Discharge Monitoring Report - Form 4500

SUBMISSION ID:		**STATUS:**	Draft
FACILITY:	Delphos WWTP	**PERMIT NUMBER:**	***2PD00029*RD***
LOCATION:	24793 Pohlman Rd	**STATION CODE:**	001
	Delphos, OH 45833	**MONITORING PERIOD :**	2016-10-01 To: 2016-10-31
COUNTY:	Allen	**REPORTING LAB:**	Delphos WWTP, Alloway
DISTRICT:	NWDO	**ANALYST:**	DT
		NO DISCHARGE INDICATOR:	

PARAMETER	E. coli	CBOD 5 day	Phosphorus, Total (P)	Oil and Grease, Hexane Extr Method	Nitrogen Kjeldahl, Total	Nitrite Plus Nitrate, Total	Silver, Total Recoverable
PARAMETER CODE	31648	80082	00665	00552	00625	00630	01079
UNITS	#/100 ml	mg/l	mg/l	mg/l	mg/l	mg/l	ug/l
FREQUENCY	3/Week	3/Week	1/Week	1 / 2 Weeks	1/Month	1/Month	1/Month
SAMPLING TYPE	Grab	24hr Composite	24hr Composite	Grab	24hr Composite	24hr Composite	24hr Composite
2016-10-01							
2016-10-02							
2016-10-03	AA 10	AA 2.0					
2016-10-04							
2016-10-05	AA 10	AA 2.0					
2016-10-06							
2016-10-07	AA 1	AA 2.0	0.76	AA 5.0	0.56	0.96	AA 1.0
2016-10-08							
2016-10-09							
2016-10-10	AA 1	AA 2.0	1.35				
2016-10-11							
2016-10-12		AA 2.0					
2016-10-13	AA 1						
2016-10-14	AA 1	4.1					
2016-10-15							
2016-10-16							
2016-10-17	AA 1	AA 2.0	2.80				
2016-10-18							
2016-10-19	AA 1	AA 2.0					
2016-10-20							
2016-10-21	1	AA 2.0					
2016-10-22							
2016-10-23							
2016-10-24	AA 1	AA 0.20	2.30				
2016-10-25							
2016-10-26	AA 1	AA 0.20		AA 5.0			
2016-10-27							
2016-10-28	AA 1	AA 0.20					
2016-10-29							
2016-10-30							
2016-10-31							

Minimum	0.0	0.0	0.76	0.0	0.56	0.96	0.0
Maximum	1.0	4.1	2.8	0.0	0.56	0.96	0.0
Average	0.08333	0.34167	1.8025	0	0.56	0.96	0
Count	12	12	4	2	1	1	1

Name of Responsible Official or Authorized Representative	I certify under the penalty of law that I have personally examined and am familiar with the information submitted herein and based on my inquiry of those individuals immediately responsible for obtaining the information, I believe the submitted information is true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.	Signature of Responsible Official or Authorized Representative	Submission Date/Time

Ohio EPA - Daily Discharge Monitoring Report - Form 4500

SUBMISSION ID:		**STATUS:**	Draft
FACILITY:	Delphos WWTP	**PERMIT NUMBER:**	***2PD00029*RD***
LOCATION:	24793 Pohlman Rd	**STATION CODE:**	001
	Delphos, OH 45833	**MONITORING PERIOD :**	2016-09-01 To: 2016-09-30
COUNTY:	Allen	**REPORTING LAB:**	Delphos wwtp, Alloway
DISTRICT:	NWDO	**ANALYST:**	DT
		NO DISCHARGE INDICATOR:	

PARAMETER	Water Temperature	Dissolved Oxygen	Flow Rate	pH, Maximum	pH, Minimum	Total Suspended Solids	Nitrogen, Ammonia (NH3)
PARAMETER CODE	00010	00300	50050	61941	61942	00530	00610
UNITS	C	mg/l	MGD	S.U.	S.U.	mg/l	mg/l
FREQUENCY	1/Day	1/Day	1/Day	1/Day	1/Day	3/Week	3/Week
SAMPLING TYPE	Maximum Indicating Thermometer	Multiple Grab	Continuous	Multiple Grab	Multiple Grab	24hr Composite	24hr Composite
2016-09-01	25.8	10.0	1.57	7.9	7.7		
2016-09-02	25.1	9.9	1.13	7.9	7.8	AA 4.0	AA 0.20
2016-09-03	24.9	10.2	1.15	7.9	7.8		
2016-09-04	24.4	10.3	1.15	7.8	7.8		
2016-09-05	24.5	10.2	1.15	7.8	7.7		
2016-09-06	25.5	10.1	1.04	7.8	7.6	AA 4.0	AA 0.20
2016-09-07	25.5	10.0	1.06	7.8	7.7	AA 4.0	AA 0.20
2016-09-08	25.4	9.9	1.47	7.8	7.5		
2016-09-09	AE	10.0	2.01	8.5	7.2	AA 4.0	AA 0.20
2016-09-10	AE	9.9	2.08	8.6	AE		
2016-09-11	AE	10.3	1.97	AE	AE		
2016-09-12	24.5	10.2	2.02	AE	AE	AA 4.0	AA 0.20
2016-09-13	24.5	10.2	1.95	7.7	7.5		
2016-09-14	25	10.2	2.03	7.6	7.5	AA 4.0	AA 0.20
2016-09-15	24.9	10.2	2.08	7.7	7.5		
2016-09-16	24.8	10.2	2.00	7.7	7.6	AA 4.0	AA 0.20
2016-09-17	24.9	10.1	2.07	7.6	7.4		
2016-09-18	24	10.3	2.01	8.1	7.6		
2016-09-19	24.4	10.3	2.04	7.7	7.6	AH	AH
2016-09-20	24.6	10.3	2.08	7.6	7.4		
2016-09-21	24.3	10.3	2.05	7.6	7.5	AA 4.0	AA 0.20
2016-09-22	25.4	10.2	1.63	7.8	7.4		
2016-09-23	25.7	10.1	1.13	7.9	7.7	AA 4.0	AA 0.20
2016-09-24	25.6	10.2	1.25	7.9	7.8		
2016-09-25	24.3	10.3	1.24	7.8	7.7		
2016-09-26	24.1	10.3	1.44	7.9	7.7	AA 4.0	.26
2016-09-27	23.9	10.3	1.19	7.9	7.8		
2016-09-28	23.9	10.3	1.25	7.9	7.7	AA 4.0	AA 0.20
2016-09-29	24.4	10.4	1.22	8.0	7.7		
2016-09-30	24.3	10.3	1.15	8.2	7.9		
Minimum	23.9	9.9	1.04	7.6	7.2	0.0	0.0

Maximum	25.8	10.4	2.08	8.6	7.9	0.0	0.26
Average	24.76296	10.18333	1.587	7.87143	7.62222	0	0.02364
Count	27	30	30	28	27	11	11

Name of Responsible Official or Authorized Representative	I certify under the penalty of law that I have personally examined and am familiar with the information submitted herein and based on my inquiry of those individuals immediately responsible for obtaining the information, I believe the submitted information is true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.	Signature of Responsible Official or Authorized Representative	Submission Date/Time

Ohio EPA - Daily Discharge Monitoring Report - Form 4500

SUBMISSION ID:		**STATUS:**	Draft
FACILITY:	Delphos WWTP	**PERMIT NUMBER:**	***2PD00029*RD***
LOCATION:	24793 Pohlman Rd	**STATION CODE:**	001
	Delphos, OH 45833	**MONITORING PERIOD :**	2016-09-01 To: 2016-09-30
COUNTY:	Allen	**REPORTING LAB:**	Delphos wwtp, Alloway
DISTRICT:	NWDO	**ANALYST:**	DT
		NO DISCHARGE INDICATOR:	

PARAMETER	E. coli	CBOD 5 day	Phosphorus, Total (P)	Oil and Grease, Hexane Extr Method	Nitrogen Kjeldahl, Total	Nitrite Plus Nitrate, Total	Silver, Total Recoverable
PARAMETER CODE	31648	80082	00665	00552	00625	00630	01079
UNITS	#/100 ml	mg/l	mg/l	mg/l	mg/l	mg/l	ug/l
FREQUENCY	3/Week	3/Week	1/Week	1 / 2 Weeks	1/Month	1/Month	1/Month
SAMPLING TYPE	Grab	24hr Composite	24hr Composite	Grab	24hr Composite	24hr Composite	24hr Composite
2016-09-01							
2016-09-02	AA 1	AA 2.0					
2016-09-03							
2016-09-04							
2016-09-05							
2016-09-06	AA 1	AA 2.0	1.62				
2016-09-07	4	AA 2.0					
2016-09-08							
2016-09-09	AA 1	AA 2.0					
2016-09-10							
2016-09-11							
2016-09-12	AA 1	AA 2.0	1.10	AA 5.0	0.50	4.13	AA 1.0
2016-09-13							
2016-09-14	AA 1	AA 2.0					
2016-09-15							
2016-09-16	AA 1	AA 2.0					
2016-09-17							
2016-09-18							
2016-09-19	AA 1	AH	AH				
2016-09-20							
2016-09-21	AA 1	AA 2.0					
2016-09-22							
2016-09-23	AA 1	AA 2.0					
2016-09-24							
2016-09-25							
2016-09-26	AA 1	AA 2.0	1.32	AA 5.0			
2016-09-27							
2016-09-28	AA 1	AA 2.0					
2016-09-29							
2016-09-30							
Minimum	0.0	0.0	1.1	0.0	0.5	4.13	0.0

Maximum	4.0	0.0	1.62	0.0	0.5	4.13	0.0
Average	0.33333	0	1.34667	0	0.5	4.13	0
Count	12	11	3	2	1	1	1

Name of Responsible Official or Authorized Representative	I certify under the penalty of law that I have personally examined and am familiar with the information submitted herein and based on my inquiry of those individuals immediately responsible for obtaining the information, I believe the submitted information is true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.	Signature of Responsible Official or Authorized Representative	Submission Date/Time

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Appendix J:
WWTP – Flowmeters – Manufacturer's Cut Sheets

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Signet 2551 Magmeter Flow Sensor

Available in a variety of wetted materials and ideal for pipe sizes up to DN900 (36 in.)

The Signet 2551 Magmeter is an insertion style magnetic flow sensor that features no moving parts. The patented* sensor design is available in corrosion-resistant materials to provide long-term reliability with minimal maintenance costs. Material options include PP with stainless steel, PVDF with Hastelloy-C, or PVDF with Titanium. Utilizing the comprehensive line of Signet installation fittings, sensor alignment and insertion depth is automatic. These versatile, simple-to-install sensors deliver accurate flow measurement over a wide dynamic range in pipe sizes ranging from DN15 to DN900 (½ to 36 inches), satisfying the requirements of many diverse applications.

Signet 2551 Magmeters offer many output options of frequency/digital (S^3L) or 4 to 20 mA which are available on both the blind and display versions. The frequency or digital (S^3L) sensor output can be used with Signet's extensive line of flow instruments while the 4 to 20 mA output can be used for a direct input to PLCs, chart recorders, etc. Both the 4 to 20 mA output and digital (S^3L) sensor interface is available for long distance signal transmission. An additional benefit is the empty pipe detection which features a zero flow output when the sensors are not completely wetted. Also, the frequency output is bi-directional while the 4 to 20 mA output can be set for uni- or bi-directional flow using the display or the 3-0252 Configuration Tool which connects to PCs for programming capabilities.

In addition, the display version of the 2551 Magmeter is available with relays and features permanent and resettable totalizer values, which can be stored and seen on the display. Also, the display contains multi-languages with English, Spanish, German, French, Italian and Portuguese menu options.

Features

- **Test certificate included for -X0, -X1**
- **Patented Magmeter technology***
- **No moving parts**
- **Bi-directional flow**
- **Empty pipe detection**
- **Installs into pipe sizes DN15 to DN900 (0.5 to 36 in.)**
- **Operating range 0.05 to 10 m/s (0.15 to 33 ft/s)**
- **Accurate measurement even in dirty liquids**
- **Polypropylene and PVDF retaining nuts standard, Valox optional**
- **4 to 20 mA, digital (S^3L), frequency, relay output (Display only)**
- **No pressure drop**
- **Corrosion resistant materials; PP or PVDF with SS, Hastelloy-C, or Titanium**
- **Multi-language display menu available**

(3-2551-PX-XX version only)

Applications

- **Chemical Processing**
- **Water and Wastewater Monitoring**
- **Metal Recovery and Landfill Leachate**
- **Commercial Pools, Spas, and Aquariums**
- **HVAC**
- **Irrigation**
- **Scrubber Control**
- **Neutralization Systems**
- **Industrial Water Distribution**

* U.S. Patent No: 7,055,396 B1

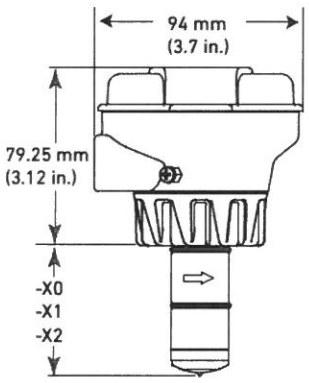
Specifications

General			
Operating Range	0.05 to 10 m/s	0.15 to 33 ft/s	
Pipe Size Range	DN15 to DN900	½ in. to 36 in.	
Linearity	± 1% reading plus 0.1% of full scale		
Repeatability	±0.5% of reading @ 25 °C (77 °F)		
Minimum Conductivity	20 µS/cm		
Wetted Materials			
Sensor Body/Electrodes and Grounding Ring	-P0, -P1, -P2: PP/316L SS		
	-T0, -T1, -T2: PVDF/Titanium		
	-V0, -V1, -V2: PVDF/Hastelloy-C		
O-rings	FPM (standard)		
	EPR (EPDM), FFPM (optional)		
Case	PBT		
Display Window	Polyamide (transparent nylon)		
Protection Rating	NEMA 4X/IP65		
Electrical			
Power Requirements	4 to 20 mA	24 VDC ±10%, regulated, 22.1 mA max.	
	Frequency	5 to 24 VDC ±10%, regulated, 15 mA max.	
	Digital (S^3L)	5 to 6.5 VDC, 15 mA max.	
Auxiliary (only required for units with relays)		9 to 24 VDC, 0.4 A max.	
Reverse Polarity and Short Circuit Protected			
Current Output 4 to 20 mA	Loop Accuracy	32 µA max. error (25 °C @ 24 VDC)	
	Isolation	Low voltage < 48 VAC/DC from electrodes and auxiliary power	
	Maximum Cable	300 m (1000 ft)	
	Error condition	22.1 mA	
	Max. Loop Resistance	300 Ω	
	Compatible with PLC, PC or similar equipment		
	4 to 20 mA load needed		
Frequency Output	Output Modes	Freq., or Mirror Relay (display version only)	
	Max. Pull-up Voltage	30 VDC	
	Max. Current Sink	50 mA, current limited	
	Maximum Cable	300 m (1000 ft)	
	Compatible with Signet Model 8550, 8900, 9900, 9900-1BC		
Digital (S^3L) Output	Serial ASCII, TTL level 9600 bps		
	Compatible with Model Signet 8900 controller		
Relay Specifications			
#1, #2 Type	Mechanical SPDT		
Rating	5 A @ 30 VDC max., 5 A @ 250 VDC max.		
#3 Type	Solid State		
	50 mA @ 30 VDC, 50 mA @ 42 VAC		
Hysteresis	User adjustable for exiting alarm condition		
Alarm On Trigger Delay	Adjustable (0 to 9999.9 sec.)		
Relay Modes	Off, Low, High, Window, and Proportional Pulse		
Relay Source	Flow Rate, Resettable Totalizer		
Error Condition	Selectable; Fail Open or Closed		
Display			
Characters		2 x 16	
Contrast		User-set in four levels	
Backlighting (only on relay versions)		Requires external 9-24 VDC, 0.4 mA max.	
Max. Temperature/Pressure Rating			
Storage Temperature		-20 °C to 70 °C	-4 °F to 158 °F
Relative Humidity		0 to 95% (non-condensing)	
Operating Temperature	Ambient	-10 °C to 70 °C	14 °F to 158 °F
	Media	0 °C to 85 °C	32 °F to 185 °F
Maximum Operating Pressure		10.3 bar @ 25 °C	150 psi @ 77 °F
		1.4 bar @ 85 °C	20 psi @ 185 °F
Shipping Weight			
	0.680 kg	1.50 lb	
Standards and Approvals			
	CE, FCC, UL, CUL, NSF (3-2551-PX-XX version only)		
	RoHS compliant, China RoHS		
	NEMA 4X / IP65 Enclosure (with cap installed)		
	Manufactured under ISO 9001 for Quality and ISO 14001 for Environmental Management and OHSAS 18001 for Occupational Health and Safety		

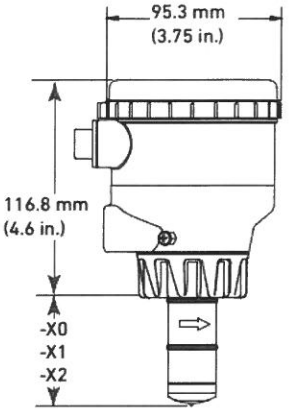
See Temperature and Pressure graphs for more information.

Dimensions

Blind version



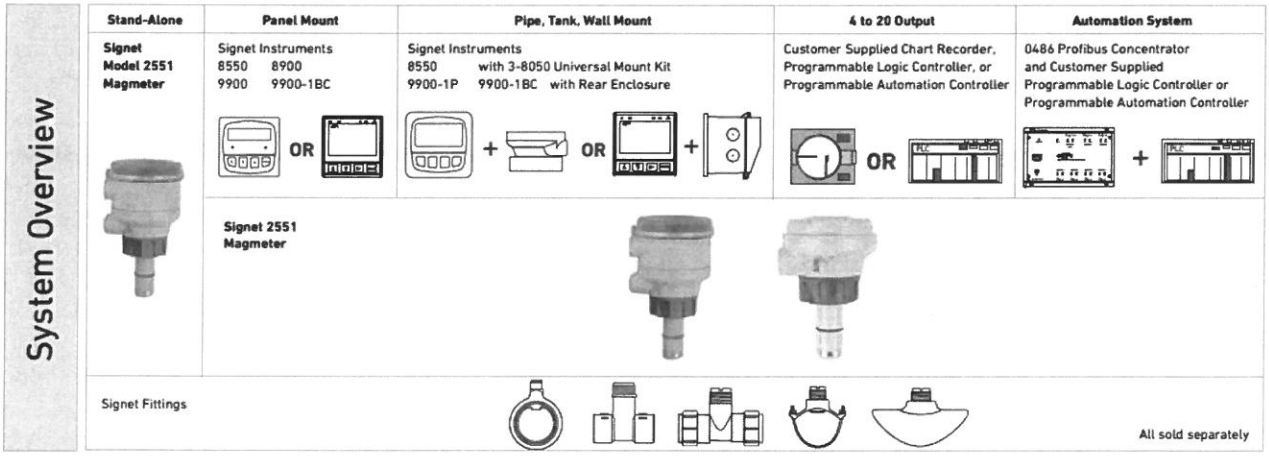
Display version



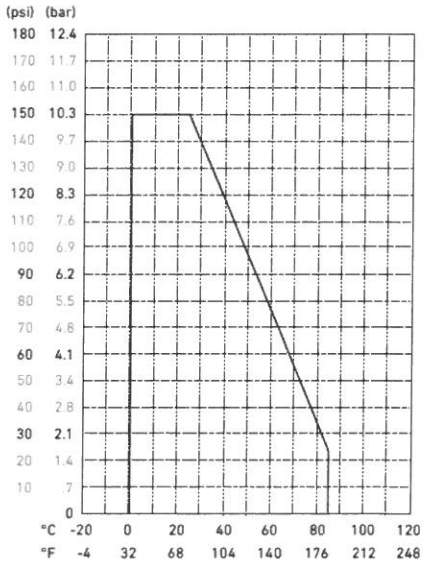
Pipe Range

1/2 to 4 in.	-X0 = 58 mm (2.3 in.)
5 to 8 in.	-X1 = 91 mm (3.6 in.)
10 to 36 in.	-X2 = 167 mm (6.6 in.)

X = Sensor Body P, T, or V



Temperature/Pressure Graphs



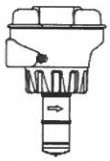
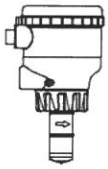
Note:
The pressure/temperature graphs are specifically for the Signet sensor. During system design the specifications of all components must be considered. In the case of a metal piping system, a plastic sensor will reduce the system specification. When using a PVDF sensor in a PVC piping system, the fitting will reduce the system specification.

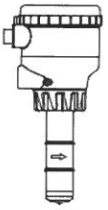
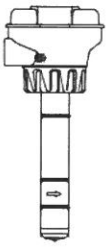
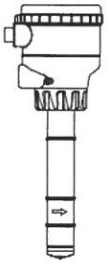
Application Tips

- Note minimum process liquid conductivity requirement is 20 µs/cm
- Install sensor using standard Signet installation fittings for best results.
- Sensor is capable of retrofitting into existing 515 and 2536 fittings.

Please refer to Wiring, Installation, and Accessories sections for more information.

Ordering Information

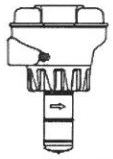
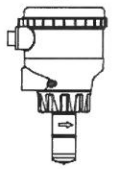



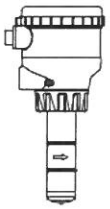




Pipe Size	Mfr. Part No.	Code	Sensor Body
Frequency or Digital (S³L) output Programmable open collector for use with any Signet Flow Instrument or the 8900 or 9900 Instruments**			
DN15 to DN100 (½ to 4 in.)			
No Display			
	3-2551-P0-11	**159 001 105**	Polypropylene and 316L SS
	3-2551-T0-11	**159 001 108**	PVDF and Titanium
	3-2551-V0-11	**159 001 257**	PVDF and Hastelloy-C
with Display, two SPDT relays, one solid state relay			
	3-2551-P0-21	**159 001 267**	Polypropylene and 316L SS
	3-2551-T0-21	**159 001 436**	PVDF and Titanium
	3-2551-V0-21	**159 001 269**	PVDF and Hastelloy-C
with display			
	3-2551-P0-41	**159 001 261**	Polypropylene and 316L SS
	3-2551-T0-41	**159 001 433**	PVDF and Titanium
	3-2551-V0-41	**159 001 263**	PVDF and Hastelloy-C
DN125 to DN200 (5 to 8 in.)			
No Display			
	3-2551-P1-11	**159 001 106**	Polypropylene and 316L SS
	3-2551-T1-11	**159 001 109**	PVDF and Titanium
	3-2551-V1-11	**159 001 258**	PVDF and Hastelloy-C
with Display, two SPDT relays, one solid state relay			
	3-2551-P1-21	**159 001 268**	Polypropylene and 316L SS
	3-2551-T1-21	**159 001 437**	PVDF and Titanium
	3-2551-V1-21	**159 001 270**	PVDF and Hastelloy-C
with Display			
	3-2551-P1-41	**159 001 262**	Polypropylene and 316L SS
	3-2551-T1-41	**159 001 434**	PVDF and Titanium
	3-2551-V1-41	**159 001 264**	PVDF and Hastelloy-C
DN250 to DN900 (10 to 36 in.)			
No Display			
	3-2551-P2-11	**159 001 107**	Polypropylene and 316L SS
	3-2551-T2-11	**159 001 448**	PVDF and Titanium
	3-2551-V2-11	**159 001 450**	PVDF and Hastelloy-C
with Display, two SPDT relays, one solid state relay			
	3-2551-P2-21	**159 001 435**	Polypropylene and 316L SS
	3-2551-T2-21	**159 001 454**	PVDF and Titanium
	3-2551-V2-21	**159 001 456**	PVDF and Hastelloy-C
with Display			
	3-2551-P2-41	**159 001 432**	Polypropylene and 316L SS
	3-2551-T2-41	**159 001 460**	PVDF and Titanium
	3-2551-V2-41	**159 001 462**	PVDF and Hastelloy-C

**This option is a programmable open collector output that is available with display versions only.

Ordering Information (continued)



Pipe Size	Mfr. Part No.	Code	Sensor Body
4 to 20 mA output for use with PLC, PC or similar equipment			
DN15 to DN100 (½ to 4 in.)			
No Display			
	3-2551-P0-12	**159 001 110**	Polypropylene and 316L SS
	3-2551-T0-12	**159 001 113**	PVDF and Titanium
	3-2551-V0-12	**159 001 259**	PVDF and Hastelloy-C
with Display, two SPDT relays, one solid state relay			
	3-2551-P0-22	**159 001 273**	Polypropylene and 316L SS
	3-2551-T0-22	**159 001 439**	PVDF and Titanium
	3-2551-V0-22	**159 001 275**	PVDF and Hastelloy-C
with Display			
	3-2551-P0-42	**159 001 279**	Polypropylene and 316L SS
	3-2551-T0-42	**159 001 442**	PVDF and Titanium
	3-2551-V0-42	**159 001 281**	PVDF and Hastelloy-C
DN125 to DN200 (5 to 8 in.)			
No Display			
	3-2551-P1-12	**159 001 111**	Polypropylene and 316L SS
	3-2551-T1-12	**159 001 114**	PVDF and Titanium
	3-2551-V1-12	**159 001 260**	PVDF and Hastelloy-C
with Display, two SPDT relays, one solid state relay			
	3-2551-P1-22	**159 001 274**	Polypropylene and 316L SS
	3-2551-T1-22	**159 001 440**	PVDF and Titanium
	3-2551-V1-22	**159 001 276**	PVDF and Hastelloy-C
with Display			
	3-2551-P1-42	**159 001 280**	Polypropylene and 316L SS
	3-2551-T1-42	**159 001 443**	PVDF and Titanium
	3-2551-V1-42	**159 001 282**	PVDF and Hastelloy-C
DN250 to DN900 (10 to 36 in.)			
No Display			
	3-2551-P2-12	**159 001 112**	Polypropylene and 316L SS
	3-2551-T2-12	**159 001 449**	PVDF and Titanium
	3-2551-V2-12	**159 001 451**	PVDF and Hastelloy-C
with Display, two SPDT relays, one solid state relay			
	3-2551-P2-22	**159 001 438**	Polypropylene and 316L SS
	3-2551-T2-22	**159 001 455**	PVDF and Titanium
	3-2551-V2-22	**159 001 457**	PVDF and Hastelloy-C
with Display			
	3-2551-P2-42	**159 001 441**	Polypropylene and 316L SS
	3-2551-T2-42	**159 001 461**	PVDF and Titanium
	3-2551-V2-42	**159 001 463**	PVDF and Hastelloy-C

Accessories and Replacement Parts

Mfr. Part No.	Code	Description
O-rings		
1220-0021	**198 801 000**	O-ring, FPM (2 required per sensor)
1224-0021	**198 820 006**	O-ring, EPR (EPDM) (2 required per sensor)
1228-0021	**198 820 007**	O-ring, FFPM (2 required per sensor)
Replacement Transducers		
3-2551-P0	**159 001 211**	PP/316L SS, DN15 to DN100 (½ to 4 in.) pipe
3-2551-P1	**159 001 212**	PP/316L SS, DN125 to DN200 (5 to 8 in.) pipe
3-2551-P2	**159 001 444**	PP/316L SS, DN250 to DN900 (10 to 36 in.) pipe
3-2551-T0	**159 001 213**	PVDF/Titanium, DN15 to DN100 (½ to 4 in.) pipe
3-2551-T1	**159 001 214**	PVDF/Titanium, DN125 to DN200 (5 to 8 in.) pipe
3-2551-T2	**159 001 445**	PVDF/Titanium, DN250 to DN900 (10 to 36 in.) pipe
3-2551-V0	**159 001 376**	PVDF/Hastelloy-C, DN15 to DN100 (½ to 4 in.) pipe
3-2551-V1	**159 001 377**	PVDF/Hastelloy-C, DN125 to DN200 (5 to 8 in.) pipe
3-2551-V2	**159 001 446**	PVDF/Hastelloy-C, DN250 to DN900 (10 to 36 in.) pipe
Replacement Electronics Module		
3-2551-11	**159 001 215**	Magmeter electronics, frequency or digital (S^3L) output
3-2551-12	**159 001 216**	Magmeter electronics, 4 to 20 mA output
3-2551-21	**159 001 372**	Magmeter display electronics, frequency or digital (S^3L) output, with relays
3-2551-22	**159 001 373**	Magmeter display electronics, 4 to 20 mA output w/relays
3-2551-41	**159 001 374**	Magmeter display electronics, frequency or digital (S^3L) output
3-2551-42	**159 001 375**	Magmeter display electronics, 4 to 20 mA output
Other		
P31536	**198 840 201**	Sensor plug, Polypropylene
7310-1024	**159 873 004**	24 VDC Power Supply, 10W, 0.42 A
7310-2024	**159 873 005**	24 VDC Power Supply, 24W, 1.0 A
7310-4024	**159 873 006**	24 VDC Power Supply, 40W, 1.7 A
7310-6024	**159 873 007**	24 VDC Power Supply, 60W, 2.5 A
7310-7024	**159 873 008**	24 VDC Power Supply, 96W, 4.0 A
3-8050.390-1	**159 001 702**	Retaining nut replacement kit, NPT, Valox
3-8050.390-3	**159 310 116**	Retaining nut replacement kit, NPT, PP
3-8050.390-4	**159 310 117**	Retaining nut replacement kit, NPT, PVDF
3-8551.521	**159 001 378**	Clear plastic cap for display
1222-0042	**159 001 379**	O-ring for clear plastic cap, EPR (EPDM)
3-0252	**159 001 808**	Configuration Tool (Blind version only)
3-9900.392-1	**159 000 839**	Liquid tight connector kit, NPT (1 pc.)
3-8050.396	**159 000 617**	RC filter kit (for relay use), 2 per kit

3-2551.099 Rev J (02/16)
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3401 Aero Jet Avenue, El Monte, CA 91731-2882 U.S.A. • Tel. (626) 571-2770 • Fax (626) 573-2057 • www.gfsignet.com • e-mail: signet.ps@georgfischer.com
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Appendix K:

WWTP – Chemical Metering Pumps – Manufacturer's Cut Sheets

Project Number: 81235.09

The Chazen Companies
May 13, 2021
Revised February 23, 2022

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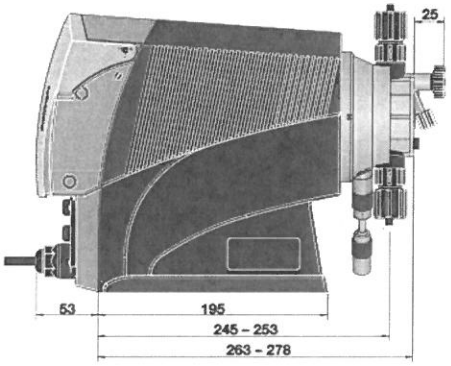
Chemical Metering Pump
(Typ of 2)

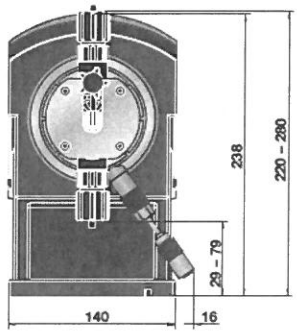
delta®

Solenoid-driven **diaphragm metering pump**

High-end technology for the most exacting requirements and varied applications. The world's first metering pump with regulated solenoid drive (optoDrive®).

- Capacity range 7.5–75 l/h, 25–2 bar
- Excellent efficiency as no need for accessories, such as pulsation dampers, flow gauges etc.
- Flexible adaptation to the dosing task with excellent precision
- The integral injection point monitoring unit detects hydraulic fault states that can be reported via the optional relays
- Versatile control options for use with almost every application
- Option to connect via PROFIBUS® or CANbus to the central control station
- Suitable for use as a central control unit with the "Process Timer" option, making programmable logic controls (PLC) redundant





delta®

Pump type	Pressure bar	max. delivery rate l/h	stroke volume ml/stroke	Nr. of strokes strokes/min	max. connection size o Ø x i Ø mm	Suction head mWC
DLTA 2508	25	7.5	0.62	200	8x4 [1]	5
DLTA 1608	16	7.8	0.65	200	8x5 [1]	5
DLTA 1612	16	11.3	0.94	200	8x5	6
DLTA 1020	10	19.1	1.59	200	12x9	5
DLTA 0730	7	29.2	2.43	200	12x9	5
DLTA 0450	4	49.0	4.08	200	G¾ – DN10	3
DLTA 0280	2	75.0	6.25	200	G¾ – DN10	2

Suction height with primed liquid end and primed suction line.

1) 6 mm inner diameter in stainless steel version.

Materials in contact with medium

Material	Liquid end	Suction/pressure port	Seals	Valve balls
NPE	Acrylic glass	PVC	EPDM	Ceramic
NPB	Acrylic glass	PVC	FPM	Ceramic
PVT	PVDF	PVDF	PTFE	Ceramic
SST	Stainless steel Mat. Nr.1.4404	Stainless steel Mat. Nr.1.4404	PTFE	Ceramic

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Appendix L:
WWTP – UV Units – Manufacturer's Cut Sheets

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VIQUA
simply safe water

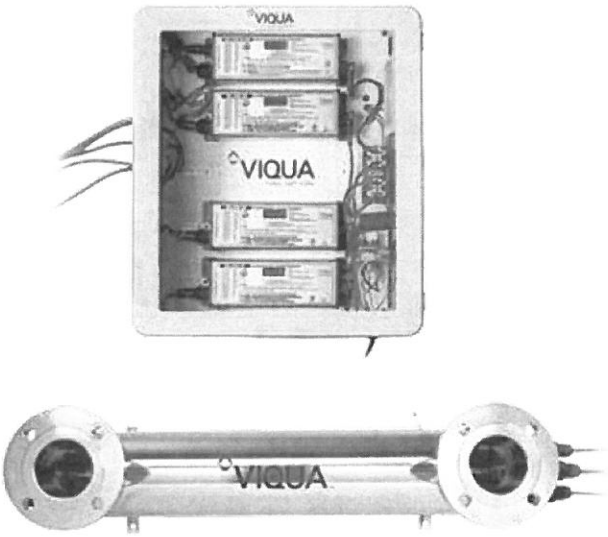
SHF-140, SHF-180, SHF-290, SHFM-140, SHFM-180 & SHFM-290

Ultraviolet Water Disinfection Systems from VIQUA

The quality of drinking water can change with time and become contaminated with harmful bacteria. The **PROFESSIONAL family** of compact UV disinfection systems provide a **reliable, economical,** and **chemical-free** way to safeguard drinking water in any light commercial application. VIQUA's products have been designed and tested to ensure quality drinking water is at everyone's finger tips.

Regardless of your need, there is a VIQUA system to suit your requirements. **VIQUA's High-Flow series offers systems with flow rates of up to 290 GPM (65 m³/hr) for facilities with higher water demands.**

VIQUA's line of High Flow UV water disinfection systems have been specifically designed to extend the flow rate range of drinking water that can be safeguarded using the proven and trusted technology already offered by the VIQUA family of products.



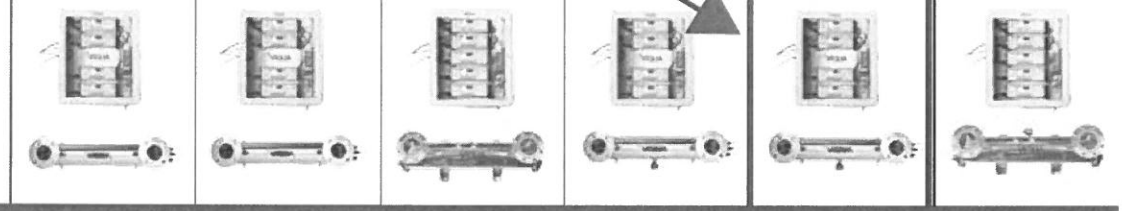
Features of VIQUA UV water disinfection systems

- Equipped to inactivate harmful microorganisms in water flows up to 290 GPM (65 m³/hr).
- Specially designed and tested Sterilume-HO lamps provide consistent and reliable UV output over the entire life of the lamp (9000 hours) to ensure continuous purification.
- Superior quality 316 stainless steel chamber.
- Separate control panel with power isolation.
- Visual display of lamp life remaining and audible/visual lamp change reminder.
- Specialised 254nm UV intensity sensor available (SHFM models) with output to enable solenoid valve or remote alarm.

Replacement Parts

		SHF-140	SHF-180	SHF-290	SHFM-140	SHFM-180	SHFM-290
S740RL-4C	UV Lamp	✓	-	-	✓	-	-
S950RL-4C	UV Lamp	-	✓	✓	-	✓	✓
QS-012	Quartz Sleeve	✓	-	-	✓	-	-
QS-180	Quartz Sleeve	-	✓	-	-	✓	-
QSO-950	Quartz Sleeve	-	-	✓	-	-	✓
254NM-HF	UV Sensor	-	-	✓	-	-	✓
BA-ICE-HF	Controller	✓	✓	✓	✓	✓	✓
BA-ICE-M-HF	Controller	-	-	-	✓	✓	✓

Specifications

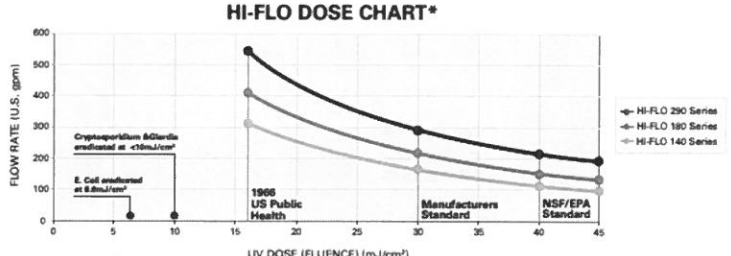


MODEL						
N. America	SHF-140	SHF-180	SHF-290	SHFM-140	SHFM-180	SHFM-290
EU CEE 7/7	SHF-140/2	SHF-180/2	SHF-290/2	SHFM-140/2	SHFM-180/2	SHFM-290/2
AUS/NZ 3112	SHF-140/2A	SHF-180/2A	SHF-290/2A	SHFM-140/2A	SHFM-180/2A	SHFM-290/2A
UK BS 1363	SHF-140/2B	SHF-180/2B	SHF-290/2B	SHFM-140/2B	SHFM-180/2B	SHFM-290/2B
FLOW RATES (@ 95% UVT)						
US Public Health (16 mJ/cm²)	310 GPM (1170 lpm) (70 m³/hr)	350 GPM (1300 lpm) (78 m³/hr)	543 GPM (2055 lpm) (123 m³/hr)	310 GPM (1300 lpm) (78 m³/hr)	350 GPM (1300 lpm) (78 m³/hr)	543 GPM (2055 lpm) (123 m³/hr)
VIQUA Standard (30 mJ/cm²)	170 GPM (640 lpm) (38 m³/hr)	210 GPM (790 lpm) (47 m³/hr)	290 GPM (1098 lpm) (65 m³/hr)	170 GPM (640 lpm) (38 m³/hr)	210 GPM (790 lpm) (47 m³/hr)	290 GPM (1098 lpm) (65 m³/hr)
NSF/EPA (40 mJ/cm²)	125 GPM (470 lpm) (28 m³/hr)	160 GPM (600 lpm) (36 m³/hr)	215 GPM (813 lpm) (48 m³/hr)	125 GPM (470 lpm) (28 m³/hr)	160 GPM (600 lpm) (36 m³/hr)	215 GPM (813 lpm) (48 m³/hr)
DIMENSIONS						
Chamber	34" x 6" x 14" (86.4 cm x 15.2 cm x 35.6 cm)	42.5" x 6" x 14" (107.3 cm x 15.2 cm x 35.6 cm)	42.5" x 8" x 17" (108 cm x 20.3 cm x 43.5 cm)	34" x 6" x 14" (86.4 cm x 15.2 cm x 35.6 cm)	42.5" x 6" x 14" (107.3 cm x 15.2 cm x 35.6 cm)	42.5" x 8" x 17" (108 cm x 20.3 cm x 43.5 cm)
Controller	17.5" x 19.5" x 8.2" (44.5 cm x 50 cm x 21 cm)	17.5" x 19.5" x 8.2" (44.5 cm x 50 cm x 21 cm)	17.5" x 19.5" x 8.2" (44.5 cm x 50 cm x 21 cm)	17.5" x 19.5" x 8.2" (44.5 cm x 50 cm x 21 cm)	17.5" x 19.5" x 8.2" (44.5 cm x 50 cm x 21 cm)	17.5" x 19.5" x 8.2" (44.5 cm x 50 cm x 21 cm)
Inlet/Outlet Port Size	3" FLANGE	3" FLANGE	4" FLANGE	3" FLANGE	3" FLANGE	4" FLANGE
Shipping Weight	96 lbs (43.5 kg)	99 lbs (45 kg)	286.5 lbs (129.7 kg)	96.5 lbs (43.7 kg)	99.5 lbs (45.1 kg)	287 lbs (130.1 kg)
ELECTRICAL						
Voltage	100-240V / 50-60 Hz	100-240V / 50-60 Hz	100-240V / 50-60 Hz	100-240V / 50-60 Hz	100-240V / 50-60 Hz	100-240V / 50-60 Hz
Power Consumption	350 W	440 W	550 W	350 W	440 W	550 W
Maximum Operating Pressure	125 psi (8.62 bar)	125 psi (8.62 bar)	125 psi (8.62 bar)	125 psi (8.62 bar)	125 psi (8.62 bar)	125 psi (8.62 bar)
Influent Water Temperature	2-40°C (36-104°F)	2-40°C (36-104°F)	2-40°C (36-104°F)	2-40°C (36-104°F)	2-40°C (36-104°F)	2-40°C (36-104°F)
Number of Lamps	4	4	5	4	4	5
FEATURES						
Visual "Power On"	YES	YES	YES	YES	YES	YES
Chamber Material	316L SS	316L SS	316L SS	316L SS	316L SS	316L SS
Visual Lamp Life Remaining	YES	YES	YES	YES	YES	YES
Audible Lamp Failure	YES	YES	YES	YES	YES	YES
Audible Lamp Replacement Reminder	YES	YES	YES	YES	YES	YES
UV Sensor	NO	NO	NO	YES	YES	YES
Sensor Reading Output (4-20mA)	–	–	–	Optional with 260134	Optional with 260134	Optional with 260134
Solenoid Valve Output	–	–	–	Optional	Optional	Optional

Water Quality Parameters

Hardness	Iron	Tannins
< 7 grains (120 mg/L)	< 0.3 mg/L	< 0.1 mg/L

HI-FLO DOSE CHART*



*@ 95% UVT and 20°C

Note: dosages based on end of lamp life (0.85 EOLL)

VIQUA simply safe water

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t. 1.519.763.1032 • f. 1.519.763.5069 • tf. 1.800.265.7246 (US/CAN)
t. +31.73.747.0144 (EUR) • info@viqua.com • **www.viqua.com**

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Appendix M:
WWTP – Odor Control – Manufacturer's Cut Sheets

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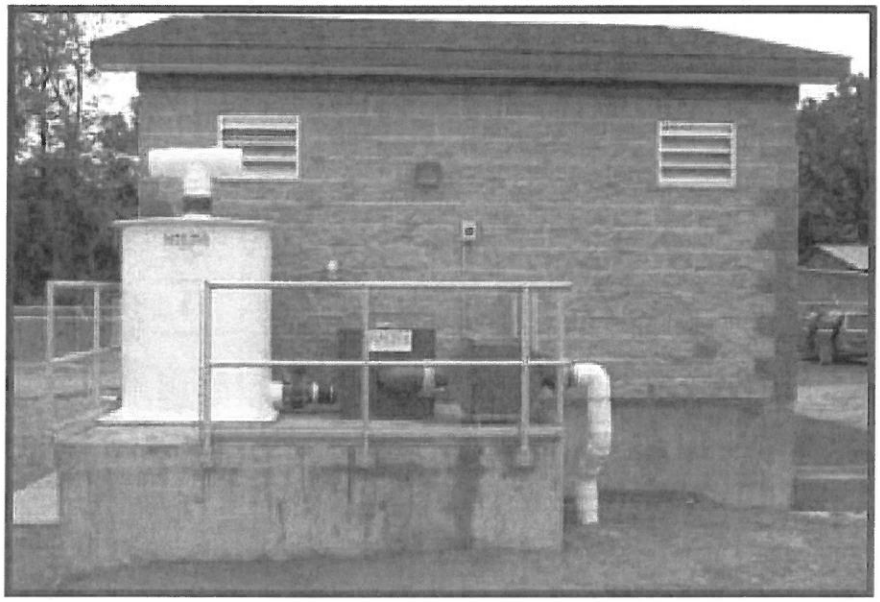
CARBTROL®

ODOR CONTROL SYSTEMS
250 to 2,000 CFM
UP FLOW



APPLICATIONS

- Odor Control
- Pump Stations
- Sewage Wet Wells
- VOC Control

COMPONENTS

- FRP or PPL vessel with sample ports, grounding rod and drain.
- FRP centrifugal blower. Also available in epoxy-lined or stainless steel.
- Control Panel with NEMA 4X or NEMA 7 enclosure.
- Transition duct, flex connector, manual flow control valve, and rain cap with bird screen.
- Differential pressure gauge.

Options:

- Grease/mist eliminator.
- Sound enclosure.

FEATURES

- Deep bed, up-flow carbon arrangement for high removal efficiency.
- Activated carbon adsorber, blower, controls, and accessories combined in factory assembled package.
- Skid mounted and supplied complete. Only requirement is power connection.
- Flow capacities from 250 to 2000 CFM.
- Wide range of catalytic carbon media to suit your application.
- Designed for H_2S removal greater than 99.9%

CARBTROL provides complete systems ranging from 90 to 20,000 CFM.

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AT-210/#1

CARBTROL®
CORPORATION

955 Connecticut Ave., Suite 5202
Bridgeport, CT 06607

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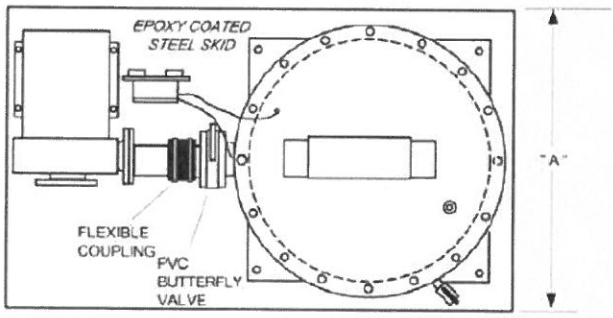
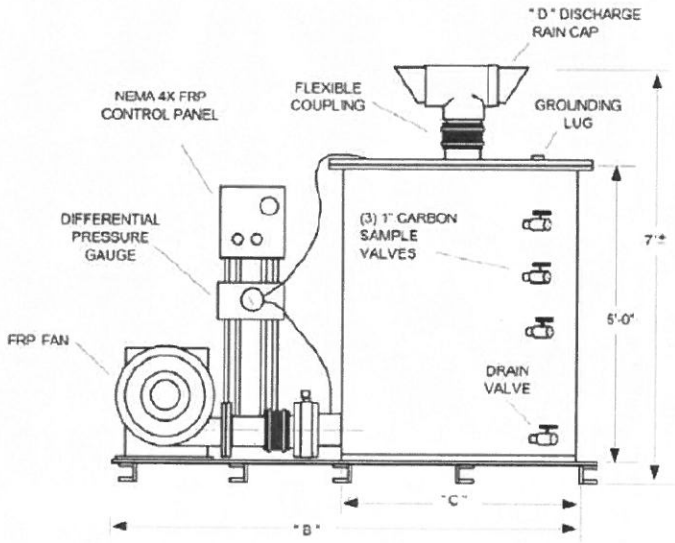
www.carbtrol.com info@carbtrol.com

CARBTROL®

ODOR CONTROL SYSTEMS

ARRANGEMENT





SPECIFICATIONS

Model	G-20	G-21	G-22	G-23	G-24
Capacity (CFM)	250	500	900	1400	2000
Carbon Weight (lbs.)	275	600	1000	1700	2400
Blower Horsepower	3/4	1	3	3	5
Skid Width - "A" (inches)	48	48	60	72	84
Skid Length - "B" (inches)	72	84	96	108	120
Vessel Dia. - "C" (inches)	24	36	48	60	72
Discharge Dia.– "D" (inches)	4	6	6	8	8

SAFETY

Certain chemical compounds in the presence of activated carbon may oxidize, decompose or polymerize. This could result in temperature increases sufficient to cause ignition of the activated carbon or adsorbed material. If a compounds reaction with activated carbon is unknown, appropriate tests should be considered.

CARBTROL®
CORPORATION

955 Connecticut Ave., Suite 5202
Bridgeport, CT 06607

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Appendix N:
WWTP – Dewatering Belt Press – Manufacturer's Cut Sheets

Project Number: 81235.09

The Chazen Companies
May 13, 2021
Revised February 23, 2022

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Aqualitec
Screening Equipment & Sludge Treatment

Looking for Screening or Sludge Equipment?
AQUALITEC HAS YOUR SOLUTION
Click Here or Call 1.855-650-2214

Combo GBT+BFP

Gravity Belt Thickener
Belt Filter Press Omega

Download

CONNECT WITH US

Combo GBT + BFP

Gravity Belt Thickener + Belt Filter Press

Combo units associate the functions of one gravity belt thickener and one belt filter press.

This combination increases the mass load of 30% and the dryness from 2 to 5%. The gravity belt thickener can be installed in the front or on the top of the belt filter press.

BENEFITS

SPACE SAVINGS

- No need for gravity settling tank, sludge storage tank or flotation unit
- Belt thickener can be mounted on the top of the belt press when footprint' constraint

OPTIMIZED BFP PERFORMANCE

- Dry solids concentration of the sludge entering the belt press is stable (The gravity belt thickener regulates DS%)
- Sludge flowing to the belt press is reduced by 4 to 10 times

COST SAVINGS

- Optimized process
- No need for additional polymer with the BFP
- Increase of the dry solids loading rate on the belt press by 30% = smaller BFP
- Adds-on equipment are common to the GBT and BFP
- Smaller footprint

EASE OF USE

- No maintenance platform
- Easy supervision of process (flocculation, thickening...)
- Easy maintenance (greasing...)
- Easy change of wear parts

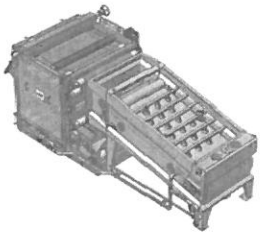
GBT+BFP COMBO OPTIONS

COMBO OMEGA CC

Belt width: from 0.60 to 1.20 m
Hydraulic flow: up to 15 m3/h

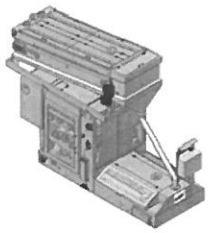
COMBO 100000 / SD OR MD

Belt width: from 1 to 2.50 m
Hydraulic flow: up to 40 m3/h

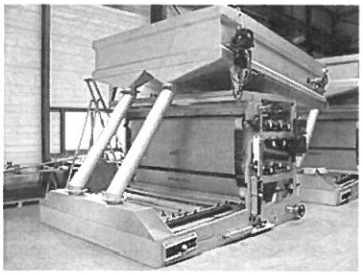


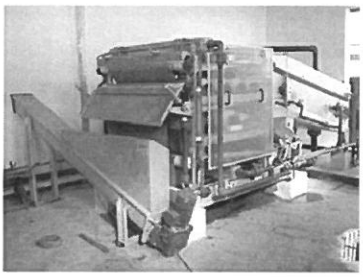
COMBO 1000 / MD, LD, THC

Belt width: from 1 to 2.50 m
Hydraulic flow: up to 150 m3/h



INSTALLATIONS





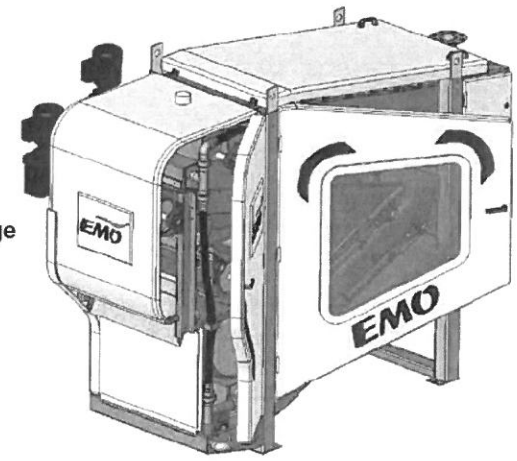
top

Aqualitec Corp. - 3415 S. Sepulveda Blvd., Suite 1100, Los Angeles, CA 90034
855-650-2214. Fax (323) 732 2815. www.aqualitec.com

Keep it simple.

Aqualitec
Screening Equipment & Sludge Treatment

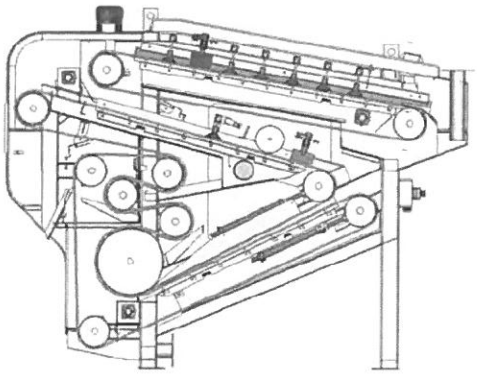
OMEGA CC
BELT THICKENER + BELT FILTER PRESS



Combo units associate the functions of one gravity belt thickener and one belt filter press.

This combination increases the mass load of 30% and the dryness from 2 to 5%. The Combo is designed for one continuous dewatering of sludge for industrial and municipal WasteWater treatment plants.

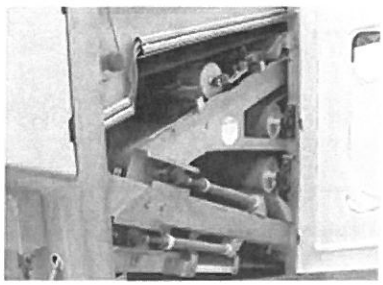
Features and Benefits



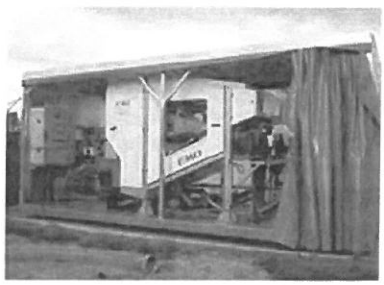
SPACE SAVINGS
No need for gravity settling tank, sludge storage tank or flotation unit
Belt thickener can be mounted on the top of the belt press when footprint' constraint
OPTIMIZED BFP PERFORMANCE
Dry solids concentration of the sludge entering the belt press is stable (The gravity belt thickener regulates DS%)
Sludge flowing to the belt press is reduced by 4 to 10 times
COST SAVINGS
Optimized process
No need for additional polymer with the BFP
Increase of the dry solids loading rate on the belt press by 30% = smaller BFP
Adds-on equipment are common to the GBT and BFP
Smaller footprint
EASE OF USE
No maintenance platform
Easy supervision of process (flocculation, thickening...)
Easy maintenance (greasing...)
Easy change of wear parts

Installations

OMEGA CC with liming



OMEGA CC 120



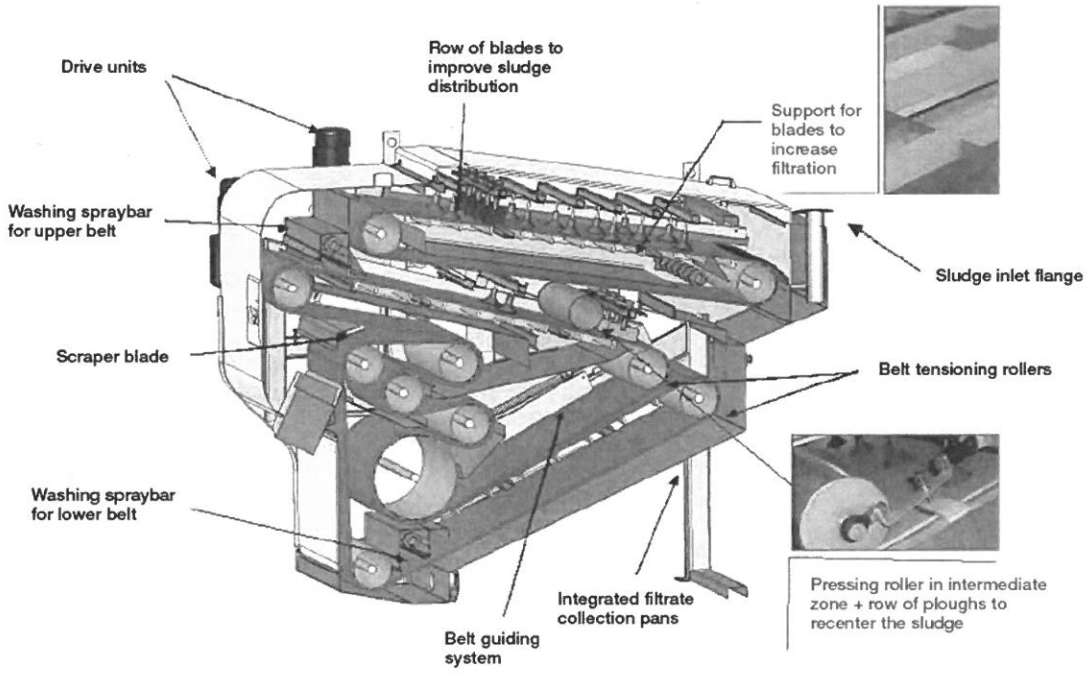
OMEGA CC Mobile Unit

Aqualitec
Screening Equipment & Sludge Treatment

OMEGA CC
BELT THICKENER + BELT FILTER PRESS

Operating Mode

Flocculated sludge enters on the upper part of the equipment by means of a sludge inlet flange. The sludge divides up on the filtering belt in a consistant way. The water contained in the sludge flows through the filtering belt and is then channelled in a tank. Plows arranged on the thickening zone create grooves in the sludge to ease the draining of the water.
The thickened sludge is then poured on a filtering belt of the pressing zone having a finer meshing to allow the pressing. The second filtering belt of pressing comes to imprison gradually the sludge to evacuate residual water. After passage between rollers of various diameters to increase the pressing, the sludge is removed from the filtering belt and discharged in the disposal system (thickened sludge pump, screw conveyor ...).



Specifications

Note that this combined unit is selected according to the DS loading rate per hour and per belt meter width. The rate varies from one type of sludge to the other.

Model	Belt width (m)	Dimensions (lxwxh)	Sludge flowrate (m^3/h)
OMEGA CC 060	0,60	2.8 x 1.2 x 2.25	6
OMEGA CC 120	1,20	2.8 x 1.8 x 2.25	12
OMEGA CC 150	1.50	2.8 x 2.1 x 2.25	15
OMEGA CC 200	2.00	2.8 x 2.7 x 2.25	20

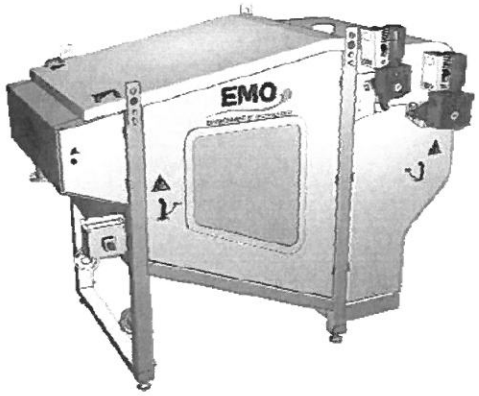
EMO

ENVIRONMENT BY TECHNOLOGY

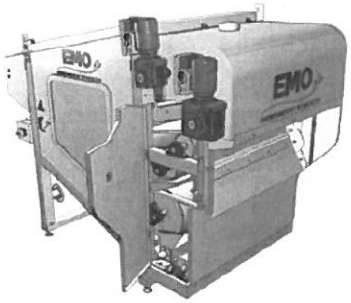
COMBINED SYSTEM OMEGA CC

Leader in the design and the manufacturing of sludge treatment systems for drinking water, waste water and sludge, EMO is present in 5 continents of the globe and holds more than 2500 recommendations to its credit since the company's creation in 1985.

- V The OMEGA Belt Filter Press is designed for the continuous mechanical dewatering of municipal and industrial sludge.
- V With its in-house, well equipped laboratory, EMO has been able to characterize many kinds of sludges and deliver tailor-made solutions for the benefit of the end-user.
- V EMO does not only provide electromechanical equipment but engineering and process solution thanks to the expertise of its Chemical & Process Engineers.



Technical data



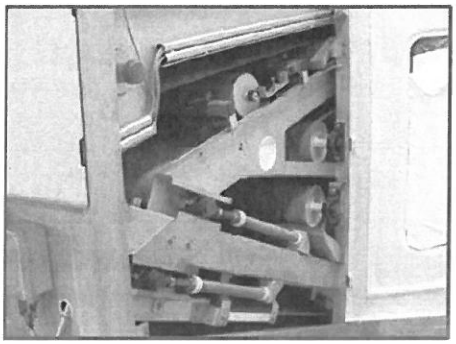
The Combined System – CC range is designed for one continuous dewatering of sludge from small water-treatment plants urban and industrial.

This compact technique of a big simplicity of operation associates the functions of a gravity belt thickener and one belt filter press :

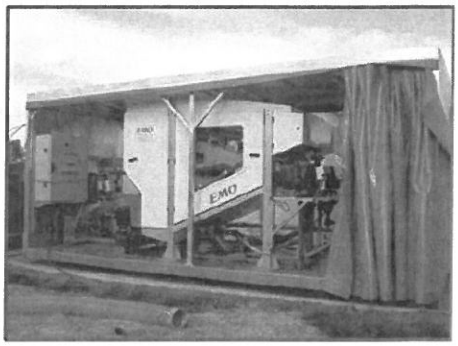
Construction in stainless steel AISI 304L
Easy maintenance and supervision
Economic – Very low cost of operation
Complelety closed - Detention of smells and noise pollutions

Installations

OMEGA CC with liming



OMEGA CC 120



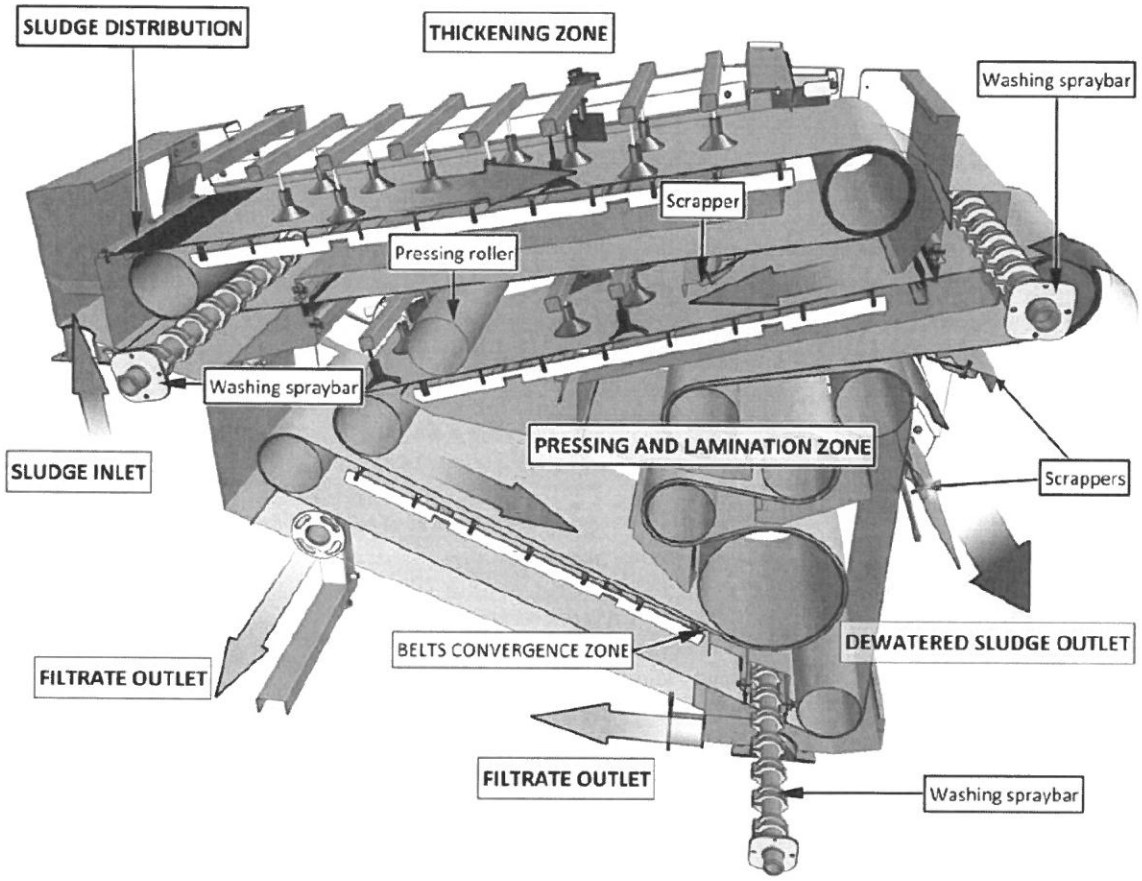
OMEGA CC Mobile Unit

EMO
ENVIRONMENT BY TECHNOLOGY

afaq ISO 9001 Qualité AFNOR CERTIFICATION

Operating principle

Floculated sludge enters on the upper part of the equipment by means of a sludge inlet flange. The sludge divides up on the filtering belt in a uniform way. The water contained in the sludge flows through the filtering belt and is then channelled in a tank. Plows arranged on the thickening zone create grooves in the sludge to ease the draining of the water.
The thickened sludge is then poured on a filtering belt of the pressing zone having a finer meshing to allow the pressing.
The second filtering belt of pressing comes to imprison gradually the sludge to evacuate residual water. After passage between rollers of various diameters to increase the pressing, the sludge is removed from the filtering belt and discharged in the disposal system (thickened sludge pump, screw conveyor ...).

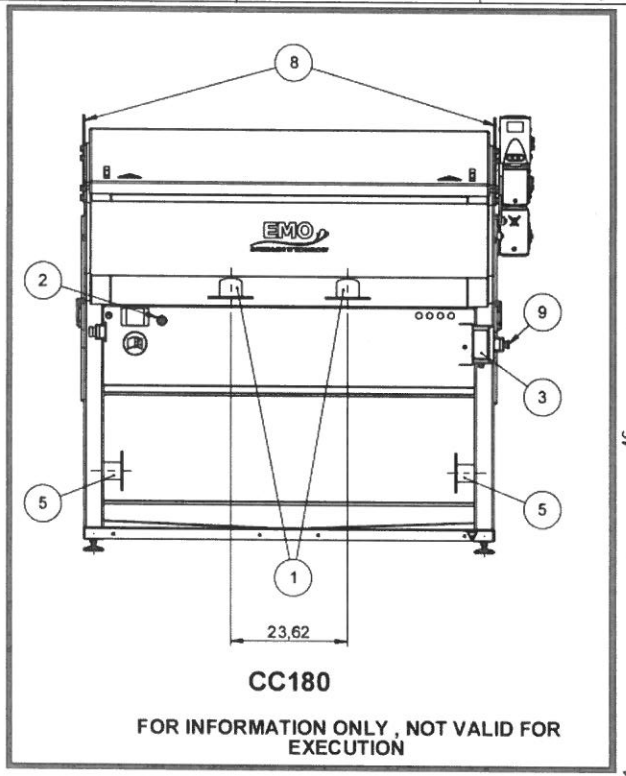


Selection tables

Note that this combined unit is selected according to the DS loading rate per hour and per belt meter width. The rate varies from one type of sludge to the other.

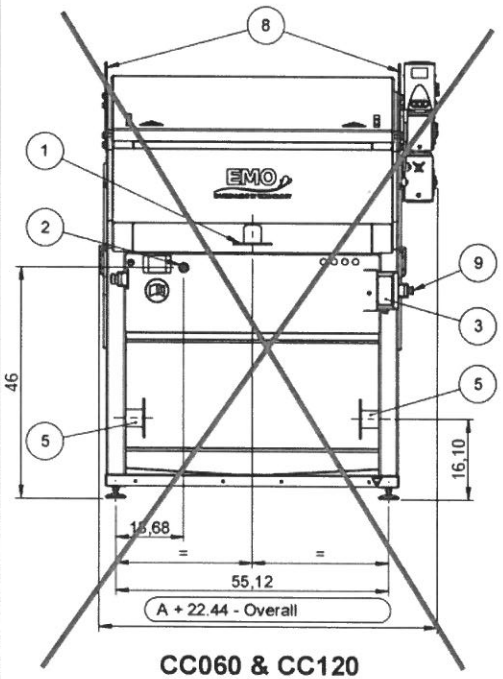
Modèle	Belt width (m)	Dimensions (lxwxh)	Sludge flowrate (m^3/h)
OMEGA CC 060	0,60	2.80 x 1,17 x 2.24	6
OMEGA CC 120	1,20	2.80 x 1.77 x 2.24	12
OMEGA CC 180	1.80	2.80 x 2.37 x 2.24	18

EMO sas - 4, rue Lépine - P.A. de la Richardière - BP 53209 - 35532 Noyal-sur-Vilaine - France
Tél. : +33 (0)2 99 86 02 03 - Fax : +33 (0)2 99 86 02 04 - E-Mail : emo@emo-france.com - www.emo-france.com
S.A.S. au capital de 480 000 € - RCS Rennes B 391 805 652 - Siret 391 805 652 00032 - APE 2829B

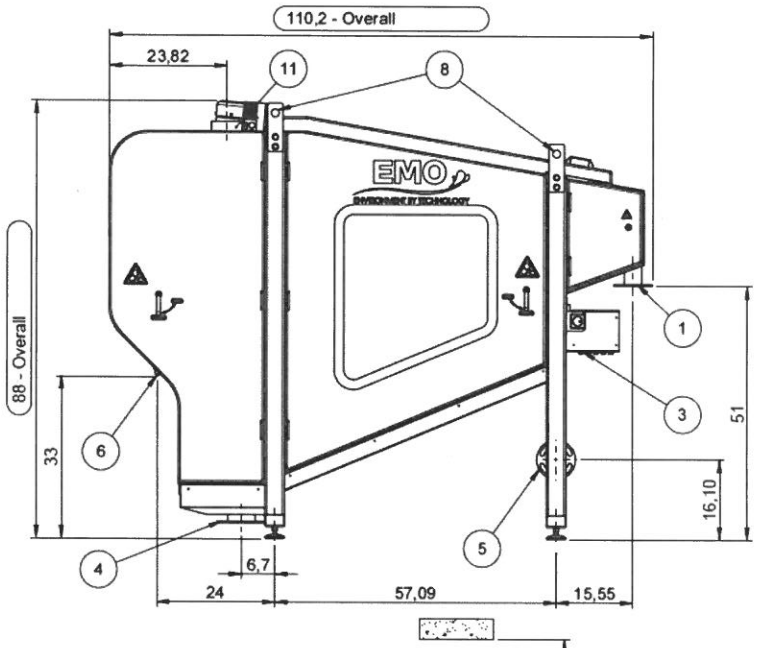


CC180

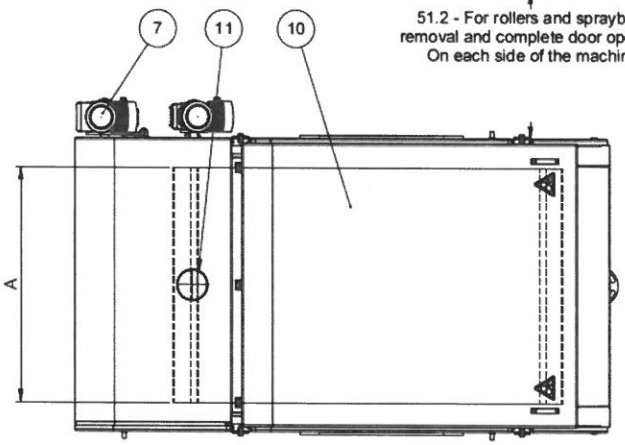
FOR INFORMATION ONLY , NOT VALID FOR EXECUTION



CC060 & CC120



51.2 - For rollers and spraybars removal and complete door opening On each side of the machine



NOTA :
- Unit of measure : INCH.
- Weight unit : Kg
- Flanges are compatible with the DIN standard et ANSI B16.1 standard.

Machine type	Belt's width A (In)	Ø Y / Pipe Ø Y	Flange ND Z (In)	ØX / Pipe ØX	Weight Lbs	Washwater flow
Ω CC060	23,62	Flange 5" - 150 lbs	3"	Ø3.54	2,430	1585 gal US/h
Ω CC120	47.24	Flange 5" - 150 lbs	3"	Ø6.3	3600	2905.9 gal US/h
Ω CC180	70.86	Flange 6" - 150 lbs	6"	Ø7.87	4200	4490.9 gal US/h

Rep			Designation	Obs
11			Odor exhaust	ØX
10			Cover	
9			Emergency stop	
8			Lifting eyes	
7			Belt 's drive motor	
6			Sludge outlet	
5			Filtrates outlet	Flange 3" - 150 lbs
4			Filtrates outlet	Ø Y
3			Electrical supply	
2			Washwater supply	Internal thread 1"1/4
1			Sludge supply	Flange Z - 150 lbs

B	03/11/2015	APPR	BESNARD L.	
	Date			Designation

Aqualitec

Omega CC

Combined unit Omega CC

EMOPRD00375-CM01

Material : 304L Stainless Steel | Finition : | Scale: 1:25 | Format : A3H

STREAMGO
WATER SOLUTIONS INC

17-400 Jones Road
Stoney Creek, ON L8E 5P4
289-277-3600
www.streamgo.ca

Belt Press Calculations

1.0 DESIGN DATA

Type of effluent	:	domestic wastewater		
Type of sludge	:	aerobic digested sludge		
Feed Dry Solids concentration	:	8 g/l (minimum)		
Dry Solids quantity/day	:	700 kg DS/d		1543 Ib. DS/d
Sludge flowrate/day	:	109 m3/d/ max		28,897 GPD
Operating time/day	:	8 hours/day		
Number of units required	:	1 unit(s) duty		
	:	1 unit(s) standby		
Total Dry Solids Per Hour	:	88 kg DS/h		193 Ib. DS/d
Total volume of sludge/hour	:	14 m3/h	60 Gal./min	3,612 Gal./hour
Output DS conc. required	:	20% from Belt Filter Press		
Organic matter content	:	NS%		
Solids capture rate required	:	NS%		

NS = Not Specified

2.0 TECHNICAL

Number of units	:	1(duty)+ 1 standby	
Belt width	:	1.8m	
Dry Solids quantity / unit	:	88kg DS/h/machine	193lb. DS/h/machine
Sludge volume	:	13.7 m3/h/machine	3,612 Gal./hour/machine
Output Dry Solids %	:	17± 2% (to be confirmed by Lab tests)	
	Or	80% of the Limit Dryness under 4 bars	
Polymer consumption	:	6± 2 kg active matters/ Ton Dry Solids (lab tests are required)	
Water consumption	:	16.2 m3/h/combined system at 7 bars pressure	
Compressed air consumption	:	7 m3/h at 7 bars pressure	

3.0 DEWATERING UNIT

Equipment

Type	:	Belt Filter Press	
Belt width	:	1.8 m	
Dimensions (L x W x H)	:	2,800 x 2,370 x 2,240	
Weight	:	1,900 kg	4,189 lb.
Acceptable sludge flowrate	:	up to 18 m3/h.	79 gpm
Thickening active area	:	5.1 m2	54.9 feet2
Pressing active area	:	3.6 m2	38.8 feet2
Washwater flowrate	:	16.2 m3/h at 7 bar	71 gpm @ 7 bar
Belt speed range			
thickening zone	:	1.25-5.8 m/min	4.1 - 19 feet/min.
pressing zone	:	0.57-2.7 m/min	1.9 - 8.8 feet/min.
Belt tracking system	:	mechanic	
Belt tensioning system	:	mechanic	
Drainage system	:	10 rows of plows or adjustable blades	
Sludge inlet flanges	:	2 x ND 100	ND 4"
Installed Power	:	1.30 kW	1.8 HP
Electrical supply	:	460 V - 3 phases - 60 Hz	

Material

Belt	:	Polyester 360 microns
Frame & structural elements	:	stainless steel AISI 304L
Belt guide and support	:	stainless steel AISI 304L
Roller (tube / shaft / flange)	:	carbon steel E24 +Sandblasting +metallization (85% zinc + 15% aluminium)
Scraper blade holder	:	stainless steel AISI 304L

Rollers

	Qty	Diam	Coating
Belt drive thickening zone	1	200 mm	NEOPREN rubber 8 mm - 60 shores
Belt drive pressing zone	1	200 mm	NEOPREN rubber 8 mm - 60 shores
Belt tensioning	2	200 mm	ABCITE
Pre-Pressing	1	170 mm	stainless steel AISI 304L
Drainage	1	410 mm	stainless steel AISI 304L
Pressing	3	200 mm	ABCITE
Return roller	3	200 mm	ABCITE
Total number	12		

Driving system

Type	:	hollow shaft gearmotor
Make	:	NORD Gear or similar
Speed variation	:	integrated frequency converter
Power thickening zone	:	0.55 kW
Power pressing zone	:	0.75 kW
Electric supply	:	460 V - 3 phases - 60 Hz
Protection - Class – Isolation	:	IP55 - B - F

Note: Rollers and frame welding according to norm NF EN ISO 5817.D

4.0 WASHWATER PUMP

Equipment

Purpose	continuous cleaning of filtration belt
Type	vertical multicellular
Make	GRUNDFOS (or equivalent)
Model	CR 15-4
Flowrate	16.5 m3/h
Design pressure	73 mWc
Inlet / Outlet flange	RP 2"
Installed motor power	5.5 kW
Motor speed	2,900 rpm Norm IE2
Protection	IP55 - class F

Materials

Motor casing	cast iron GG 20 (AS TM 25B)
Pump body	stainless steel AISI 304
Impeller	stainless steel AISI 304
Diffuser	stainless steel AISI 304
Packing material	SIC / C / EPDM
Other	plastic / rubber parts

Accessories not included

pressure gauge (on BFP pipeline)
sampling valve
water discharge valve

5.0 SCREW CONVEYOR

Equipment

Purpose	:	conveying of dewatered sludge
Type	:	shaftless screw conveyor
Mounting position	:	inclined
Capacity horizontal	:	up to 5 m3/h Max 22 gpm
Capacity with inclination	:	up to 1.5 m3/h Max 7 gpm

Dimensions

Conveying length	:	9,000 mm 29.5 feet
Spiral diameter	:	240 mm 9.4 in
Spiral pitch	:	240 mm 9.4 in
Discharge height	up to :	approx. 2,700 mm 8.9 ft

Materials

Spiral	:	painted carbon steel
Trough and accessories	:	stainless steel AISI 304L
Covers	:	stainless steel AISI 304L
Liner	:	HDPE
Belt clearing roller	:	rubber coated

Drive unit

Motor position	:	pushing
Installed motor power	:	1.5 kW 2.1HP
Output speed	:	53 rpm

Speed variation	:	no
Voltage supply	:	460 V - 3 phases - 60 Hz
Electrical protection / class	:	IP55 class F

6.0 SCREW CONVEYOR

Equipment

Purpose	:	conveying of dewatered sludge
Type	:	shaftless screw conveyor
Mounting position	:	horizontal
Capacity horizontal	:	up to 5 m3/h Max 22 gpm
Capacity with inclination	:	up to 1.5 m3/h Max 7 gpm

Dimensions

Conveying length	:	3,000 mm 9.8 feet
Spiral diameter	:	240 mm 9.4 in
Spiral pitch	:	240 mm 9.4 in
Discharge height up to	:	1,850 mm approx. 6.1 ft

Materials

Spiral	:	painted carbon steel
Trough and accessories	:	stainless steel AISI 304L
Covers	:	stainless steel AISI 304L
Liner	:	HDPE
Belt clearing roller	:	rubber coated

Drive unit

Motor position	:	pushing
Installed motor power	:	0.75 kW 1.1 HP
Output speed	:	53 rpm
Speed variation	:	no
Voltage supply	:	460 V - 3 phases - 60 Hz
Electrical protection/ insulation class:		IP55 class F

7.0 ELECTRICAL CONTROL PANEL

Control Panel
Type : wall mounted or floor standing
Enclosure material: painted steel or polyester

Equipment controlled		Qty	
GBT belt drive	:	1	
BFP belt drive	:	1	
Belt override limit switches on BFP:		2	
Air pressure switch	:	1	
Washwater pressure switch	:	1	
Emergency push button	:	2	
Flocculation tank mixer	:	1	
Washwater pump	:	1	
Horizontal sludge conveyor	:	1	
Inclined sludge conveyor	:	1	
Sludge level sensor in pumping sump	:	1	(if any)
Sludge level switch at inlet of GBT	:	1	to prevent from overflowing

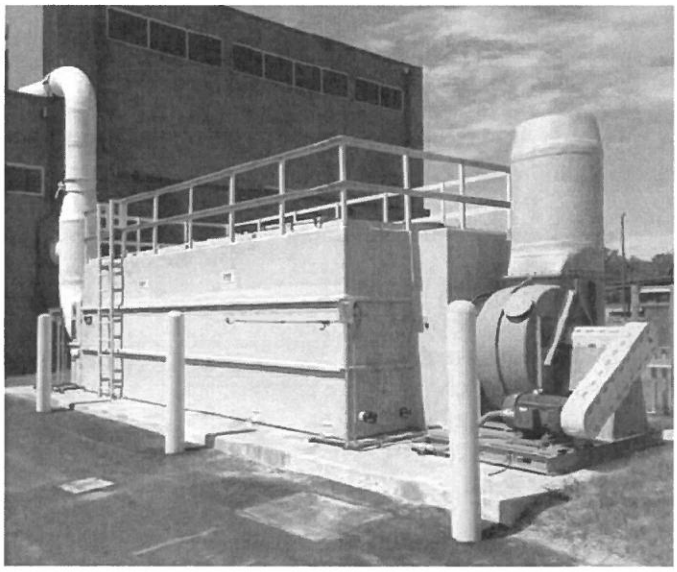
V-Bank Transition System (VTS)

PureAIR FILTRATION

Highest airflow system to remove 99.5% of unwanted gases from the air

SPECIFICATIONS:

Applications	Protecting electronics, Wastewater odor control, & Environmental emission control.
Airflow Range	5,946.5 CMH (3,500 CFM) – 71,358.4 CMH (42,000 CFM) **Please review the model selection sheet for more information.*
Configuration	Horizontal airflow
Construction Material	**Standard:** Fiberglass reinforced plastic (FRP) **Other options:** Stainless Steel, Aluminum
Particulate Filtration	**Odor Control Applications:** Mist & Grease Filter **Other Applications:** 5 cm (2 in), 30% MERV 8 Prefilter, 15 cm (6 in), 95% MERV 13 Final Filter **Other filter sizes/options available upon request. Please contact the factory for more information.*
Blower Configuration	**DRAWTHRU:** Standard and allows the blower to work in clean air, thus making it last longer and require lower maintenance **BLOWTHRU:** An option for customers who want less noise from the blower **Redundant blowers & other special options available.*
Customizable	PureAir offers Full "V" or Half "V". A full "V" is two beds and half "V" is one bed. Each bed can have multiple banks of media. Reference model selection chart on the back for details on the Full "V" and consult the catalog for information regarding the Half "V". Add-on accessories like sound enclosures are available. Contact factory for more information. **Don't see what you are looking for? PureAir specializes in customization. Contact us with your air filtration needs and we will work with you to find the best solution for your needs.*



BENEFITS:

- Low Maintenance: Bulk loading and unloading options
- Horizontal footprint for spaces with limited height, but high airflow.
- Lower carbon media change-out costs, more flexibility in future adsorbent media selection with multiple media beds, and less electrical consumption than traditional carbon towers.
- Multiple beds available for adsorbent media. For more information on the adsorbent media, please see the media brochure.

Media Bed Rod:
This unit is equipped with a metal Media Bed rod to detect the remaining life of the media. See back for more details.

Case Study
RL Sutton

SCAN ME

+1 678.935.1431 | Toll Free: 866.543.7479
www.PureAirFiltration.com | 6050 Peachtree Pkwy Suite 240-187. Atlanta, GA, USA 30092

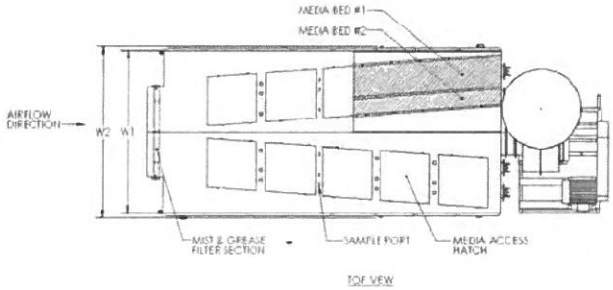
MODEL SELECTION TABLE

MODEL NUMBER VTS-	INDUSTRIAL AIR FLOW RANGE IN CMH (CFM)	MUNICIPAL AIR FLOW RANGE CMH (CFM)	MOTOR SIZE kW (HP)	MEDIA VOLUME M^3 (FT^3)	SHIPPING WEIGHT KG (LBS)	OPERATING WEIGHT KG (LBS)
7102	11,890-23,780 (7,000-14,000)	11,890-17,840 (7,000-10,500)	29.8 (40)	13.6 (480)	2,700 (5,950)	9,500 (20,950)
7152	17,840-35,680 (10,500-21,000)	17,840-26,760 (10,500-15,750)	37.2 (50)	20.4 (720)	3,740 (8,240)	13,940 (30,740)
7202	23,790-47,570 (14,000-28,000)	23,790-35,680 (14,000-21,000)	44.7 (60)	27.2 (960)	5,030 (11,100)	18,640 (41,100)
7252	29,310-59,470 (17,250-35,0000)	29,310-44,600 (17,250-26,250)	55.9 (75)	34.0 (1,200)	6,740 (14,860)	23,750 (52,360)
7302	35,680-71,360 (21,000-42,000)	35,680-53,520 (21,000-31,500)	74.6 (100)	40.8 (1,440)	7,960 (17,540)	28,370 (62,540)

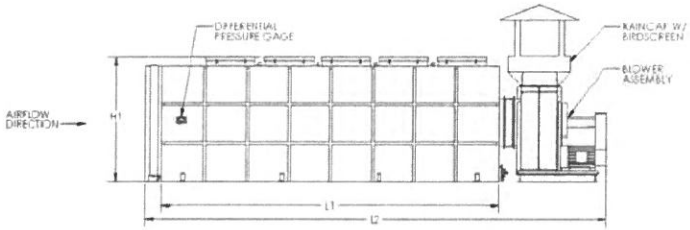
MEDIA BED ROD:

This unit is equipped with a metal Media Bed Rod. The rod is positioned inside the system at an angle against the direction of airflow and detects the expiration level of the media.

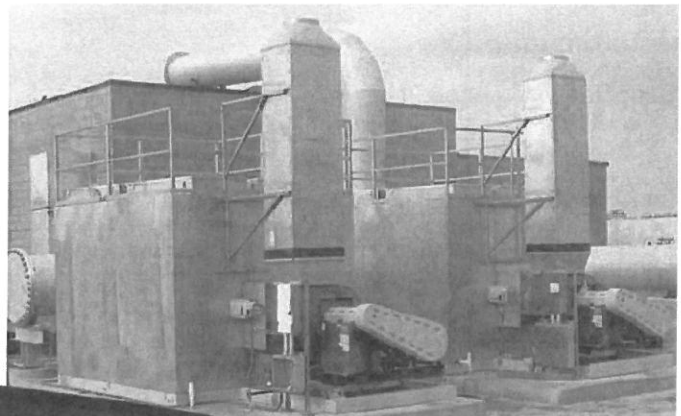
- Dark, corroded coloration on rod shows where media has expired. Once half the rod has been corroded, one should contact the factory to replace the media to ensure the proper functioning of the system.
- Interested in instant notification of media life? Ask about our Electronic Media Bed Rod that can that be added to your system as an upgrade.

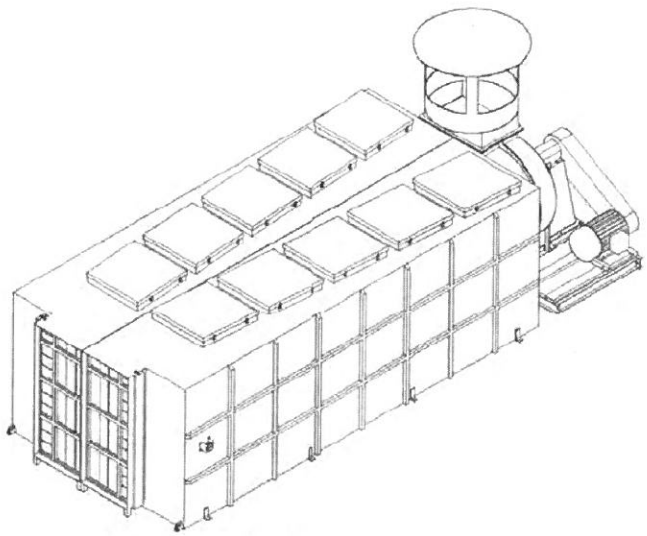


TOP VIEW



ELEVATION VIEW





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Toll Free: 866.543.7479
www.PureAirFiltration.com
6050 Peachtree Pkwy Suite 240-187. Atlanta, GA, USA 30092

Sulphasorb™ Adsorbent Media

PureAIR FILTRATION

Basic Information:

- PureAir Sulphasorb™ targets gases that are predominant in pulp and paper and refinery markets, especially hydrogen sulfide.
- PureAir starts with the highest grade activated carbon ensuring that the greatest possible adsorption capacity is reached. The carbon is then impregnated with an acid gas neutralizing compound and a proprietary reagent that improves its neutralizing efficiency.
- This product is designed to perform exceptionally well in all scrubbers, including Westvaco vapor absorbers and Purafil tub scrubbers.

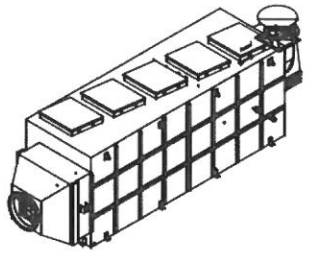
General Description	Product Specifications	Removal Capability
Porous, cylindrical pellets of high grade bituminous activated carbon.	• Particle Size: 4mm diameter cylinder • Density: 576 kg/m^3 (36 lbs/ft^3) • Surface Area: 1100 m^2/g • Typical Moisture Content %: 15% • Crush Test: 97 lbs • Abrasion Loss %: 3% maximum • Relative Pressure Drop: See Curve C • Ignition Temperature: 425° C • CTC Value: 70% • Iodine #: 1100 mg/g • Ash Content: 5% maximum • Butane Activity: 27% minimum	• Hydrogen Sulfide: 0.15 g/cc or 26 % by weight • Sulfur Dioxide: 7% by weight • Dichloride: 14% by weight

REACH COMPLIANCE

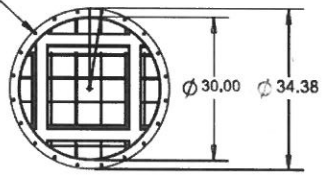
+1 678.935.1431
Toll Free: 866.543.7479
www.PureAirFiltration.com
6050 Peachtree Pkwy Suite 240-187. Atlanta, GA 30092 U.S.A.

NOTES:
- MATERIAL: FRP
- RATED FLOW: 7000 & 8000 CFM
- INLET FLANGES PER PS15-69
- COLOR: RAL 7004
- SYSTEM COMES WITH PRESSURE GAGES PRE INSTALLED.

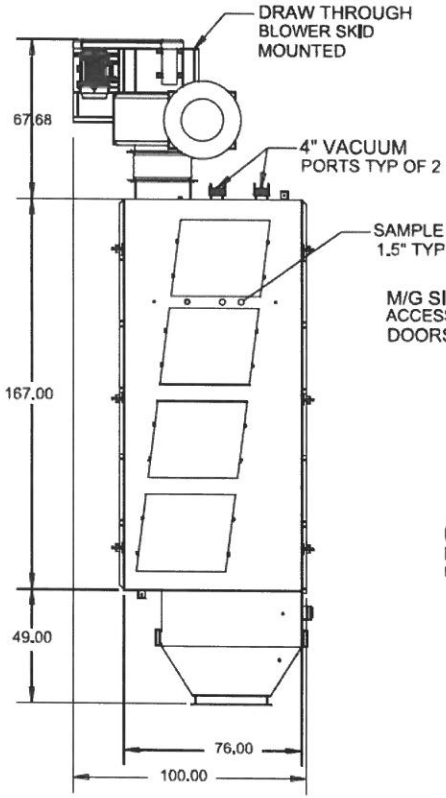
- ALL HARDWARE STAINLESS STEEL



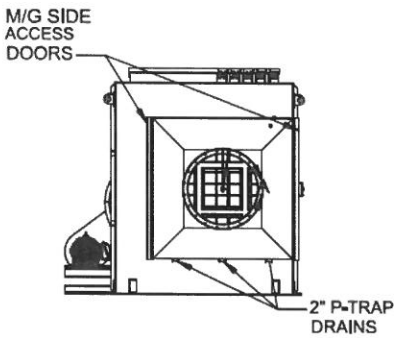
ISOMETRIC VIEW



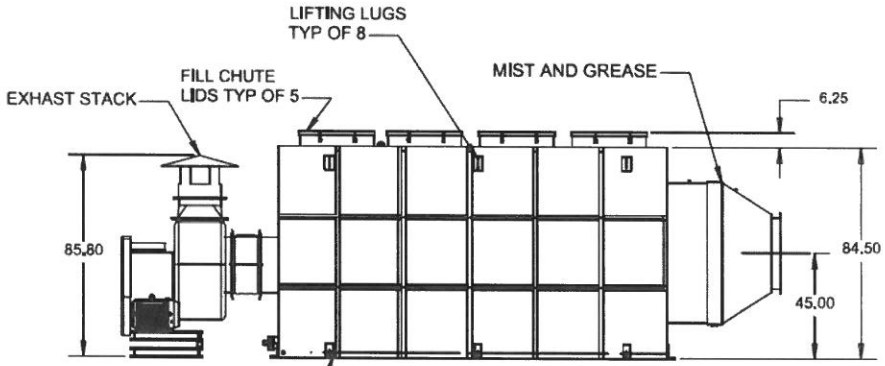
DETAIL A
SCALE 1 : 25



PLAN VIEW



FRONT VIEW



SIDE VIEW

UNLESS OTHERWISE SPECIFIED:		NAME	DATE
DIMENSIONS ARE IN INCHES TOLERANCES: FRACTIONAL ± ANGULAR: MACH ± BEND ± TWO PLACE DECIMAL ± THREE PLACE DECIMAL ±	DRAWN	JPB	2/13/2022
	CHECKED		
	ENG APPR.		
	MFG APPR.		
	Q.A.		
	COMMENTS:		

PROPRIETARY AND CONFIDENTIAL

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INTERPRET GEOMETRIC TOLERANCING PER:

MATERIAL

FINISH

DO NOT SCALE DRAWING

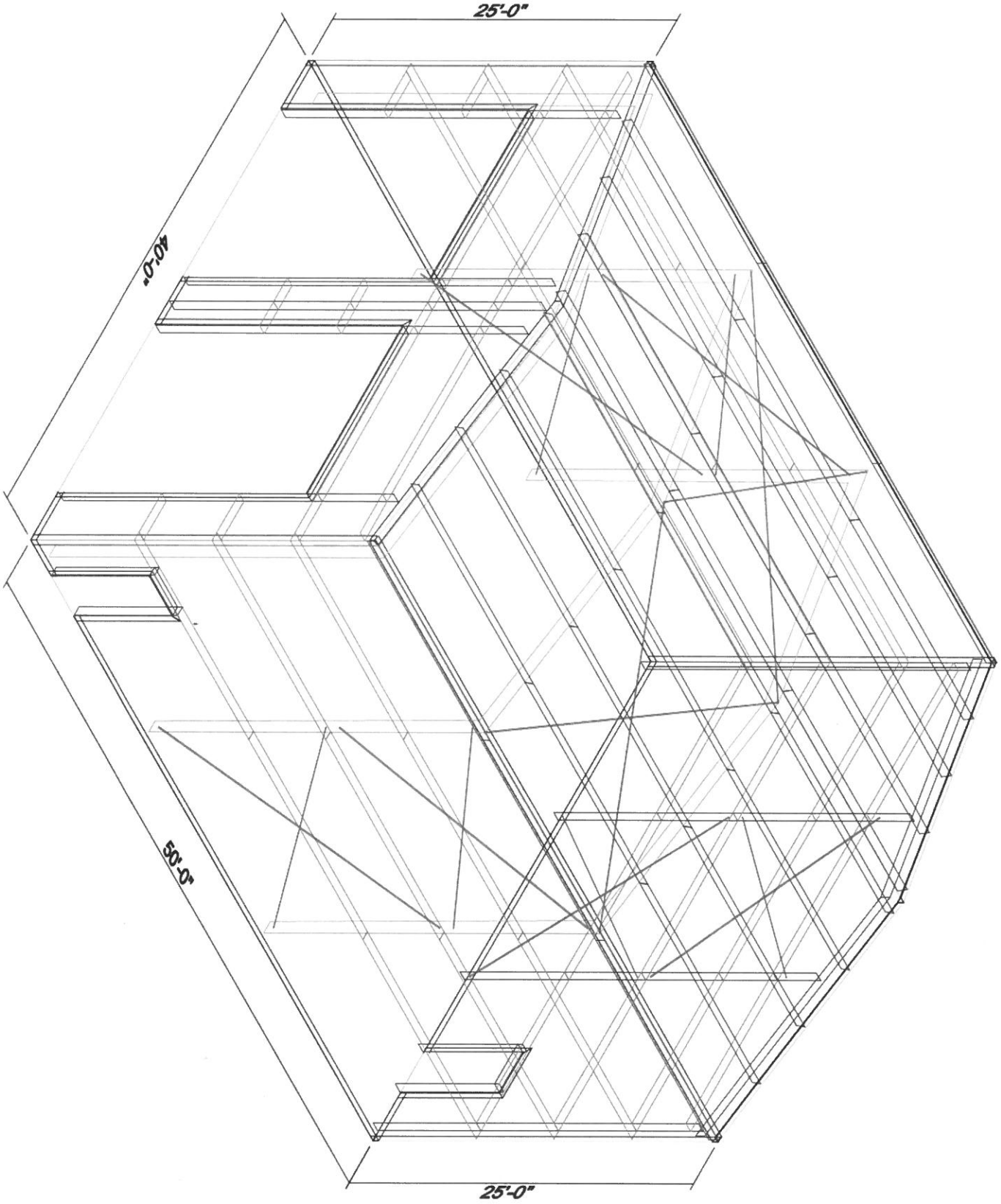
PureAir Filtration

TITLE:

HYDE PARK, NY
8000 CFM UNITS

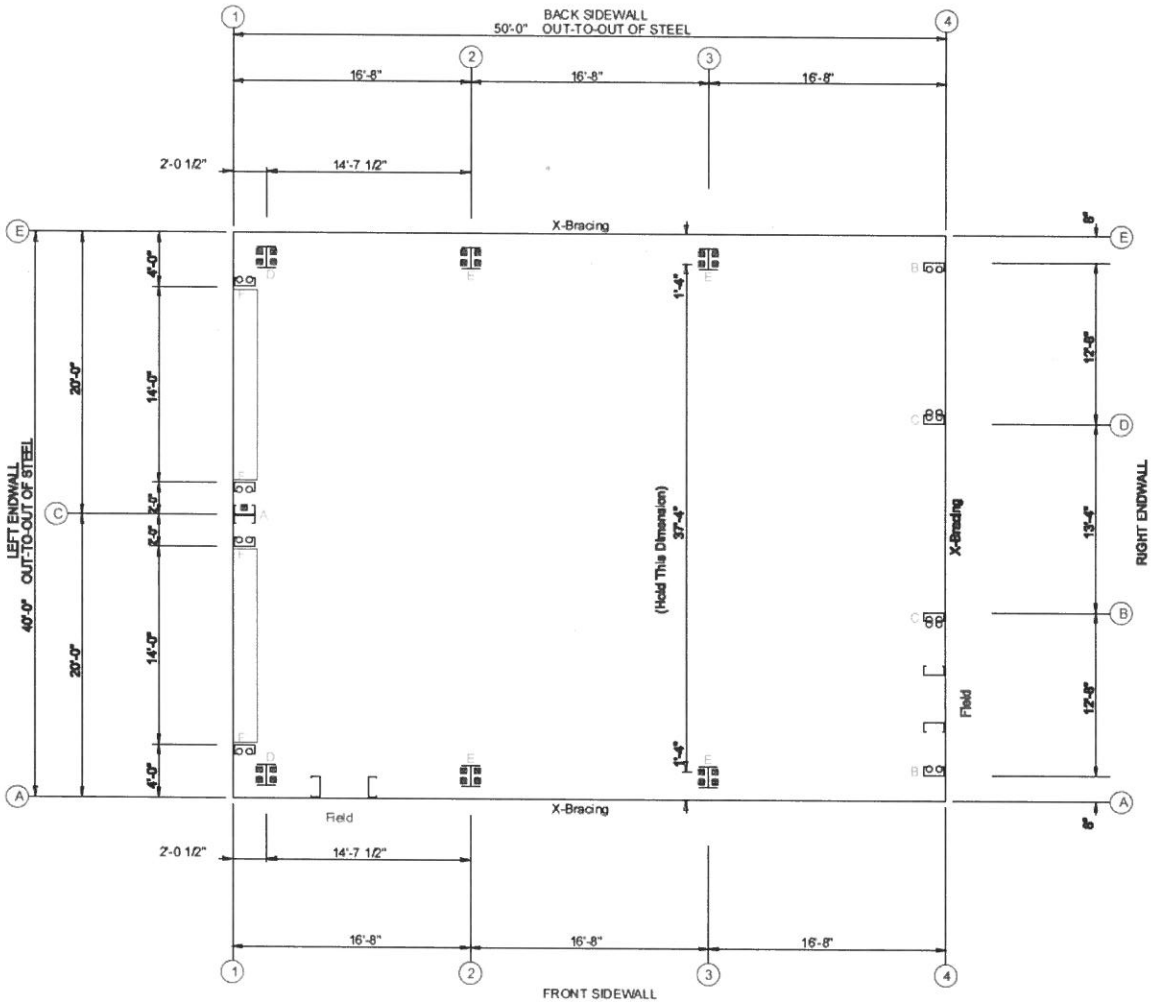
SIZE	DWG. NO.	REV
B	VTS-07151	0

SCALE: 1:96 | WEIGHT: | SHEET 1 OF 1


25'-0"
40'-0"
50'-0"
25'-0"

o Dia= 1/2"

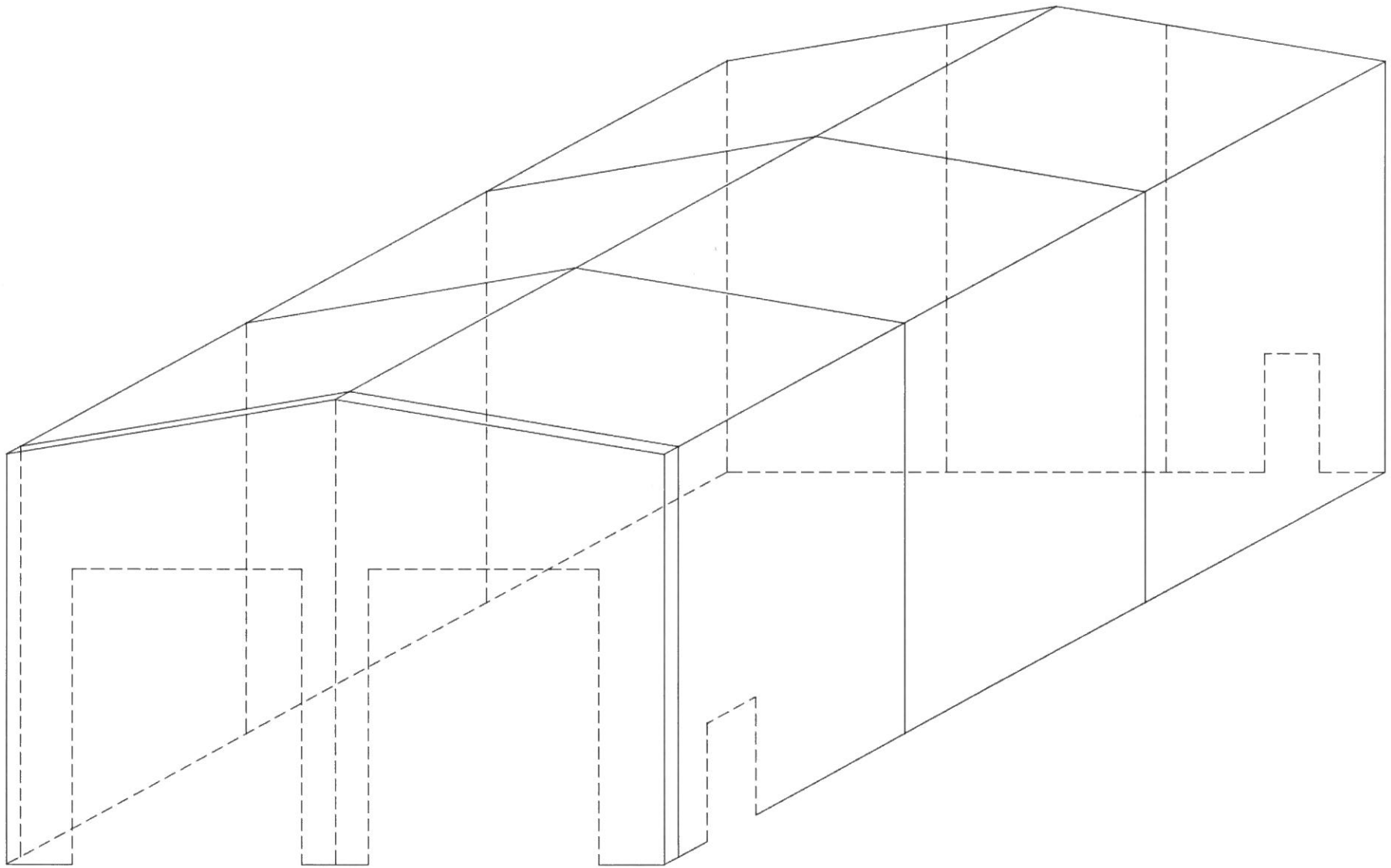
⊠ Dia= 3/4"



ANCHOR BOLT PLAN

NOTE: All Base Plates @ 100'-0" (U.N.)

Nonsteel Buildings		Customer: CUSTOMER INFO	
DLR ADDRESS 2		CUSTOMER ADDRESS 2	
Drafter: XX	Date: 2/ 8/22	Designer: RA	Date: 2/ 8/22
Detailer: XX	Date: 2/ 8/22	Sales ID:	Factory ID:
Checker: XX	Date: 2/ 8/22		
ANCHOR BOLT PLAN			Sht E of

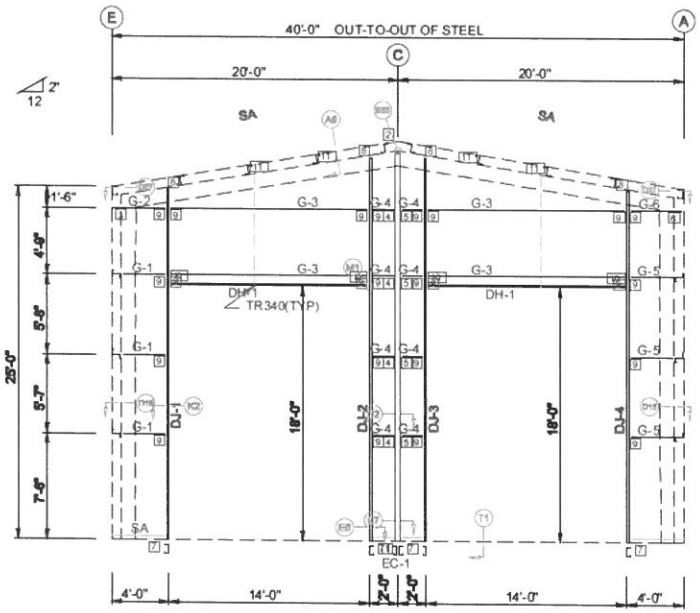


Asad	Building Layout	2/ 6/22

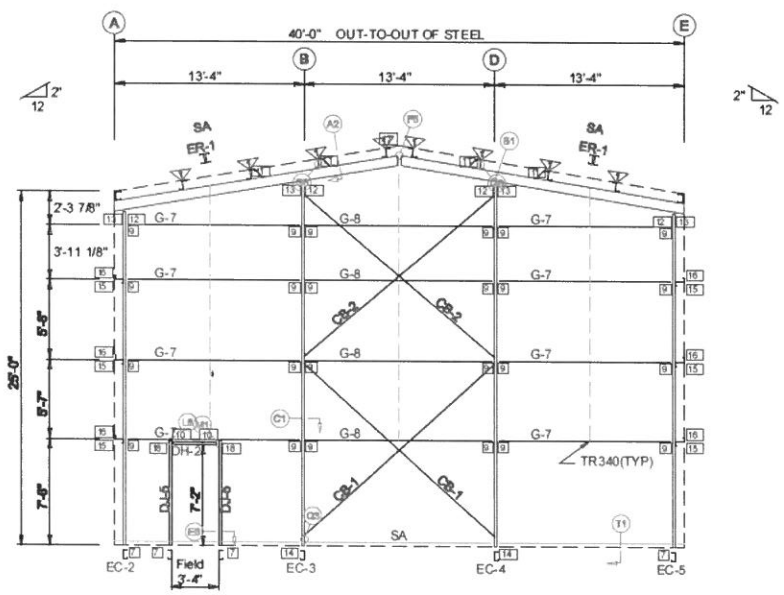
BOLT TABLE FRAME LINE 1 & 4				
LOCATION	QUAN	TYPE	DIA	LENGTH
ER-1/ER-1	4	A325T	1/2"	2"
Columns/Raf	2	A325T	1/2"	2"
Columns/Raf	8	A325T	1/2"	2"
Jamb	8	A325T	1/2"	2"

FLANGE BRACE TABLE FRAME LINE 1 & 4		
▽ID	MARK	LENGTH
1	FB28.8	2'-4 3/4"

CONNECTION PLATES FRAME LINE 1 & 4	
☐ID	MARK/PART
1	f1
2	n1
3	d2
4	b1
5	b2
6	d3
7	CLC008
8	n2
9	CLC062
10	CLC025
11	CL156
12	CLC081
13	CLC083
14	f3
15	CLC054
16	CL050
17	CLC122
18	j1



ENDWALL FRAMING: FRAME LINE 1



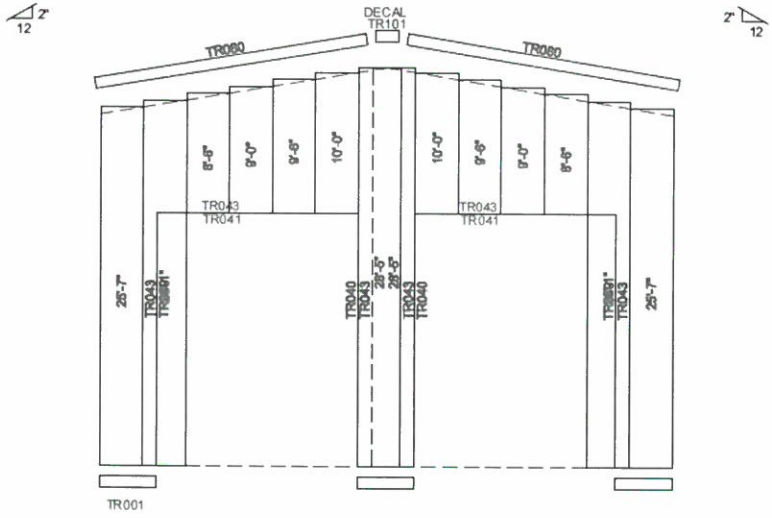
ENDWALL FRAMING: FRAME LINE 4

CABLE NOTES:
FIELD SLOT GIRTS FOR CABLE TO PASS-THRU.

GENERAL NOTES:
MINOR FIELD WORK OF STRUCTURAL, SECONDARY AND PANEL/TRIM ITEMS MAY BE NECESSARY TO ENSURE PROPER FIT. SUCH WORK IS CONSIDERED A NORMAL PART OF METAL BUILDING ERECTION. WE WILL NOT HONOR BACKCHARGES FOR MINOR FIELD WORK.

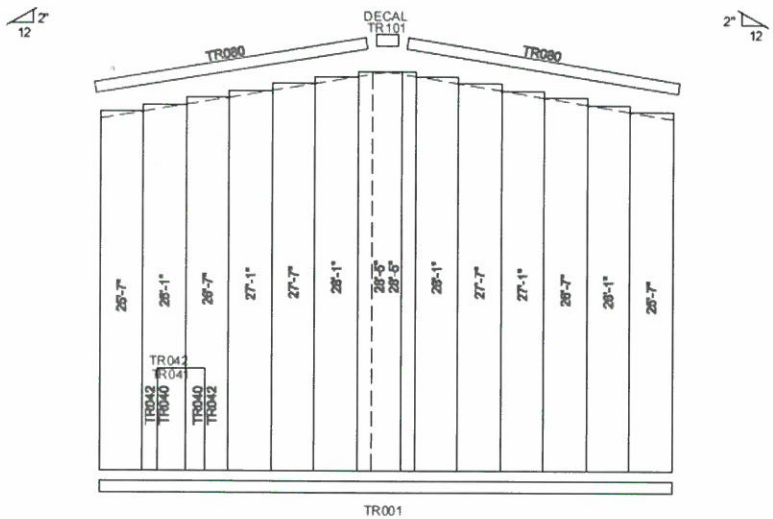
Nortest Buildings		Customer: CUSTOMER INFO	
DLR ADDRESS 2		CUSTOMER ADDRESS 2	
Drafter: XX	Date: 2/ 6/22	Designer: RA	Date: 2/ 6/22
Detailer: XX	Date: 2/ 6/22	Sales ID:	Factory ID:
Checker: XX	Date: 2/ 6/22		
ENDWALL FRAMING			Sht E of

TRIM TABLE	
TYPE	COLOR
Base	NEED COLOR
Gable	NEED COLOR
Opening	NEED COLOR



ENDWALL SHEETING & TRIM: FRAME LINE 1

PANELS: 26 Ga. PBR - NEED COLOR



ENDWALL SHEETING & TRIM: FRAME LINE 4

PANELS: 26 Ga. PBR - NEED COLOR

GENERAL NOTES:

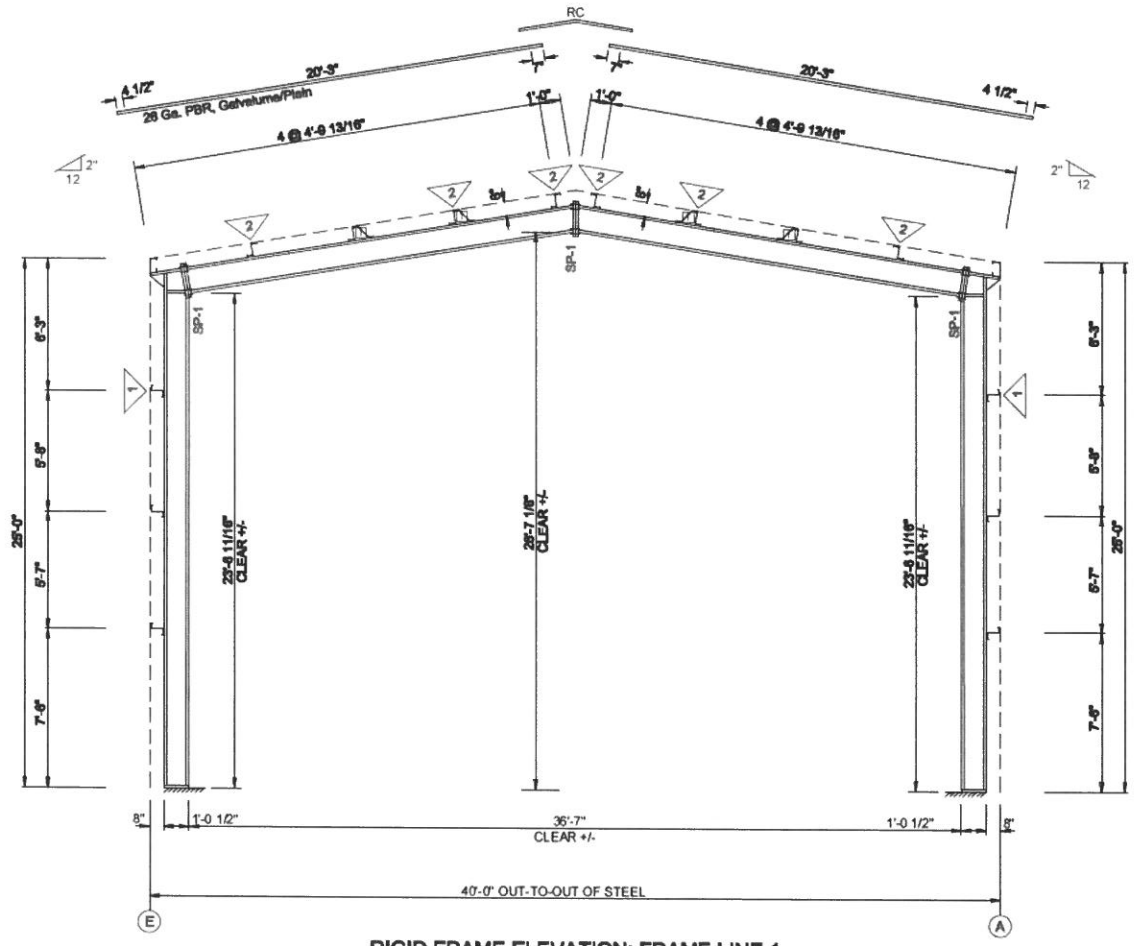
MINOR FIELD WORK OF STRUCTURAL, SECONDARY AND PANEL/TRIM ITEMS MAY BE NECESSARY TO ENSURE PROPER FIT. SUCH WORK IS CONSIDERED A NORMAL PART OF METAL BUILDING ERECTION. WE WILL NOT HONOR BACKCHARGES FOR MINOR FIELD WORK.

Nonstad Buildings		Customer: CUSTOMER INFO	
DLR ADDRESS 2		CUSTOMER ADDRESS 2	
Drafter: XX	Date: 2/ 8/22	Designer: RA	Date: 2/ 8/22
Detailer: XX	Date: 2/ 8/22	Sales ID:	Factory ID:
Checker: XX	Date: 2/ 8/22		
ENDWALL FRAMING			Sht E of

SPLICE BOLT TABLE						
Mark	Qty Top	Bot	Int	Type	Dia	Length
SP-1	4	4	0	A325	0.625	2.25

FLANGE BRACE TABLE FRAME LINE 1			
▽ ID	# SIDES	MARK	LENGTH
1	1	FB30.8	2'-6 3/4"
2	1	FB31	2'-7"

CONNECTION PLATES	
☐ ID	Mark/Part
1	CL156



RIGID FRAME ELEVATION: FRAME LINE 1

GENERAL NOTES:

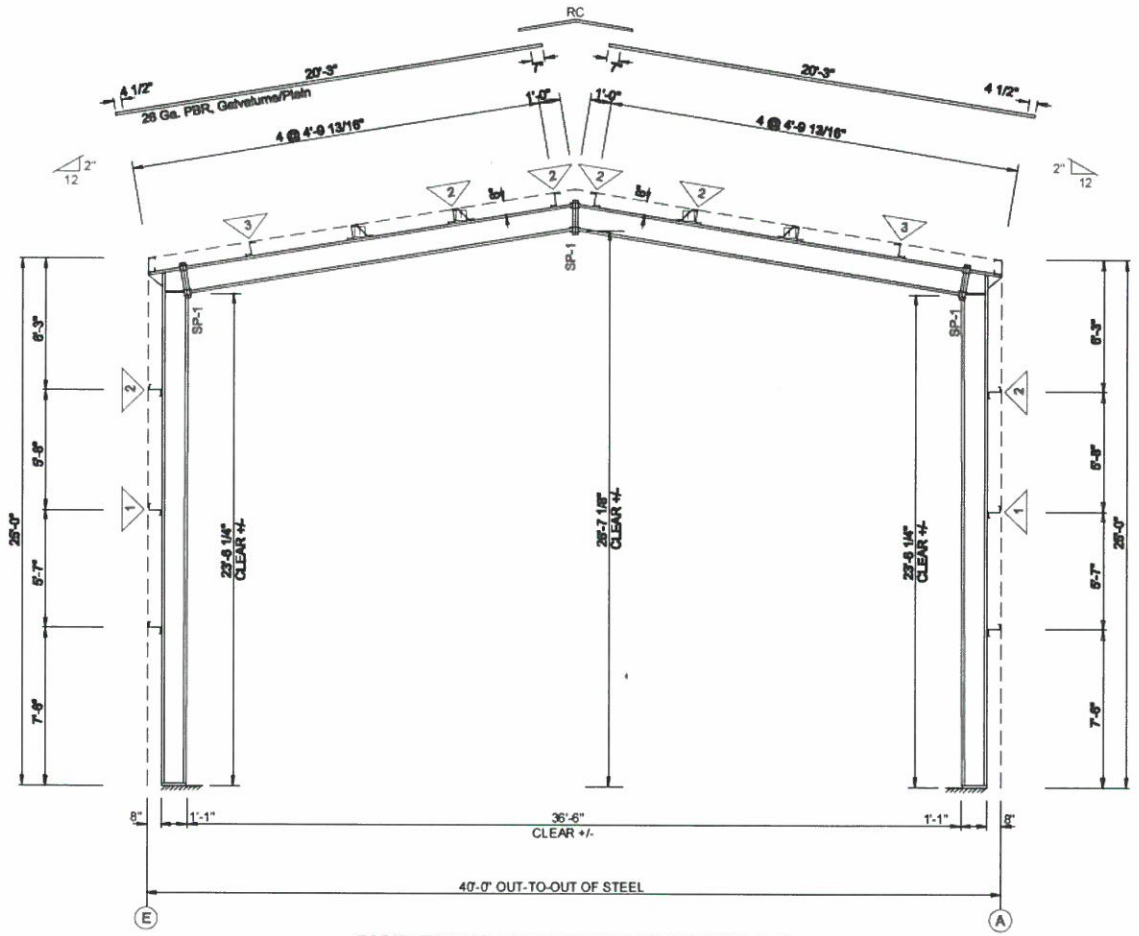
MINOR FIELD WORK OF STRUCTURAL, SECONDARY AND PANEL/TRIM ITEMS MAY BE NECESSARY TO ENSURE PROPER FIT. SUCH WORK IS CONSIDERED A NORMAL PART OF METAL BUILDING ERECTION. WE WILL NOT HONOR BACKCHARGES FOR MINOR FIELD WORK.

Nomisel Buildings		Customer: CUSTOMER INFO	
DLR ADDRESS 2		CUSTOMER ADDRESS 2	
Drafter: XX	Date: 2/ 6/22	Designer: RA	Date: 2/ 6/22
Detailer: XX	Date: 2/ 6/22	Sales ID:	Factory ID:
Checker: XX	Date: 2/ 6/22		
RIGID FRAME ELEVATION			Sht E of

SPLICE BOLT TABLE						
Mark	Qty Top	Bot	Int	Type	Dia	Length
SP-1	4	4	0	A325	0.625	2.25

FLANGE BRACE TABLE FRAME LINE 2 3			
▽ ID	# SIDES	MARK	LENGTH
1	1	FB30.8	2'-6 3/4"
2	1	FB31	2'-7"
3	1	FB31.3	2'-7 1/4"

CONNECTION PLATES	
☐ ID	Mark/Part
1	CL156



RIGID FRAME ELEVATION: FRAME LINE 2 3

GENERAL NOTES:

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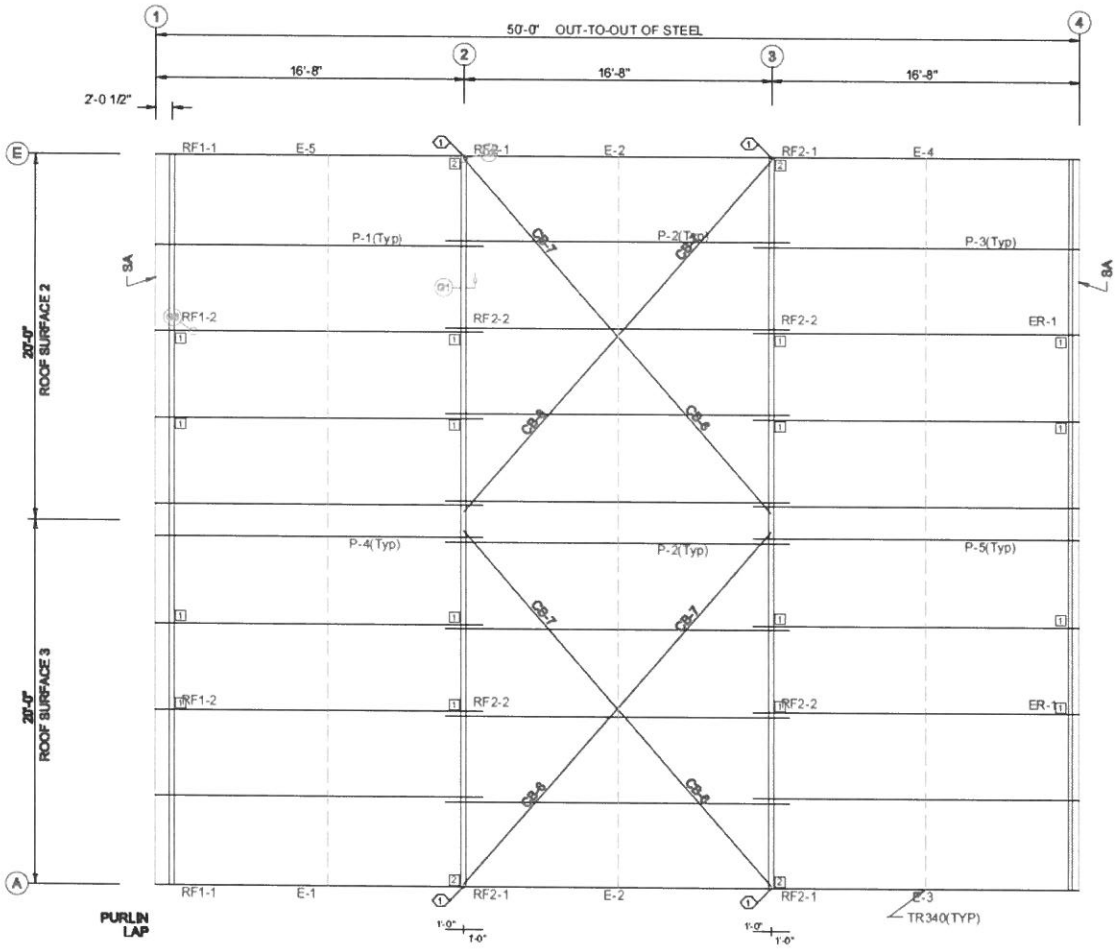
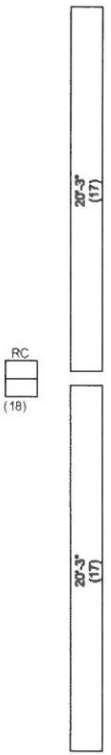
Nominal Buildings		Customer: CUSTOMER INFO	
DLR ADDRESS 2		CUSTOMER ADDRESS 2	
Drafter: XX	Date: 2/ 6/22	Designer: RA	Date: 2/ 6/22
Detailer: XX	Date: 2/ 6/22	Sales ID:	Factory ID:
Checker: XX	Date: 2/ 6/22		
RIGID FRAME ELEVATION			Sht E of

SPECIAL BOLTS ROOF PLAN					
ID	QUAN	TYPE	DIA	LENGTH	WASH
1	3	A325T	1/2"	2"	0

CONNECTION PLATES ROOF PLAN	
ID	MARK/PART
1	CL156
2	CL154



ROOF FRAMING PLAN



ROOF SHEETING

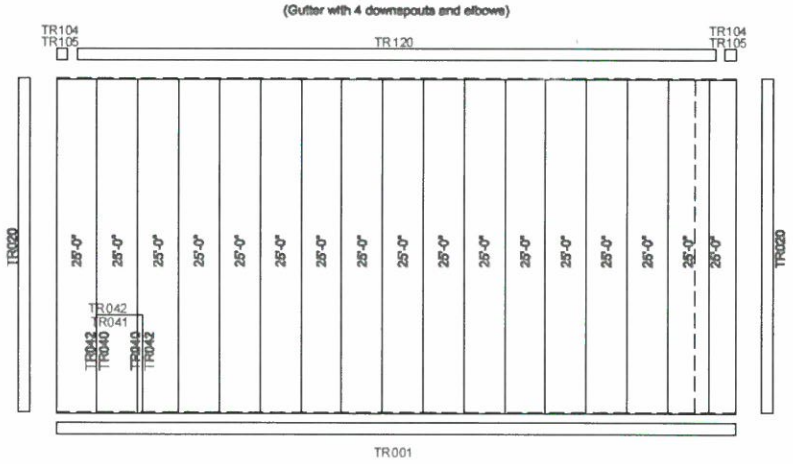
PANELS: 26 Ga. PBR
Galvalume/Plain

GENERAL NOTES:

MINOR FIELD WORK OF STRUCTURAL, SECONDARY AND PANEL/TRIM ITEMS MAY BE NECESSARY TO ENSURE PROPER FIT. SUCH WORK IS CONSIDERED A NORMAL PART OF METAL BUILDING ERECTION. WE WILL NOT HONOR BACKCHARGES FOR MINOR FIELD WORK.

Nonsteel Buildings		Customer: CUSTOMER INFO	
DLR ADDRESS 2		CUSTOMER ADDRESS 2	
Drafter: XX	Date: 2/ 8/22	Designer: RA	Date: 2/ 8/22
Detailer: XX	Date: 2/ 8/22	Sales ID:	Factory ID:
Checker: XX	Date: 2/ 8/22		
ROOF FRAMING			Sht E of

TRIM TABLE	
TYPE	COLOR
Base	NEED COLOR
Corner	NEED COLOR
Eave	NEED COLOR
Opening	NEED COLOR
Gutter	NEED COLOR
Downspout	NEED COLOR



SIDEWALL SHEETING & TRIM: FRAME LINE A

PANELS: 26 Ga. PBR - NEED COLOR

SIDEWALL SHEETING & TRIM: FRAME LINE E

PANELS: 26 Ga. PBR - NEED COLOR

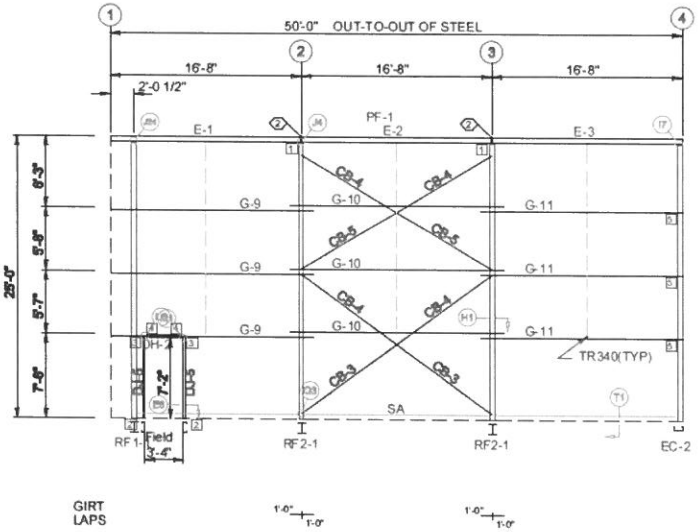
GENERAL NOTES:

MINOR FIELD WORK OF STRUCTURAL, SECONDARY AND PANEL/TRIM ITEMS MAY BE NECESSARY TO ENSURE PROPER FIT. SUCH WORK IS CONSIDERED A NORMAL PART OF METAL BUILDING ERECTION. WE WILL NOT HONOR BACKCHARGES FOR MINOR FIELD WORK.

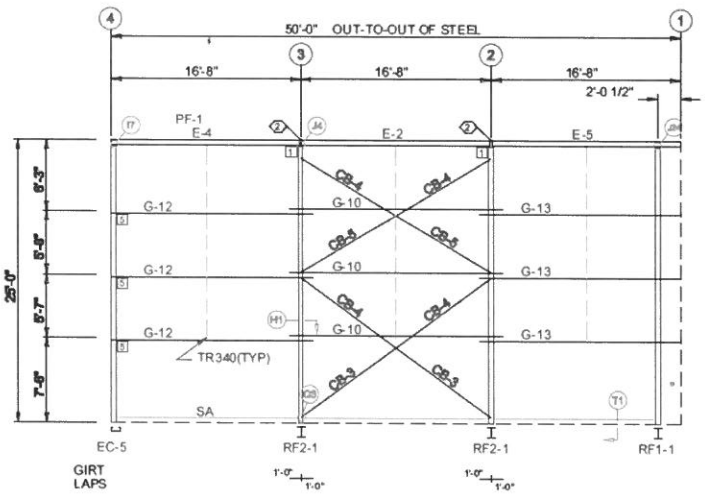
Nonsteel Buildings		Customer: CUSTOMER INFO	
DLR ADDRESS 2		CUSTOMER ADDRESS 2	
Drafter: XX	Date: 2/ 8/22	Designer: RA	Date: 2/ 8/22
Detailer: XX	Date: 2/ 8/22	Sales ID:	Factory ID:
Checker: XX	Date: 2/ 8/22		
SIDEWALL FRAMING			Sht E of

SPECIAL BOLTS					
ID	QUAN	TYPE	DIA	LENGTH	WASH
2	3	A325T	1/2"	2"	0

CONNECTION PLATES FRAME LINE A & E	
ID	MARK/PART
1	k1
2	CLC008
3	j1
4	CLC025
5	CLC054



SIDEWALL FRAMING: FRAME LINE A



SIDEWALL FRAMING: FRAME LINE E

GENERAL NOTES:

MINOR FIELD WORK OF STRUCTURAL, SECONDARY AND PANEL/TRIM ITEMS MAY BE NECESSARY TO ENSURE PROPER FIT. SUCH WORK IS CONSIDERED A NORMAL PART OF METAL BUILDING ERECTION. WE WILL NOT HONOR BACKCHARGES FOR MINOR FIELD WORK.

Norsteel Buildings		Customer: CUSTOMER INFO	
DLR ADDRESS 2		CUSTOMER ADDRESS 2	
Drafter: XX	Date: 2/ 8/22	Designer: RA	Date: 2/ 8/22
Detailer: XX	Date: 2/ 8/22	Sales ID:	Factory ID:
Checker: XX	Date: 2/ 8/22		
SIDEWALL FRAMING			Sht E of

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Appendix O:
WWTP – Generator – Manufacturer's Cut Sheets

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Model: 350REOZJ

KOHLER POWER SYSTEMS

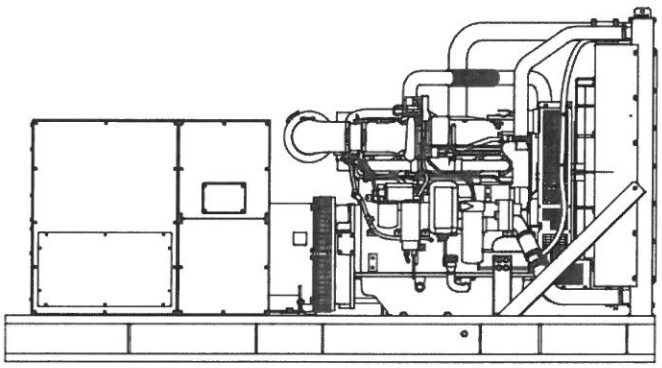
208-600 V Diesel

ISO 9001 KOHLER POWER SYSTEMS NATIONALLY REGISTERED

Tier 3 EPA-Certified for Stationary Emergency Applications

Ratings Range

		60 Hz
Standby:	**kW**	280-350
	kVA	280-438
Prime:	**kW**	275-320
	kVA	275-400



Standard Features

- Kohler Co. provides one-source responsibility for the generating system and accessories.
- The generator set and its components are prototype-tested, factory-built, and production-tested.
- The 60 Hz generator set offers a UL 2200 listing.
- The generator set accepts rated load in one step.
- The 60 Hz emergency generator set meets NFPA 110, Level 1, when equipped with the necessary accessories and installed per NFPA standards.
- A standard one-year limited warranty covers all systems and components. Two-, five-, and ten-year extended warranties are also available.
- Alternator features:
  - The pilot-excited, permanent magnet (PM) alternator provides superior short-circuit capability.
  - The brushless, rotating-field alternator has broadrange reconnectability.
- Other features:
  - Kohler designed controllers for guaranteed system integration and remote communication. See Controllers on page 3.
  - The low coolant level shutdown prevents overheating (standard on radiator models only).
  - Integral vibration isolation eliminates the need for under-unit vibration spring isolators.
  - An electronic, isochronous governor delivers precise frequency regulation.
  - Multiple circuit breaker configurations.

Generator Set Ratings

Alternator	Voltage	Ph	Hz	150°C Rise Standby Rating kW/kVA	150°C Rise Standby Rating Amps	130°C Rise Standby Rating kW/kVA	130°C Rise Standby Rating Amps	125°C Rise Prime Rating kW/kVA	125°C Rise Prime Rating Amps	105°C Rise Prime Rating kW/kVA	105°C Rise Prime Rating Amps
4M4019	120/208	3	60	350/438	1214	350/438	1214	320/400	1110	320/400	1110
	127/220	3	60	350/438	1148	350/438	1148	320/400	1050	320/400	1050
	139/240	3	60	350/438	1052	350/438	1052	320/400	962	320/400	962
	220/380	3	60	305/381	579	305/381	579	275/344	522	275/344	522
	240/416	3	60	350/438	607	350/438	607	320/400	555	320/400	555
	277/480	3	60	350/438	526	350/438	526	320/400	481	320/400	481
4M4021	120/208	3	60	350/438	1214	350/438	1214	320/400	1110	320/400	1110
	127/220	3	60	350/438	1148	350/438	1148	320/400	1050	320/400	1050
	139/240	3	60	350/438	1052	350/438	1052	320/400	962	320/400	962
	220/380	3	60	315/394	598	315/394	598	285/356	541	285/356	541
	240/416	3	60	350/438	607	350/438	607	320/400	555	320/400	555
	277/480	3	60	350/438	526	350/438	526	320/400	481	320/400	481
5M4027	120/208	3	60	350/438	1214	350/438	1214	320/400	1110	320/400	1110
	127/220	3	60	350/438	1148	350/438	1148	320/400	1050	320/400	1050
	120/240	1	60	305/305	1271	280/280	1167	275/275	1146	275/275	1146
	139/240	3	60	350/438	1052	350/438	1052	320/400	962	320/400	962
	220/380	3	60	350/438	665	350/438	665	320/400	608	320/400	608
	240/416	3	60	350/438	607	350/438	607	320/400	555	320/400	555
	277/480	3	60	350/438	526	350/438	526	320/400	481	320/400	481
4M4266	347/600	3	60	350/438	421	350/438	421	320/400	385	320/400	385
5M4272	347/600	3	60	350/438	421	350/438	421	320/400	385	320/400	385

RATINGS: All three-phase units are rated at 0.8 power factor. *Standby Ratings:* The standby rating is applicable to varying loads for the duration of a power outage. There is no overload capability for this rating. *Prime Power Ratings:* At varying load, the number of generator set operating hours is unlimited. A 10% overload capacity is available for one hour in twelve. Ratings are in accordance with ISO-8528-1 and ISO-3046-1. For limited running time and continuous ratings, consult the factory. Obtain technical information bulletin (TIB-101) for ratings guidelines, complete ratings definitions, and site condition derates. The generator set manufacturer reserves the right to change the design or specifications without notice and without any obligation or liability whatsoever.

Alternator Specifications

Specifications		Alternator
Type		4-Pole, Rotating-Field
Exciter type		Brushless, Permanent-Magnet, Pilot Exciter
Leads: quantity, type		12, Reconnectable
Voltage regulator		Solid State, Volts/Hz
Insulation:		NEMA MG1
Material		Class H, Synthetic, Nonhygroscopic
Temperature rise		130°C, 150°C Standby
Bearing: quantity, type		1, Sealed
Coupling		Flexible Disc
Amortisseur windings		Full
Rotor balancing		125%
Voltage regulation, no-load to full-load		Controller Dependent
One-step load acceptance		100% of Rating
Unbalanced load capability		100% of Rated Standby Current
Peak motor starting kVA:		(35% dip for voltages below)
480 V	4M4019 (12 lead)	1325
480 V	4M4021 (12 lead)	1350
480 V	5M4027 (12 lead)	1550
600 V	4M4266 (4 lead)	1300
600 V	5M4272 (4 lead)	1750

- NEMA MG1, IEEE, and ANSI standards compliance for temperature rise and motor starting.
- Sustained short-circuit current of up to 300% of the rated current for up to 10 seconds.
- Sustained short-circuit current enabling downstream circuit breakers to trip without collapsing the alternator field.
- Self-ventilated and dripproof construction.
- Superior voltage waveform from a two-thirds pitch stator and skewed rotor.
- Brushless alternator with brushless pilot exciter for excellent load response.

Application Data

Engine

Engine Specifications	
Engine manufacturer	John Deere
Engine model	6135HF485
Engine type	4-Cycle, Turbocharged, Charge Air-Cooled
Cylinder arrangement	6, Inline
Displacement, L (cu. in.)	13.5 (824)
Bore and stroke, mm (in.)	132 x 165 (5.2 x 6.5)
Compression ratio	16.0:1
Piston speed, m/min. (ft./min.)	594 (1950)
Main bearings: quantity, type	7, Replaceable Insert
Rated rpm	1800
Max. power at rated rpm, kWm (BHP)	401 (538)
Crankshaft material	Forged Steel
Valve material	
Intake/Exhaust	Nickel-Chromium Head Chromium-Silicone Stem
Governor: type, make/model	JDEC Electronic L15
Frequency regulation, no-load to full-load	Isochronous
Frequency regulation, steady state	±0.25%
Frequency	Fixed
Air cleaner type, all models	Dry

Exhaust

Exhaust System	
Exhaust manifold type	Dry
Exhaust flow at rated kW, m^3/min. (cfm)	75 (2649)
Exhaust temperature at rated kW, dry exhaust, °C (°F)	446 (835)
Maximum allowable back pressure, kPa (in. Hg)	Min. 4 (1.2) Max. 10 (3.0)
Engine exhaust outlet size, mm (in.)	See ADV drawing

Engine Electrical

Engine Electrical System	
Battery charging alternator:	
Ground (negative/positive)	Negative
Volts (DC)	24
Ampere rating	60
Starter motor rated voltage (DC)	24
Battery, recommended cold cranking amps (CCA):	
Qty., CCA rating each	Two, 950
Battery voltage (DC)	12

Fuel

Fuel System	
Fuel supply line, min. ID, mm (in.)	13 (0.50)
Fuel return line, min. ID, mm (in.)	10 (0.38)
Max. lift, fuel pump: type, m (ft.)	Electronic 2.1 (6.8)
Max. fuel flow, Lph (gph)	180.6 (47.7)
Fuel prime pump	Electronic
Fuel filter	
Secondary	2 Microns @ 98% Efficiency
Primary	10 Microns
Water Separator	Yes
Recommended fuel	#2 Diesel

Lubrication

Lubricating System	
Type	Full Pressure
Oil pan capacity, L (qt.)	40.0 (42.3)
Oil pan capacity with filter, L (qt.)	42.0 (44.4)
Oil filter: quantity, type	1, Cartridge
Oil cooler	Water-Cooled

Application Data

Cooling

Radiator System	
Ambient temperature, °C (°F)*	50 (122)
Engine jacket water capacity, L (gal.)	18 (4.8)
Radiator system capacity, including engine, L (gal.)	67.2 (17.8)
Engine jacket water flow, Lpm (gpm)	469 (124)
Heat rejected to cooling water at rated kW, dry exhaust, kW (Btu/min.)	194 (11042)
Heat rejected to air charge cooler at rated kW, dry exhaust, kW (Btu/min.)	106 (6033)
Water pump type	Centrifugal
Fan diameter, including blades, mm (in.)	965 (38)
Fan, kWm (HP)	18 (24)
Max. restriction of cooling air, intake and discharge side of radiator, kPa (in. H_2O)	0.125 (0.5)

* Enclosure with internal silencer reduces ambient temperature capability by 5°C (9°F).

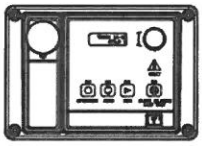
Operation Requirements

Air Requirements	
Radiator-cooled cooling air, m^3/min. (scfm)†	651 (23000)
Cooling air required for generator set when equipped with city water cooling or remote radiator, based on 14°C (25°F) rise, m^3/min. (cfm)†	297 (10500)
Combustion air, m^3/min. (cfm)	33 (1165)
Heat rejected to ambient air:	
Engine, kW (Btu/min.)	83 (4724)
Alternator, kW (Btu/min.)	36.6 (2082)

† Air density = 1.20 kg/m^3 (0.075 lbm/ft^3)

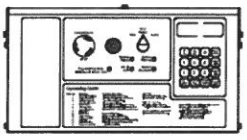
Fuel Consumption	
Diesel, Lph (gph) at % load	**Standby Rating**
100%	100.3 (26.5)
75%	73.2 (19.3)
50%	51.9 (13.7)
25%	30.7 (8.1)
Diesel, Lph (gph) at % load	**Prime Rating**
100%	88.3 (23.3)
75%	66.1 (17.5)
50%	47.6 (12.6)
25%	27.2 (7.2)

Controllers



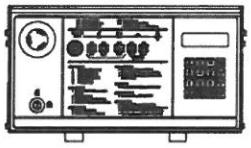
Decision-Maker® 3000 Controller
Provides advanced control, system monitoring, and system diagnostics for optimum performance and compatibility.
- Digital display and menu control provide easy local data access
- Measurements are selectable in metric or English units
- Remote communication thru a PC via network or serial configuration
- Integrated hybrid voltage regulator with ±0.5% regulation
- Built-in alternator thermal overload protection
- NFPA 110 Level 1 capability

Refer to G6-100 for additional controller features and accessories.



Decision-Maker® 550 Controller
Provides advanced control, system monitoring, and system diagnostics with remote monitoring capabilities.
- Digital display and keypad provide easy local data access
- Measurements are selectable in metric or English units
- Remote communication thru a PC via network or modem configuration
- Controller supports Modbus® protocol
- Integrated voltage regulator with ±0.25% regulation
- Built-in alternator thermal overload protection
- NFPA 110 Level 1 capability

Refer to G6-46 for additional controller features and accessories.



Decision-Maker® 6000 Paralleling Controller
Provides advanced control, system monitoring, and system diagnostics with remote monitoring capabilities for paralleling multiple generator sets.
- Paralleling capability with first-on logic, synchronizer, kW and kVAR load sharing, and protective relays
- Digital display and keypad provide easy local data access
- Measurements are selectable in metric or English units
- Remote communication thru a PC via network or modem configuration
- Controller supports Modbus® protocol
- Integrated voltage regulator with ±0.25% regulation
- Built-in alternator thermal overload protection
- NFPA 110 Level 1 capability

Refer to G6-107 for additional controller features and accessories.

KOHLER CO., Kohler, Wisconsin 53044 USA
Phone 920-457-4441, Fax 920-459-1646
For the nearest sales and service outlet in the
US and Canada, phone 1-800-544-2444
KohlerPower.com

Kohler Power Systems
Asia Pacific Headquarters
7 Jurong Pier Road
Singapore 619159
Phone (65) 6264-6422, Fax (65) 6264-6455

Standard Features

- Alternator Protection
- Battery Rack and Cables
- Customer Connection
  (standard with Decision-Maker® 6000 controller only)
- Local Emergency Stop Switch
- Oil Drain Extension
- Operation and Installation Literature

Available Options

Approvals and Listings

- ☐ California OSHPD Approval
- ☐ CSA Approval
- ☐ IBC Seismic Certification
- ☐ UL 2200 Listing

Enclosed Unit

- ☐ Sound Enclosure Level 1 and Subbase Fuel Tank Packages
- ☐ Sound Enclosure Level 2 and Subbase Fuel Tank Packages
- ☒ Weather Enclosure and Subbase Fuel Tank Packages

Open Unit

- ☒ Exhaust Silencer, Critical (kit: PA-354880)
- ☐ Exhaust Silencer, Hospital (kit: PA-354905)
- ☐ Flexible Exhaust Connector, Stainless Steel

Fuel System

- ☐ Auxiliary Fuel Pump
- ☐ Flexible Fuel Lines (Select rubber or stainless steel)

Controller

- ☐ Common Failure Relay
- ☐ Communication Products and PC Software
  (Decision-Maker® 550 and 6000 controllers only)
- ☐ Customer Connection (Decision-Maker® 550 controller only)
- ☐ Decision-Maker® Paralleling System (DPS)
  (Decision-Maker® 6000 controller only)
- ☐ Dry Contact (isolated alarm)
  (Decision-Maker® 550 and 6000 controllers only)
- ☐ Input/Output Module (Decision-Maker® 3000 controller only)
- ☐ Remote Audiovisual Alarm Panel
  (Decision-Maker® 550 and 6000 controllers only)
- ☐ Remote Emergency Stop
- ☐ Remote Mounting Cable
- ☐ Remote Serial Annunciator Panel
- ☐ Run Relay

Cooling System

- ☐ Block Heater, 2500 W, 90-120 V, 1 Ph
- ☐ Block Heater, 2500 W, 190-208 V, 1 Ph
- ☐ Block Heater, 2500 W, 210-240 V, 1 Ph
- ☐ Block Heater, 2500 W, 380-480 V, 1 Ph
  [recommended for ambient temperatures below 0°C (32°F)]
- ☐ Radiator Duct Flange
- ☐ Remote Radiator Setup

Electrical System

- ☐ Alternator Strip Heater
- ☐ Battery
- ☒ Battery Charger, Equalize/Float Type
- ☐ Battery Heater
- ☐ Line Circuit Breaker (NEMA type 1 enclosure)
- ☐ Line Circuit Breaker with Shunt Trip (NEMA type 1 enclosure)

Paralleling System

- ☐ Manual Speed Adjust
- ☐ Voltage Sensing

Miscellaneous

- ☐ Air Cleaner, Heavy Duty
- ☐ Air Cleaner Restriction Indicator
- ☐ Crankcase Emissions Canister
- ☐ Engine Fluids (oil and coolant) Added
- ☐ Rated Power Factor Testing

Literature

- ☐ General Maintenance
- ☐ NFPA 110
- ☐ Overhaul
- ☐ Production

Warranty

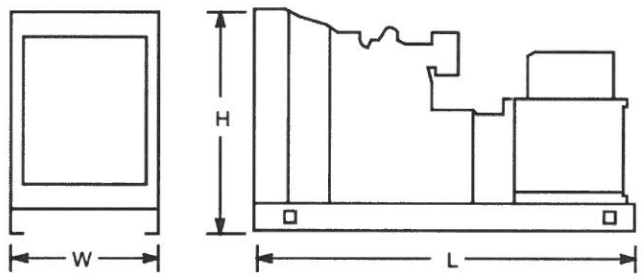
- ☐ 2-Year Basic
- ☐ 5-Year Basic
- ☐ 5-Year Comprehensive
- ☐ 10Year Major Components

Other Options

- ☐ _____
- ☐ _____
- ☐ _____
- ☐ _____
- ☐ _____

Dimensions and Weights

Overall Size, L x W x H, max., mm (in.):	3630 x 1725 x 1993 (142.9 x 67.9 x 78.5)
Weight (radiator model), wet, max., kg (lb.):	3901 (8600)



NOTE: This drawing is provided for reference only and should not be used for planning installation. Contact your local distributor for more detailed information.

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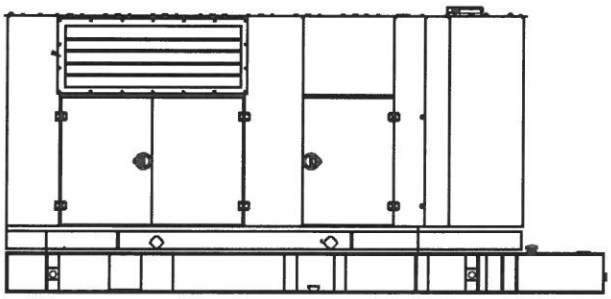
KOHLER. Power Systems

Aluminum and Steel Enclosure and Subbase Fuel Tank Package

ISO 9001 KOHLER POWER SYSTEMS NATIONALLY REGISTERED

All Generator Set, Enclosure, and Fuel Tank Options are UL 2200 Certified.



Applicable to the following:
350-500REOZJ

Weather Enclosure Standard Features

- Internal silencer, flexible exhaust connector and rain cap.
- Mounts to generator set skid. Aluminum or steel construction with hinged and removable doors.
- Fade-, scratch-, and corrosion-resistant Kohler® Power Armor™ automotive-grade textured finish.
- Enclosure has six large access doors which allow for easy maintenance.
- Lockable, flush-mounted door latches.
- Air inlet louvers reduce rain entry.

Sound Enclosures Standard Features

- Includes all of the weather enclosure features with the addition of acoustic insulation material.
- Internal vertical discharge plenum directs air up to reduce noise.
- Acoustic insulation that meets UL 94 HF1 flammability classification.
- Sound enclosure offering Level 1 or Level 2 sound reduction using acoustic insulation. See specifications at the back of this document for sound pressure levels.

Subbase Fuel Tank Features

- The fuel tank has a Power Armor Plus™ textured epoxy-based rubberized coating.
- The above-ground rectangular secondary containment tank mounts directly to the generator set, below the generator set skid (subbase).
- Both the inner and outer tanks have emergency relief vents.
- Flexible fuel lines are provided with subbase fuel tank selection. Stainless steel fuel lines are an available option.
- The secondary containment tank's construction protects against fuel leaks or ruptures. The inner (primary) tank is sealed inside the outer (secondary) tank. The outer tank contains the fuel if the inner tank leaks or ruptures.
- State tanks with varying capacities are an available option.

Enclosure and Subbase Fuel Tank Combinations

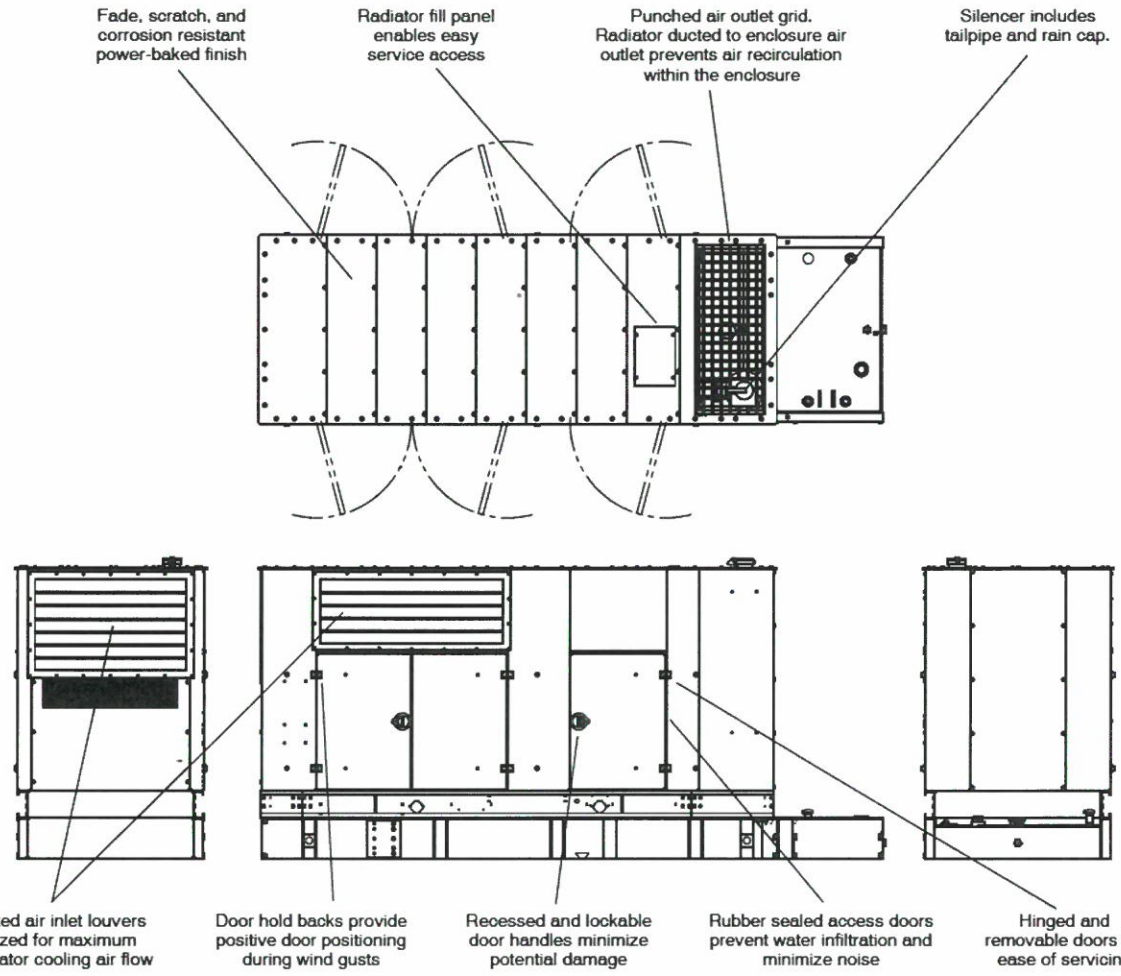
There are three enclosure configurations available with the subbase fuel tanks.

Weather Enclosure with Internal Silencer
Sound Enclosure Level 1 with Internal Silencer
Sound Enclosure Level 2 with Internal Dual Silencers (connected in series)

Available Approvals and Listings

- ☐ UL 2200 Listing
- ☐ CSA Approval
- ☐ IBC Seismic Certification
- ☐ California OSHPD Approval
- ☐ cUL Listing (fuel tanks only)

Weather Enclosure



Enclosure ships assembled on the generator set skid.
Note: Sample model shown, other models are similar.

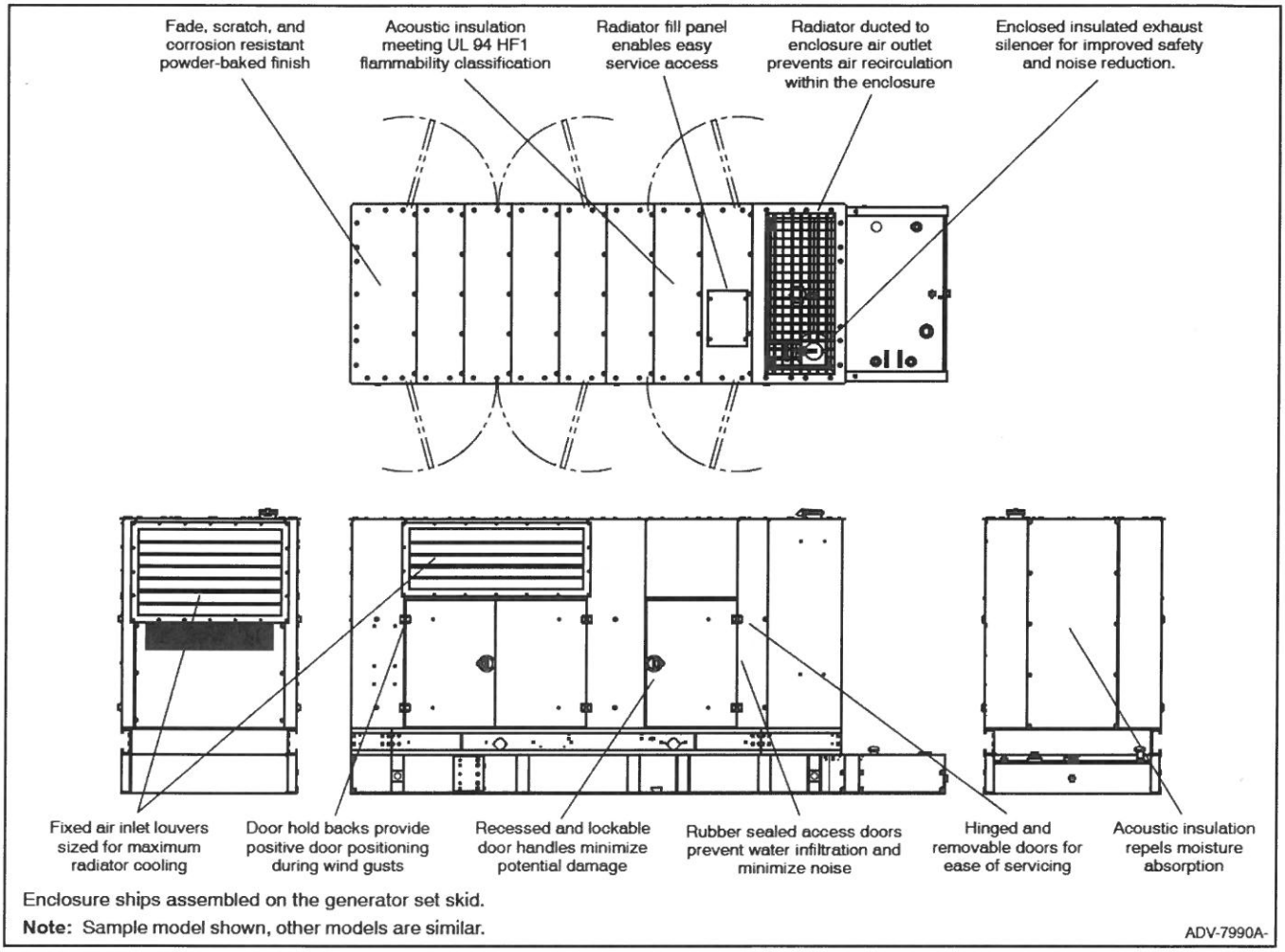
ADV-7991A-

Weather Enclosure Features

- Heavy-duty formed panels, solid construction. Preassembled package offering corrosion resistant, dent resilient structure mounting directly to the generator set skid. Available in 3 mm (0.125 in.) aluminum or 14 gauge steel.
- Power Armor™ automotive-grade finish resulting in advanced corrosion and abrasion protection as well as enhanced edge coverage and color retention.
- Internal exhaust silencer. Offers maximum component life, operator safety, and includes rain shield and cap.

  NOTE: Installing an additional length of exhaust tail pipe may increase backpressure levels. Please refer to the generator set spec sheet for the maximum backpressure value.
- Service access. Multi-personnel doors for easy access to generator set control and servicing of the fuel fill, fuel gauge, oil fill, and battery.
- Interchangeable modular panel construction allows design flexibility.
- Bolted panels facilitate service, future modification upgrades, or field replacement.
- Cooling/combustion air intake. Weather protective designs using fixed air inlet louvers. Sized for maximum cooling airflow.
- Cooling air discharge. Weather protective design featuring vertical air discharge. Exhausts air through a punched air outlet grille.

Level 1 and Level 2 Sound Enclosure



Enclosure ships assembled on the generator set skid.

Note: Sample model shown, other models are similar.

ADV-7990A-

Level 1 and Level 2 Sound Enclosure Features

- Heavy-duty formed panels, solid construction. Pre-assembled package offering corrosion resistant, dent resilient structure mounting directly to the generator set skid. Available in 3 mm (0.125 in.) aluminum or 14 gauge steel.
- Power Armor™ automotive-grade finish resulting in advanced corrosion and abrasion protection as well as enhanced edge coverage and color retention.
- Internal exhaust silencer offering maximum component life and operator safety.

  NOTE: Installing an additional length of exhaust tail pipe may increase backpressure levels. Please refer to the generator set spec sheet for the maximum backpressure value.
- Service access. Multi-personnel doors for easy access to generator set control and servicing of the fuel fill, fuel gauge, oil fill, and battery.
- Interchangeable modular panel construction. Allows complete serviceability or replacement without compromising enclosure design.
- Bolted panels facilitate service, future modification upgrades, or field replacement.
- Cooling/combustion air intake. Weather protective designs using fixed air inlet louvers. Sized for maximum cooling airflow.
- Cooling air discharge. Attenuated models offering an internal vertical discharge scoop that redirects cooling air up and above the enclosure to reduce noise.

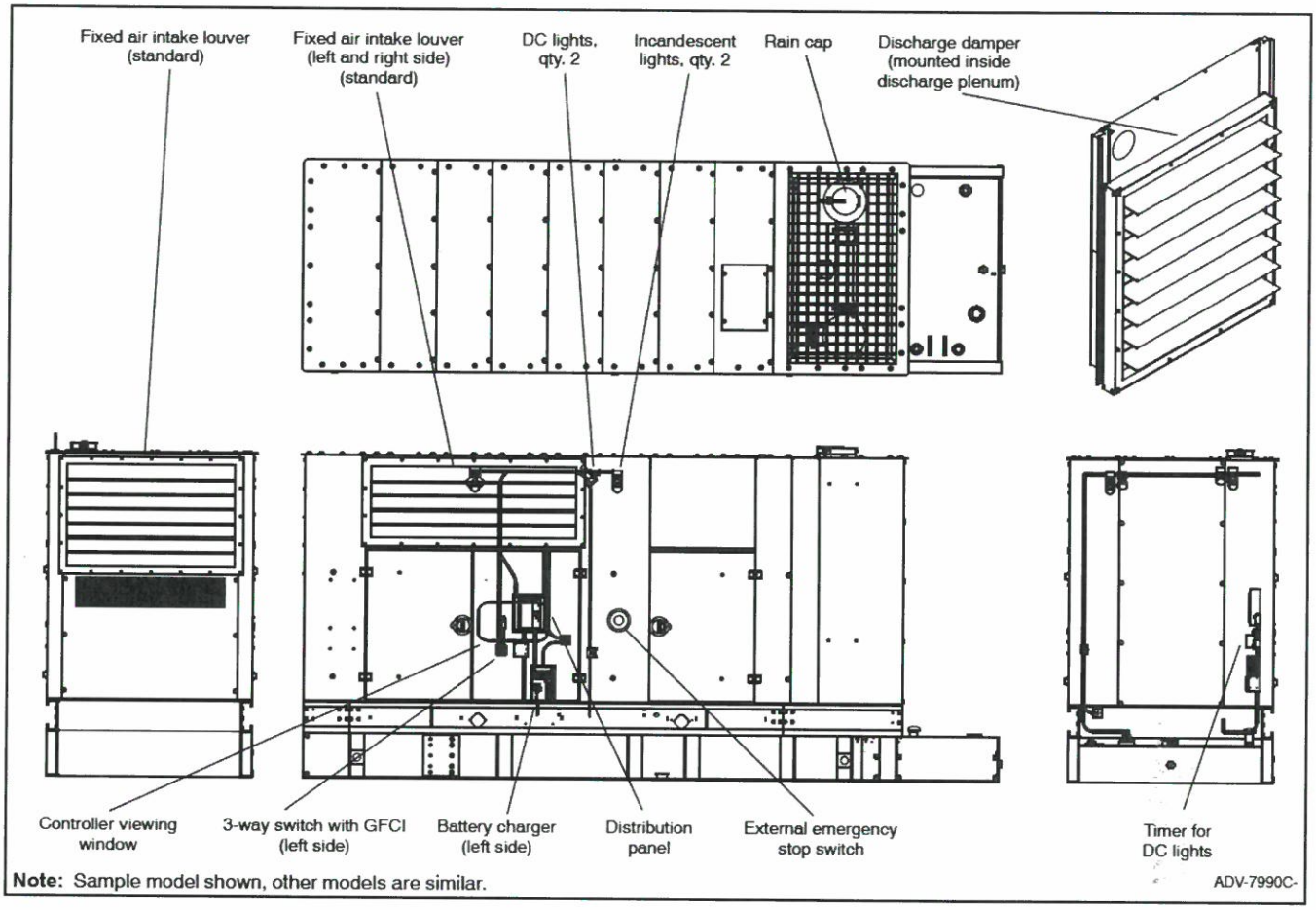
Level 1 Sound Enclosure Features

- Attenuated design using a silencer and acoustic insulation UL 94 HF1 listed for flame resistance.

Level 2 Sound Enclosure Features

- Attenuated design using dual silencers connected in series and acoustic insulation UL 94 HF1 listed for flame resistance.

Weather and Sound Enclosure Options



Note: Sample model shown, other models are similar.

ADV-7990C-

Enclosure Material

- ❑ Aluminum Enclosure
- ❑ Steel Enclosure

Enclosure Silencer Options

- ❑ Internal Silencer, weather enclosure
- ❑ Internal Silencer, sound enclosure, level 1
- ❑ Internal Silencer, sound enclosure, level 2

Basic Electrical Package (BEP)

- ❑ **Distribution Panel/Load Center.** Prewired AC power distribution of all factory-installed features including two GFCI-protected internal 120-volt service receptacles, two AC incandescent lights, and commercial grade wall switch. The single-phase load center powered by building source power and protected by a main circuit breaker, rated for 100 amps with capacity and circuit positions for future expansion. AC power distribution installed in accordance with NEC and all wiring within EMT thin wall conduit. Incandescent AC lights located within UL-listed fixtures designed for wet locations.

DC Light Package

- ❑ **DC Light Package (DLP).** Prewired qty. 2, internal DC light package offering an economical alternative light source within the enclosure, as a complement to the BEP or a source of light when AC power is not available. Battery drain limited with fuse protection and controlled through a 0–60 minute, spring-wound, no-hold timer.

Miscellaneous Enclosure Options

Controller Viewing Window. Control panel viewing window.

- ❑ Aluminum construction
- ❑ Steel construction

- ❑ **Skid Extensions.** Steel construction (for aluminum or steel enclosures)

- ❑ **Gravity Discharge.** Aluminum construction (for aluminum or steel enclosures)

- ❑ **Battery Charger, Mounted.** Mounting and prewiring of DC output and AC input when optional BEP is selected. Battery charger located inside the enclosure and accessible through an access door.

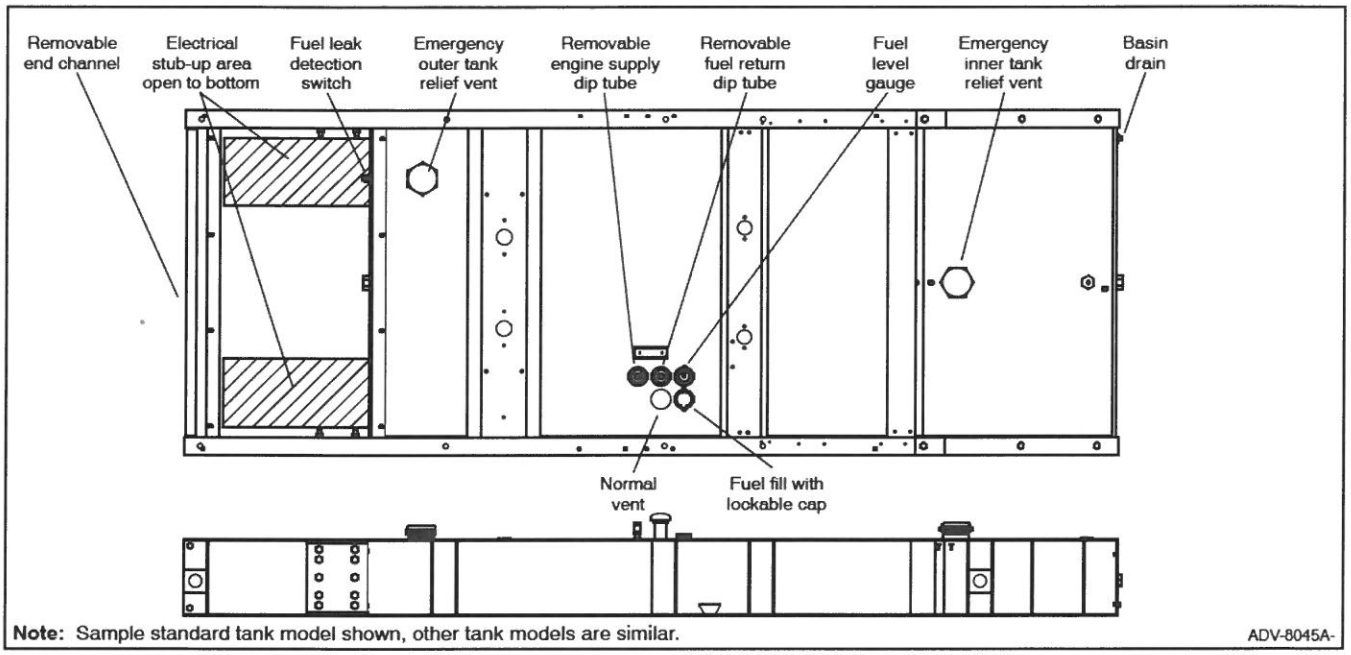
- ❑ **Battery Charger with Alarms.** Mounted and wired.

Block Heater Wiring. Prewiring of AC input when optional BEP is selected.

- ❑ Heater available in single phase 90–120 VAC
- ❑ Heater available in single phase 208–240 VAC

- ❑ **Remote Emergency Stop Switch.** Externally mounted, recessed emergency stop switch.

Subbase Fuel Tank



Note: Sample standard tank model shown, other tank models are similar. ADV-8045A-

Standard Subbase Fuel Tank Features

- Extended operation. Optional tank capacities for multiple hour requirements.
- Power Armor Plus™ textured epoxy-based rubberized coating that creates an ultra-thick barrier between the tank and harsh environmental conditions like humidity, saltwater, and extreme temperatures, and provides advanced corrosion and abrasion protection.
- UL listed. Secondary containment generator set base tank meeting UL 142 requirements.
- NFPA compliant. Designed to comply with the installation standards of NFPA 30 and NFPA 37.
- Integral external lift lugs. Enables crane with spreader-bar lifting of the complete package (empty tank, mounted generator set, and enclosure) to ensure safety.
- Emergency pressure relief vents. Vents ensure adequate venting of inner and outer tank under extreme pressure and/or emergency conditions.
- Normal vent with cap. Vent is raised above lockable fuel fill.
- Fuel level sender with fuel level and low and high fuel warning annunciated through the generator set controller.
- Leak detection switch. Annunciates a contained primary tank fuel leak condition at generator set control.
- Electrical stub-up area.

State Subbase Fuel Tank Options

Bottom Clearance/Coating

❑ I-beams, provides 106 mm (4.2 in.) of ground clearance

Fuel in Basin Options

❑ Fuel in basin switch, Florida Dept. of Environmental Protection (FDEP) File No. EQ-682 approved

Fuel Fill Options

❑ Fill pipe extension to within 152 mm (6 in.) of bottom of fuel tank

❑ 18.9 L (5 gallon) spill containment with 95% shutoff

❑ 18.9 L (5 gallon) spill containment

❑ 18.9 L (5 gallon) spill containment fill to within 152 mm (6 in.) of bottom of fuel tank

❑ 28.4 L (7.5 gallon) spill containment, Florida Dept. of Environmental Protection (FDEP) File No. EQ-345 approved

❑ 28.4 L (7.5 gallon) spill containment with 95% shutoff, Florida Dept. of Environmental Protection (FDEP) File No. EQ-345/EQ-257 approved

Fuel Supply Options

❑ Fire safety valve (installed on fuel supply line)

❑ Ball valve (installed on fuel supply line)

High Fuel Level Switch

❑ High fuel level switch, Florida Dept. of Environmental Protection (FDEP) File No. EQ-682 approved

❑ Three-alarm fuel tank panel

❑ Three-alarm fuel tank panel, Florida Dept. of Environmental Protection (FDEP) File No. EQ-682 approved

Normal Vent Options

❑ 3.7 m (12 ft.) above grade (without spill containment)

❑ 3.7 m (12 ft.) above grade (with spill containment)

Tank Marking Options

❑ Decal, Combustible Liquids - Keep Fire Away (qty. 2)

❑ Decal, NFPA 704 identification (qty. 2)

❑ Decal, tank number and safe fuel fill height (qty. 2)

❑ Decal, tank number and safe fuel fill height, NFPA 704 identification

Fluid Containment Option

❑ 100% engine fluid containment

Freestanding Stairs

❑ Stairs only

❑ Stairs with platform

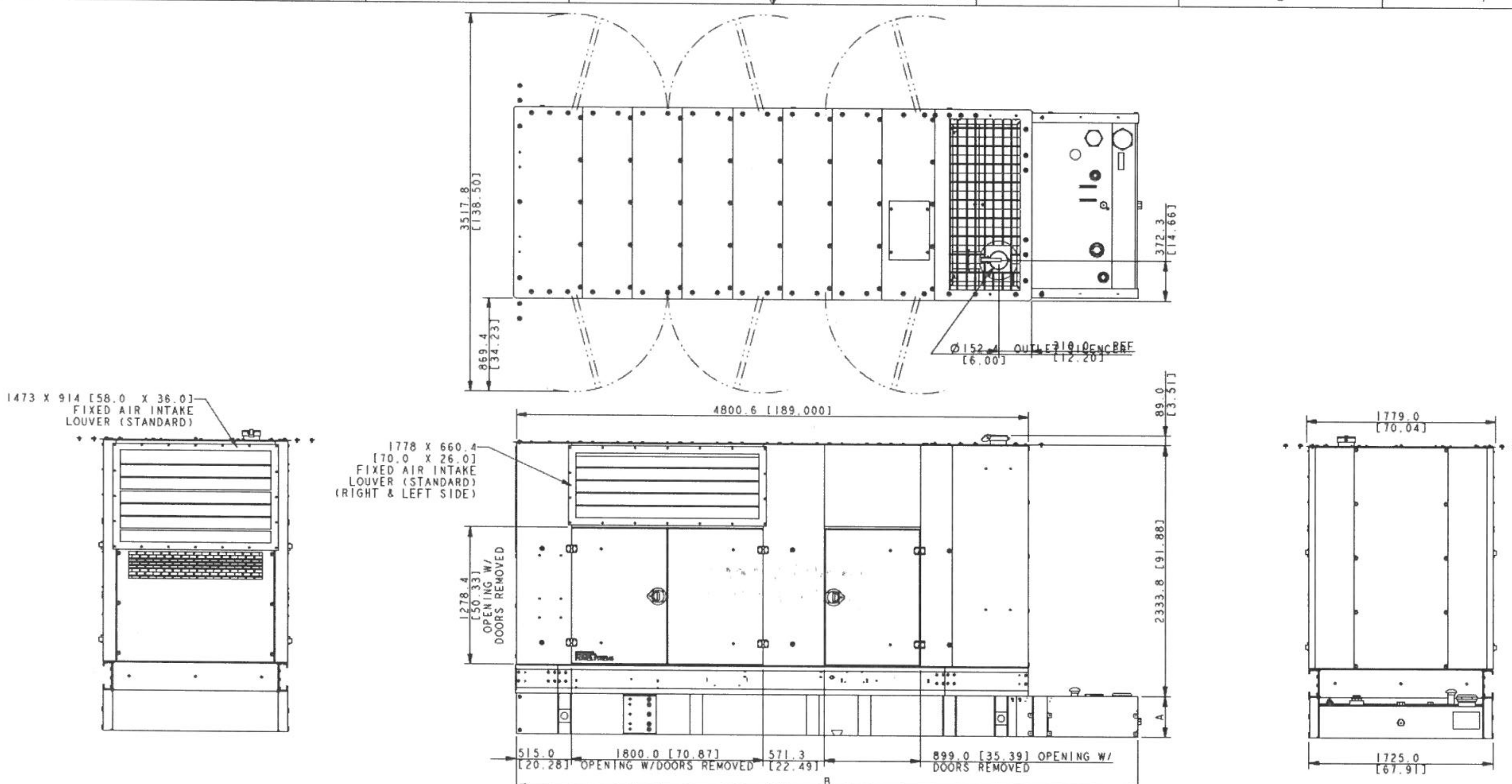
❑ Stairs with catwalk

Fuel Tank Capacity, L (gal.)	Est. Fuel Supply Hours at 60 Hz with Full Load	350REOZJ					Fuel Tank Height, mm (in.)	Enclosure Sound Pressure Levels, dB(A) †
		Max. Dimensions, mm (in.)			Max. Weight, kg (lb.) *			
		Length	Width	Height	With Steel Enclosure	With Aluminum Enclosure		
Weather Enclosure and Standard Subbase Fuel Tank								
No Tank	0	4801 (189)	1779 (70)	2423 (95)	5077 (11193)	4524 (9974)	0 (0)	92
1508 (398)	12	5030 (198)		2804 (110)	6147 (13635)	5594 (12416)	381 (15)	
2905 (767)	24			3083 (121)	6450 (14221)	5897 (13002)	660 (26)	
4298 (1135)	36			3337 (131)	6697 (14764)	6144 (13545)	914 (36)	
4975 (1314)	48	5627 (222)			6904 (15222)	6351 (14003)		
Weather Enclosure and State Subbase Fuel Tank								
1532 (404)	12	5830 (230)	1779 (70)	2804 (110)	6303 (13896)	5750 (12677)	381 (15)	92
2930 (774)	24			3007 (118)	6579 (14504)	6026 (13285)	584 (23)	
4395 (1161)	36	7634 (301)		3083 (121)	7103 (15659)	6550 (14440)	660 (26)	
5046 (1333)	48			3134 (123)	7187 (15845)	6634 (14626)	711 (28)	
10009 (2644)	72	6731 (265)	2591 (102)	3499 (138)	8576 (18906)	8023 (17687)	914 (36)	
Sound Enclosure (Level 1) and Standard Subbase Fuel Tank								
No Tank	0	4801 (189)	1779 (70)	2423 (95)	5113 (11273)	4561 (10054)	0 (0)	81
1508 (398)	12	5030 (198)		2804 (110)	6183 (13715)	5631 (12496)	381 (15)	
2905 (767)	24			3083 (121)	6486 (14301)	5934 (13082)	660 (26)	
4298 (1135)	36			3337 (131)	6733 (14844)	6181 (13625)	914 (36)	
4975 (1314)	48	5627 (222)			6940 (15302)	6388 (14083)		
Sound Enclosure (Level 1) and State Subbase Fuel Tank								
1532 (404)	12	5830 (230)	1779 (70)	2804 (110)	6339 (13976)	5787 (12757)	381 (15)	81
2930 (774)	24			3007 (118)	6615 (14584)	6063 (13365)	584 (23)	
4395 (1161)	36	7634 (301)		3083 (121)	7139 (15739)	6587 (14520)	660 (26)	
5046 (1333)	48			3134 (123)	7223 (15925)	6671 (14706)	711 (28)	
10009 (2644)	72	6731 (265)	2591 (102)	3499 (138)	8612 (18986)	8060 (17767)	914 (36)	
Sound Enclosure (Level 2) and Standard Subbase Fuel Tank								
No Tank	0	5029 (198)	1779 (70)	2423 (95)	5227 (11523)	4669 (10294)	0 (0)	74
1508 (398)	12	5030 (198)		2804 (110)	6297 (13965)	5739 (12736)	381 (15)	
2905 (767)	24			3083 (121)	6600 (14551)	6042 (13322)	660 (26)	
4298 (1135)	36			3337 (131)	6847 (15094)	6289 (13865)	914 (36)	
4975 (1314)	48	5627 (222)			7054 (15552)	6496 (14323)		
Sound Enclosure (Level 2) and State Subbase Fuel Tank								
1532 (404)	12	5830 (230)	1779 (70)	2804 (110)	6453 (14226)	5895 (12997)	381 (15)	74
2930 (774)	24			3007 (118)	6729 (14834)	6171 (13605)	584 (23)	
4395 (1161)	36	7634 (301)		3083 (121)	7253 (15989)	6695 (14760)	660 (26)	
5046 (1333)	48			3134 (123)	7337 (16175)	6779 (14946)	711 (28)	
10009 (2644)	72	6731 (265)	2591 (102)	3499 (138)	8726 (19236)	8168 (18007)	914 (36)	

Note: Data in table is for reference only, refer to the respective ADV drawings for details.

* Max. weight includes the generator set (wet) with largest alternator option, enclosure, silencer, and tank (no fuel).

† Log average sound pressure level of 8 measured positions around the perimeter of the unit at a distance of 7 m (23 ft). Refer to TIB-114 for details.



TANK INFORMATION

LITERS [GALLONS] MIN HOURS	GENSETS	DIM A MM [INCH]	DIM B MM [INCH]	TANK WEIGHT KG [LBS] (NO FUEL)
1508 [398] 12 HOURS	350-400KW	381.0 [15.0]	5030.2 [198.0]	1070 [2442]
1734 [458] 12 HOURS	500KW	431.8 [17.0]	5030.2 [198.0]	1153 [2543]
2905 [767] 24 HOURS	350-400KW	660.4 [26.0]	5030.2 [198.0]	1373 [3028]
3347 [884] 24 HOURS	500KW	787.4 [31.0]	5030.2 [198.0]	1477 [3257]
4298 [1135] 36 HOURS	350-400KW	914.4 [36.0]	5030.2 [198.0]	1620 [3571]
4975 [1314] 48/36 HOURS	350KW	914.4 [36.0]	5626.7 [221.5]	1827 [4029]
5767 [1523] 48/36 HOURS	400/500KW	914.4 [36.0]	6236.7 [245.5]	2004 [4419]
6659 [1759] 48 HOURS	500KW	914.4 [36.0]	6922.5 [272.5]	2245 [4951]
1532 [404] 12 HOURS STATE	350-400KW	381.0 [15.0]	5830.3 [229.5]	1226 [2703]
1771 [468] 12 HOURS STATE	500KW	381.0 [15.0]	5830.3 [229.5]	1301 [2869]
2930 [774] 24 HOURS STATE	350-400KW	584.2 [23.0]	5830.3 [229.5]	1502 [3311]
3385 [894] 24 HOURS STATE	500KW	660.4 [26.0]	5830.3 [229.5]	1580 [3483]
4395 [1161] 36 HOURS STATE	350-400KW	660.4 [26.0]	7633.7 [300.5]	2026 [4466]
5046 [1333] 48/36 HOURS STATE	350KW	711.2 [28.0]	7633.7 [300.5]	2110 [4652]
5767 [1523] 48/36 HOURS STATE	400/500KW	812.8 [32.0]	7633.7 [300.5]	2226 [4911]
6675 [1763] 48 HOURS STATE	500KW	914.4 [36.0]	7633.7 [300.5]	2360 [5204]

STEEL WEATHER ENCLOSURE WEIGHT	1176 [2593]
ALUM. WEATHER ENCLOSURE WEIGHT	623 [1374]
350-500 REOZJ	KG [LBS]
STEEL SOUND L1 ENCLOSURE WEIGHT	1212 [2673]
ALUM. SOUND L1 ENCLOSURE WEIGHT	660 [1454]

350-500KW REOZJ
STEEL & ALUMINUM ENCL.
SOUND L1 & WEATHER

REV	DATE	ON COMPOSITE DWGS. SEE PART NO. FOR REVISION LEVEL	BY
-	2-14-11	NEW DRAWING [90647-22]	RJS
A	6-13-11	(A-7) 450KW REMOVED FROM GENSET COLUMN [91640]	DJV
B	7-15-11	(D-3) 372.3 WAS 321.5 [91583]	RJS
C	12-12-11	SEE SHEET 5 [92430-5]	RJS
D	5-21-13	VIEWS UPDATED FOR E-VENT [CT47063]	SVP
E	6-25-14	(A-4) G-585 NOTE REMOVED [CT85078]	SSH

UNLESS OTHERWISE SPECIFIED - 1) DIMENSIONS ARE IN MILLIMETERS 2) TOLERANCES ARE: X.XX ± 0.25, X.X ± 1.5, X ± 1.5, ANGLES ± 0° 30' SURFACE FINISH MAX.

THIRD ANGLE PROJECTION

APPROVALS		DATE
DRAWN	RJS	2-14-11
CHECKED	RJS	2-14-11
APPROVED	AJD	2-14-11

KOHLER CO. METRIC | PRO-E

POWER SYSTEMS, KOHLER, WI 53044 U.S.A.

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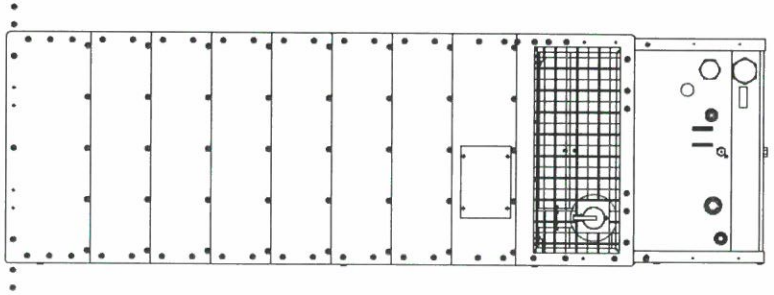
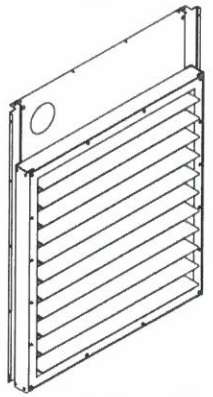
TITLE: DIMENSION PRINT, 350-500REOZJ WTHR/SND LVL 1 & TANKS

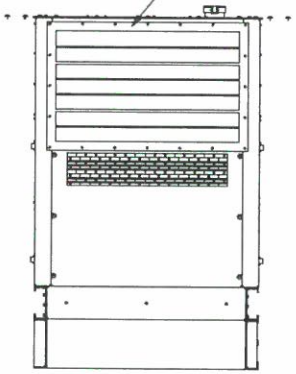
SCALE 0.06 | CAD NO. | SHEET 1 of 6

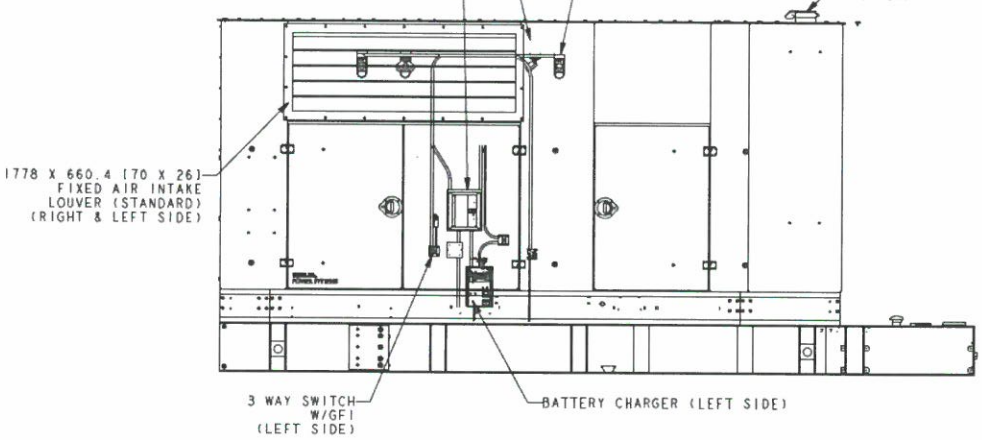
DWG NO. ADV-7991 | D

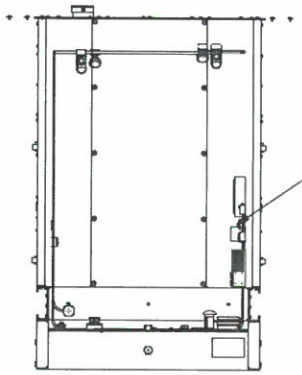




OPTIONAL DISCHARGE DAMPER
(MOUNTED INSIDE DISCHARGE PLENUM)







REV	DATE	ON COMPOSITE DWGS, SEE PART NO. FOR REVISION LEVEL	BY
-	2-14-11	NEW DRAWING [90647-22]	RJS
A	6-13-11	SEE SHEET 1 & 4-6 [91640]	DJV
B	7-15-11	SEE SHEET 1 & 2 [91583]	RJS
C	12-12-11	SEE SHEET 5 [92430-5]	RJS
D	5-21-13	VIEWS UPDATED FOR E-VENT [CT47063]	SVP
E	6-25-14	SEE SHEET 1 [CT65078]	SSH

UNLESS OTHERWISE SPECIFIED -
.X DIMENSIONS ARE IN MILLIMETERS
.XX TOLERANCES ARE:
.X ± 0.25
.XX ± 0.13
ANGLES ± 1° 30'
SURFACE FINISH 3.2 MAX.
THIRD ANGLE PROJECTION

APPROVALS		DATE
DRAWN	RJS	2-14-11
CHECKED	RJS	2-14-11
APPROVED	AJD	2-14-11

KOHLER CO. METRIC PRO-E
POWER SYSTEMS, KOHLER, WI 53044 U.S.A.
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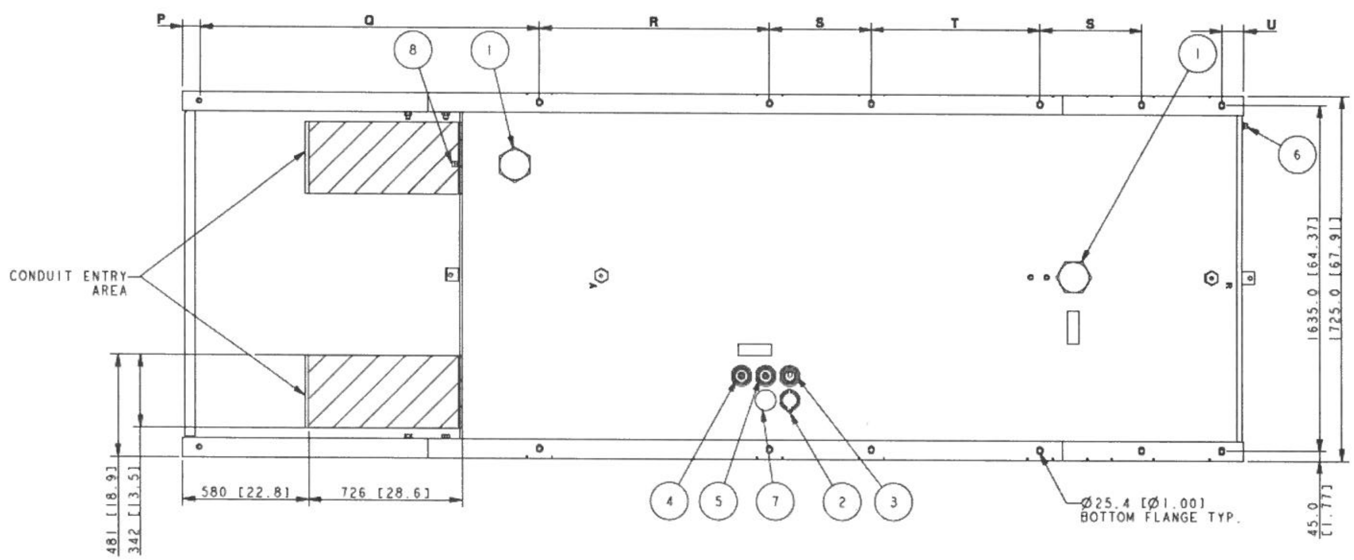
TITLE
DIMENSION PRINT, 350-500REOZJ WITH/SKID LVL 1 & TANKS

SCALE 0.66 CAD NO. SHEET 3 of 6

SIZE D DWG NO. ADV-7991

STANDARD TANK



1508 [398 GAL] 12 HOUR TANK SHOWN.

ITEM	DESCRIPTION
8	SWITCH, FUEL IN BASIN
7	VENT, NORMAL
6	DRAIN, (1/2" NPT)
5	RETURN, FUEL (1/2" NPT)
4	SUPPLY, FUEL (1/2" NPT)
3	GAUGE, FUEL LEVEL, W/ SENDER
2	FILL CAP, 2" LOCKABLE W/PIPE RISER
1	CAP, EMERGENCY VENT

12 - 48 HOUR
350-500kW STD TANK
W/ SOUND L1 & WEATHER HOUSE

TANK INFORMATION

LITERS [GALLONS] MIN HOURS	GENSETS	P	Q	R	S	T	U
1508 [398] 12 HOURS	350-400KW	83.1 [3.3]	1604.8 [63.2]	1090.4 [42.9]	482.6 [19.0]	800.0 [31.5]	105.6 [4.2]
1734 [458] 12 HOURS	500KW						
2905 [767] 24 HOURS	350-400KW						
3347 [884] 24 HOURS	500KW						
4298 [1135] 36 HOURS	350-400KW						
4975 [1314] 48/36 HOURS	350KW						702.5 [27.7]
5767 [1523] 48/36 HOURS	400/500KW						1312.1 [51.7]
6659 [1759] 48 HOURS	500KW						1997.9 [78.7]

REV	DATE	ON COMPOSITE DWGS, SEE PART NO. FOR REVISION LEVEL	BY
-	3-14-11	NEW DRAWING [90647-22]	RJS
A	6-13-11	(A-7) 450KW REMOVED FROM GENSET COLUMN [91640]	DJV
B	7-15-11	SEE SHEET 1 & 2 [91583]	RJS
C	12-12-11	SEE SHEET 5 [92430-5]	RJS
D	5-21-13	VIEWS UPDATED FOR E-VENT [CT47063]	SVP
E	6-25-14	SEE SHEET 1 [CT85078]	SSH

UNLESS OTHERWISE SPECIFIED - 1) DIMENSIONS ARE IN MILLIMETERS 2) TOLERANCES ARE: X.XX ± 0.25, X.X ± 1.0, X ± 1.5, ANGLES ± 0° 30'. SURFACE FINISH MAX. THIRD ANGLE PROJECTION

APPROVALS		DATE
DRAWN	RJS	3-14-11
CHECKED	RJS	3-14-11
APPROVED	AJD	3-14-11

KOHLER CO. METRIC PRO-E
POWER SYSTEMS, KOHLER, WI 53044 U.S.A.

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TITLE: DIMENSION PRINT, 350-500REOZJ WTHR/SND LVL 1 & TANKS

SCALE 0.06 SHEET 4 of 6

ADV-7991 D

KOHLER. Power Systems

Sizing Report

Project information

Project name: Bellefield
Customer's name:
Customer contact:

Site requirements

Voltage:	277/480
Phase:	3
Frequency:	60Hz
Alt. Temp. Rise Duty:	130°C Standby
Qty of Gensets:	1
Fuel type:	Diesel
Country :	United States

Application:	Construction
Genset Application:	~~Stationary emergency~~ Standby
Altitude:	500 Feet
Max. Ambient Temp.:	77 Degrees F
Min. Genset Loading :	25 %
Max. Genset Loading :	90 %

Site load requirements summary

Running kW:	284.77
Running kVA:	314.42
Running P.F.:	0.91

Max. Starting kW:	145.84 in step 5
Max. Starting kVA:	277.71 in step 5

Generator selection

Genset Model:	350REOZJ
Engine:	6135HF485
Emission level:	EPA Tier 3
BHP:	538.00
Displacement:	824.00
RPM:	1800

Alternator:	4M4019
Alternator Leads:	12 lead
Alt. Starting kVA at 35% V dip:	1,325.00
Excitation System :	PMG

Rated kW :	350.00
Site Rated kW :	350.00
UL 2200 Certified	

Generator Performance Summary

Voltage Dip Limit:	30.00 %
Frequency Dip Limit:	10.00 %
Harmonic Distortion Limit:	10.00 %

Calculated Voltage Dip:	9.37 %
Calculated Frequency Dip:	1.85 %
Calculated Harmonic Distortion:	9.36 %
Calculated Genset % Loaded:	81.36 %

Report prepared by: Richard Nie

TOTAL SYSTEM INTEGRATION
GENERATORS | TRANSFER SWITCHES | SWITCHGEAR | CONTROLS

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Software version: 1.0026.4.20

Friday, November 3, 2017

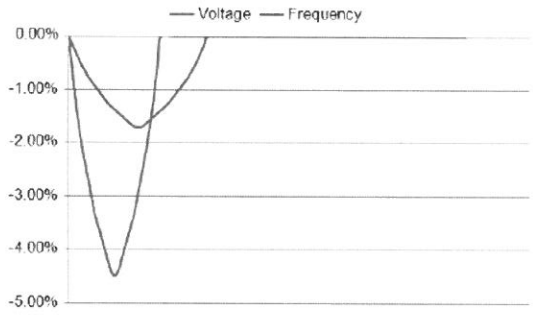
KOHLER Power Systems

Sizing Report

Model : 350REOZJ, Alternator : 4M4019

Load Profile

Step # 1	Qty	Run			Start			Volt Dip %	Freq Dip %	Volt. Dist. %
		kW	kVA	PF	kW	kVA	PF			
Lighting **Building lighting/recepticles** **Evenly distributed** **Incandescent**	1	6.24	6.24	1.00	6.24	6.24	1.00			
Motor Bar Screen 0.75 HP 3 Phase Motor code : L Loaded NEMA Design across the line	1	0.78	1.14	0.68	4.85	7.13	0.68			
Motor EQ Pump 58.00 HP 3 Phase Motor code : G Loaded NEMA Design VFD	1	52.60	58.44	0.90	52.60	58.44	0.90			
Motor Lift Station Pump 10.00 HP 3 Phase Motor code : G Loaded NEMA Design VFD	1	9.75	10.84	0.90	9.75	10.84	0.90			



Report prepared by: Richard Nie

TOTAL SYSTEM INTEGRATION
GENERATORS | TRANSFER SWITCHES | SWITCHGEAR | CONTROLS

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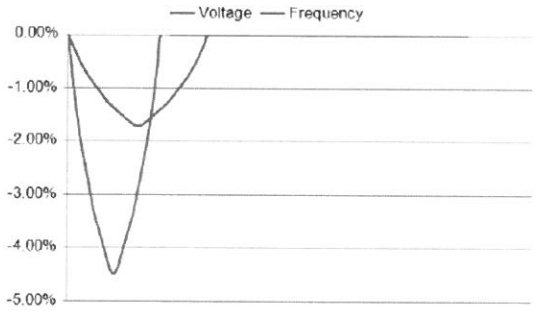
KOHLER. Power Systems

Sizing Report

Step # 1	Qty	Run			Start			Volt Dip %	Freq Dip %	Volt. Dist. %
		kW	kVA	PF	kW	kVA	PF			
Motor Sludge Transfer Pump 5.00 HP 3 Phase Motor code : H Loaded NEMA Design across the line	1	4.55	6.07	0.75	18.43	33.50	0.55			
Lighting Sludge BLDG Heaters Evenly distributed Incandescent	3	15.00	15.00	1.00	15.00	15.00	1.00			
Lighting Sludge Building Lighting/Recp Evenly distributed Incandescent	1	12.47	12.47	1.00	12.47	12.47	1.00			
Step Total		101.38	107.27	0.95	119.33	135.12	0.88	4.47	1.71	3.46
Cum.Total		101.38	107.27	0.95						



Report prepared by: Richard Nie

TOTAL SYSTEM INTEGRATION
GENERATORS | TRANSFER SWITCHES | SWITCHGEAR | CONTROLS

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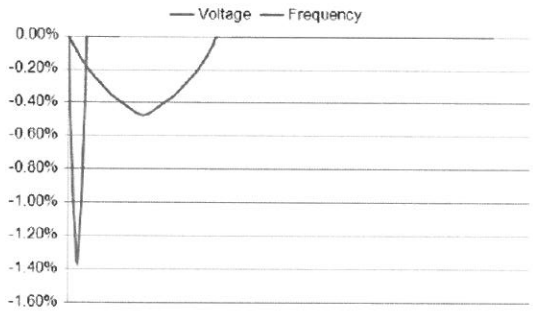
KOHLER Power Systems

Sizing Report

Step # 2	Qty	Run			Start			Volt Dip %	Freq Dip %	Volt. Dist. %
		kW	kVA	PF	kW	kVA	PF			
Motor Sludge Blower 3.00 HP 3 Phase Motor code : H Loaded NEMA Design across the line	1	2.80	3.78	0.74	11.66	20.10	0.58			
Motor EQ Blower 3.00 HP 3 Phase Motor code : H Loaded NEMA Design across the line	1	2.80	3.78	0.74	11.66	20.10	0.58			
Step Total		5.60	7.56	0.74	23.32	40.20	0.58	1.36	0.47	3.46
Cum.Total		106.98	114.26	0.94						



Report prepared by: Richard Nie

TOTAL SYSTEM INTEGRATION
GENERATORS | TRANSFER SWITCHES | SWITCHGEAR | CONTROLS

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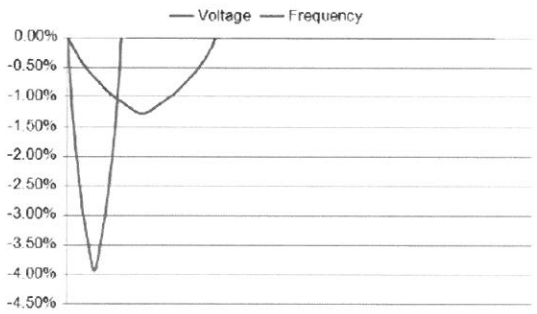
KOHLER Power Systems

Sizing Report

Step # 3	Qty	Run			Start			Volt Dip %	Freq Dip %	Volt. Dist. %
		kW	kVA	PF	kW	kVA	PF			
Motor Permeate Pump 7.50 HP 3 Phase Motor code : G Loaded NEMA Design VFD	3	22.34	24.82	0.90	22.34	24.82	0.90			
Motor MBR Feed Pump 4.70 HP 3 Phase Motor code : H Loaded NEMA Design across the line	3	12.83	17.10	0.75	51.96	94.47	0.55			
Step Total		35.16	41.55	0.85	74.29	116.48	0.64	3.93	1.28	4.70
Cum.Total		142.14	155.18	0.92						



Report prepared by: Richard Nie

TOTAL SYSTEM INTEGRATION
GENERATORS | TRANSFER SWITCHES | SWITCHGEAR | CONTROLS

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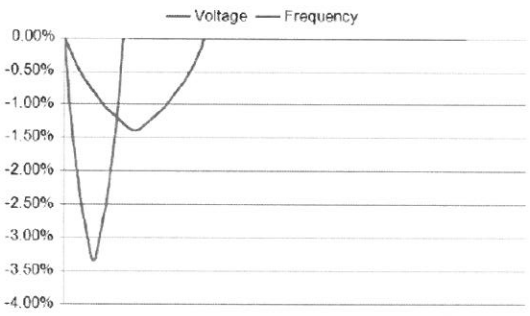
KOHLER Power Systems

Sizing Report

Step # 4	Qty	Run			Start			Volt Dip %	Freq Dip %	Volt. Dist. %
		kW	kVA	PF	kW	kVA	PF			
Motor **Aeration Blower** **30.00 HP** **3 Phase** **Motor code : G** **Loaded** **NEMA Design** **VFD**	3	83.82	93.13	0.90	83.82	93.13	0.90			
Step Total		83.82	93.13	0.90	83.82	93.13	0.90	3.34	1.39	9.36
Cum.Total		225.96	248.27	0.91						



Report prepared by: Richard Nie

TOTAL SYSTEM INTEGRATION
GENERATORS | TRANSFER SWITCHES | SWITCHGEAR | CONTROLS

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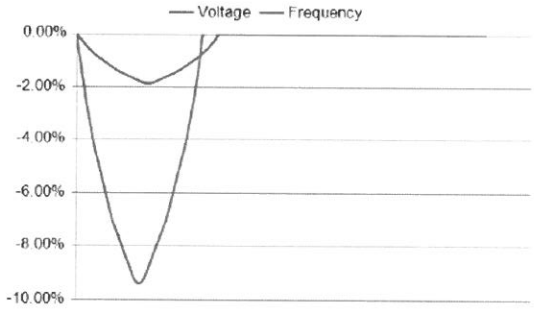
KOHLER. Power Systems

Sizing Report

Step # 5	Qty	Run			Start			Volt Dip %	Freq Dip %	Volt. Dist. %
		kW	kVA	PF	kW	kVA	PF			
Lighting Heater Evenly distributed Incandescent	4	20.00	20.00	1.00	20.00	20.00	1.00			
Motor MBR Blower 15.00 HP 3 Phase Motor code : G Loaded NEMA Design across the line	3	38.81	49.31	0.79	125.84	267.75	0.47			
Step Total		58.81	66.21	0.89	145.84	277.71	0.53	9.37	1.85	9.36
Cum.Total		284.77	314.42	0.91						
Grand Total		284.77	314.42	0.91				9.37	1.85	9.36



Report prepared by: Richard Nie

TOTAL SYSTEM INTEGRATION
GENERATORS | TRANSFER SWITCHES | SWITCHGEAR | CONTROLS

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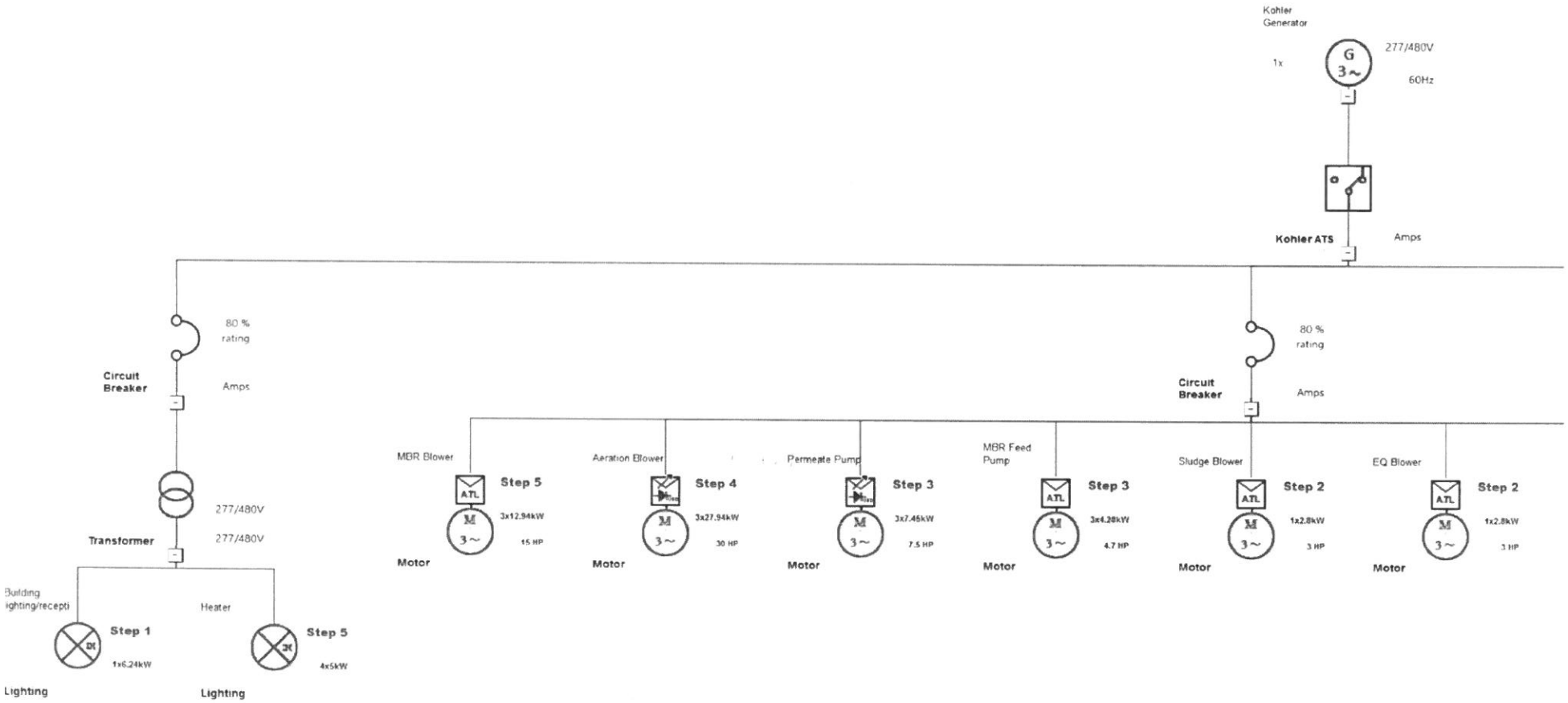
KOHLER Power Systems

Single Line Diagram



Report prepared by: Richard Nie

TOTAL SYSTEM INTEGRATION

GENERATORS | TRANSFER SWITCHES | SWITCHGEAR | CONTROLS

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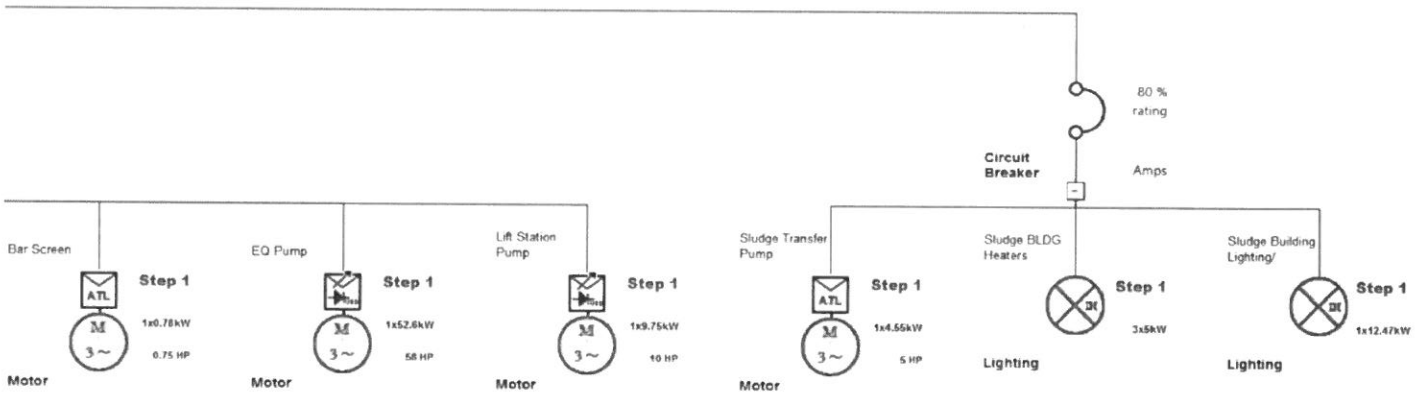
Software version: 1.0026.4.20

Friday, November 3, 2017

KOHLER Power Systems

Single Line Diagram



Report prepared by: Richard Nie

TOTAL SYSTEM INTEGRATION

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Software version: 1.0026.4.20

Friday, November 3, 2017

KOHLER. Power Systems

Summary sizing report

Project information

Project name: Bellefield
Customer's name:
Customer contact:

Site requirements

Voltage:	277/480
Phase:	3
Frequency:	60Hz
Alt. Temp. Rise Duty:	130°C Standby
Qty of Gensets:	1
Fuel type:	Diesel
Country :	United States

Application:	Construction
Genset Application:	Stationary emergency
Altitude:	500 Feet
Max. Ambient Temp.:	77 Degrees F
Min. Genset Loading :	25 %
Max. Genset Loading :	90 %

Site load requirements summary

Running kW:	284.77
Running kVA:	314.42
Running P.F.:	0.91

Max. Starting kW:	145.84 in step 5
Max. Starting kVA:	277.71 in step 5

Generator selection

Genset Model:	350REOZJ
Engine:	6135HF485
Emission level:	EPA Tier 3
BHP:	538.00
Displacement:	824.00
RPM:	1800

Alternator:	4M4019
Alternator Leads:	12 lead
Alt. Starting kVA at 35% V dip:	1,325.00
Excitation System :	PMG

Rated kW :	350.00
Site Rated kW :	350.00
UL 2200 Certified	

Generator Performance Summary

Voltage Dip Limit:	30.00 %
Frequency Dip Limit:	10.00 %
Harmonic Distortion Limit:	10.00 %

Calculated Voltage Dip:	9.37 %
Calculated Frequency Dip:	1.85 %
Calculated Harmonic Distortion:	9.36 %
Calculated Genset % Loaded:	81.36 %

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Report prepared by: Richard Nie

TOTAL SYSTEM INTEGRATION
GENERATORS | TRANSFER SWITCHES | SWITCHGEAR | CONTROLS

Software version: 1.0026.4.20

Friday, November 3, 2017

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Appendix P:
Flow and Mass Balance

Project Number: 81235.09

The Chazen Companies
May 13, 2021
Revised February 23, 2022

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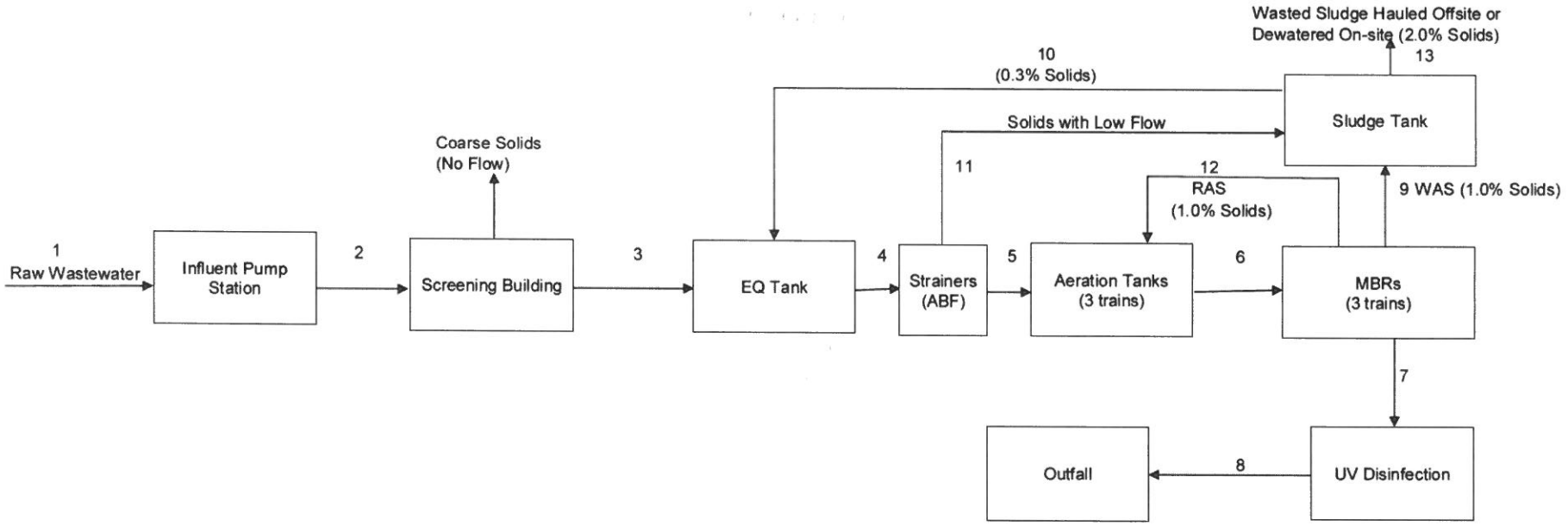
Flow and Mass Balance Diagram
Bellefield at Historic Hyde Park - WWTP at Buildout
Design Average Day Flow: 342,000 gal



Flow and Mass Balance

Bellefield at Historic Hyde Park - WWTP at Buildout
Design Average Day Flow: 342,000 gal

Stream	Function	Flow Rate Source	Avg Design Flow Day						
				BOD		TSS		Ammonia	
			Flow (gpd)	(lb/d)	(mg/l)	(lb/d)	(mg/l)	(lb/d)	(mg/l)
1	Raw Wastewater Flow (note 1)	Design	342,000	998	350	1,141	400	8.1	45
2	Screenings Influent	1	342,000	998	350	1,141	400	8.1	45
3	EQ Tank Influent	2	342,000	998	350	1,141	400	8.1	45
4	EQ to Strainer	3+10	353,885			1,438	487		
5	Aeration Tank Influent	4-11	347,045			1,413	488		
6	MBR Influent	5+12	432,045	12	53	14	4	1.53	6.8
7	MBR Effluent (note 5)	6-(9+12)	334,000	0.35	2	1	4	0.04	0.20
8	Effluent to Outfall	7	334,000	0.35	2	1	4	0.04	0.20
9	Waste Activated Sludge (note 2)	Estimate	13,045			1,088	10,000		
10	Sludge Decant to EQ (note 4)	(9+11)-13	11,885			297	3,000		
11	Strainer Solids to Sludge Tank	1 x 2%	6,840			25	438		
12	Return Activated Sludge	6 x 20%	85,000			7,089	10,000		
13	Wasted Sludge (Hauled Offsite) (note 3)	Estimate	8,000			1,334	20,000		
	Balance	8+13	342,000			1,335			

Notes:

1. Daily Flow (gpd) values based on design. TSS mass values are calculated from daily flows. TSS concentration values based on daily flows.
2. Waste Activated Sludge and Return Activated Slude assumed to have 1.0% dry solids.
3. Wasted Sludge assumed to have 2.0% dry solids.
4. Sludge to EQ assumed to have 0.3% dry solids.
5. Effluent limits are based on FibrePlate Operation Report data. Actual results exceed SPDES permit requirements.
6. Sludge Production is calculated as a composition of total suspended solids (TSS) and biological solids (BOD) produced in the aeration basins and wasted the sludge holding tanks. Secondary sludge from TSS in influent, dry weight is:
 = (TSS in- TSS out) (Q)(3.785 L/gal)(2.205 lb/1,000,000 mg)
The total biological solids produced as a result of carbonaceous BOD oxidation and the additional nitrification limit is:
= [0.3 x (SBOD in - SBOD out) + 0.15(NH3 in - NH3 out)] (Q) (8.34 L-lb/mg-MG)

The Chazen Companies

Appendix Q:
WWTP – NYSDEC Facility Scoring Worksheet

Project Number: 81235.09

The Chazen Companies
May 13, 2021
Revised February 23, 2022

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Facility Name Bellefield WWTP SPDES # NY0281140 Facility Operator _____ FOAS 100-4/95

Facility phone number (___) _____ Date Completed 07/08/21 Regional Reviewer _____ Circle units/items that apply

Design Flow - 3 points per MGD or part (Minimum 1 point - Maximum 50 points) **3 points x** 0.342 **MGD =** 1 **Flow Points**

Unit or Item	Points	Unit or Item	Points
Preliminary Treatment (Maximum 8 points)		Phosphorus Removal (required by permit), 4K	8
Bar Screens and/or Comminutor, 1A	(2)	Chemical Addition for neutralization, 4L	3
Manual Grit Removal, 1B	2	**Advanced Treatment Subtotal$_4$**	8
Mechanical or Aerated Grit Removal, 1C	3	**Disinfection (Maximum 8 points)**	
Pre-aeration, 1D	(2)	Chlorination:	
Raw sewage or Effluent pumping, 1E	(3)	Gas Chlorination, 5A	5
Flow equalization basin, 1F	(3)	Other Chlorination, 5B	2
(Preliminary Score) Subtotal$_1$	8	Dechlorination, 5C	3
Primary Treatment (Maximum 5 points)		Ultraviolet, 5D	(5)
Primary Treatment Including: Primary Clarifiers, Imhoff tanks, Spirogesters, Clarigesters, Fixed Screens, and Hydroscreens, 2A	(5)	Ozonization, 5E	5
		Bromine Chloride, 5F	5
Primary Treatment Subtotal$_2$	5	**Disinfection Subtotal$_5$**	5
Secondary Treatment (Maximum 25 points)		**Solids Handling / Disposal (Maximum 25 points)**	
Lagoon (unaerated), 3B	3	Gravity Thickener, 6A	5
Intermittent sand filters without recirculation, 3C	3	Dissolved air floatation thickener, 6B	8
Intermittent sand filters with recirculation, 3D	5	Centrifugation, (includes all modifications) 6C	8
Aerated Lagoon, 3E	7	Aerobic Digestion, 6D	5
Trickling Filter / Biological Filter without recirculation, 3F	9	Single Stage Anaerobic Digestion (unheated), 6E	5
Trickling Filter / Biological Filter with recirculation, 3G	11	Single Stage Anaerobic Digestion (heated), 6F	8
Rotating Biological Contactors, 3H	11	Two Stage Anaerobic Digestion, 6G	10
Activated Sludge (includes all process modifications), 3I	(20)	Sludge Drying Beds, except vacuum assisted drying bed, 6H	3
Chemical Coagulation with rapid mix, flocculation, clarification, 3J	20	Belt Filter Press, 6I	(8)
Secondary Treatment Subtotal$_3$	20	Plate & Frame Press, 6O	8
Advanced Waste Treatment / Tertiary Treatment (Maximum 20 points)		Vacuum Filters, 6P	8
Polishing pond, 4A	2	All other dewatering units, 6J	5
Microscreens, 4B	3	Land Application, 6K	5
Intermittent sand filter, 4C	3	Composting:	
Rapid sand filter, 4D	5	Invessel, 6L	10
Activated carbon columns or beds, 4E	5	Static Pile, 6M	5
Reverse osmosis, electrodialysis, ion exchange, 4F	5	Solids Reduction (incineration, wet oxidation), 6N	15
Nitrification required by permit (Ammonia, TKN, or UOD limit):		**Solids Handling/Disposal Subtotal$_6$**	8
by Activated Sludge, 4G	(8)	**Miscellaneous**	
Nitrification by other process, 4H	5	Nutrient addition (nitrogen and/or phosphorus), 7A	3
Denitrification required by permit (Nitrate or Total Nitrogen limit):		Carbon Regeneration (onsite), 7B	10
Nitrification by Activated Sludge and Denitrification, 4I	13	**Miscellaneous Subtotal$_7$**	
Nitrification by other process and Denitrification, 4J	10	**Total Score (add subtotals 1 thru 7 plus Flow Points)**	55

Wastewater Treatment Plant Rating Worksheet for Wastewater Treatment Plant Certification (Ref: Part 650.3, 650.6)

Attached is the scoring system for wastewater treatment plants in New York State. Scoring will be done to determine the certification grade of the chief operator and the assistant/shift operator needed at each wastewater treatment plant. The operator grades are divided into two designations, a number (1, 2, 3, or 4 with 1 being the lowest and 4 the highest grade), and the letter "A" for wastewater treatment plant operators working at facilities using the activated sludge process. All other treatment processes have no letter designation.

The scoring system is based on types of treatment processes at the wastewater treatment plant and flow. **Generally the treatment unit receives points only for its designed purpose or function** (example - a spare aerobic digester being used as a gravity thickener only receives points for an aerobic digester). Below are some basic guidelines for completing the scoring sheet. These guidelines are intended to cover most but not all possible options. DEC, specifically FOAS, will make the final determination regarding scoring questions. No additional points will be given for units/items not listed in the scoring system.

1) **Flow Scoring** - Flow scoring should be based on the 30 day average design flow limit of the treatment plant. If the 30 day average design flow is not known, the SPDES permit 30 day average flow limit should be used. If the average design flow is not known and there is no SPDES permit flow limit, flow points will be based on actual flow measurements - the flow points will be calculated from the maximum recorded 30 day average flow. The calculated flow point score should be rounded to the nearest whole number.
Example; 3 pts x 6.4 MGD = 19.2 or 19 Flow Points.

2) **Raw sewage or effluent pumping** - can be onsite, or offsite such as a pump station if there are no connections between the pump station and the plant.

3) An **aerated grit chamber** is not a preaeration unit.

4) A **flow equalization basin** must be a unit designed for flow equalization, not a sewer or an empty tank.

5) **Secondary Treatment** - Secondary Clarifier scoring is included in the secondary treatment processes. No additional points are given for secondary clarifiers.

6) **Lagoons** - No double scoring for lagoons. Example; the first lagoon is aerated and subsequent lagoons are unaerated, scores 7 points for the aerated lagoon, no additional points for the unaerated lagoon.

7) **A lagoon or pond is not an activated sludge process** unless it meets the following definition; A mixture of wastewater and activated sludge is agitated and aerated. The activated sludge is then separated from the treated wastewater by sedimentation and returned or wasted to the process as needed.

8) **Trickling Filters** - No double scoring for trickling filters. Two trickling filters in series or parallel are 1 unit regardless of differences in size, media or recirculation capability. If one or more units has recirculation, the facility receives 11 points (TF with recirculation).

9) **Polishing Pond** - to be considered a polishing pond, the pond must directly follow a settling unit that has sludge withdrawal. Example; Two lagoons in series do not receive points for a lagoon and a polishing pond even if the second lagoon is unaerated. A trickling filter followed by a secondary clarifier then a pond or lagoon will receive points for the polishing pond.

10) **Multiple Treatment Units** - Two treatment units may be scored if they exist at the WWTP, (see exceptions above), but the maximum scoring for secondary treatment is still 25 points. Example #1; Activated Sludge 20 points + Trickling Filter 11 points = 31 points, would receive 25 points for secondary treatment. Example #2; Trickling Filter with recirculation 11 points followed by an RBC 11 points = 22 points.

11) **Chemical Coagulation with Rapid mix, flocculation, & clarification** - To receive credit for this option, there must be separate rapid mix, flocculation and clarification units that are independent of primary or biological treatment systems. Chemical coagulation processes following biological treatment are ineligible.

12) **Rapid Sand Filter** - any filter with backwash capability is considered a rapid sand filter.

13) **Advanced Waste Treatment, Nitrification** - To get points for nitrification the WWTP must have a permit limit for Ammonia, TKN, or UOD. Monitoring alone does not receive the points. Credit for Nitrification is limited to one treatment process (activated sludge or other processes, not both).

14) **Denitrification points** - the WWTP must have a permit limit for Nitrates or Total Nitrogen. Denitrification is limited to one treatment process (activated sludge or other processes, not both).

15) **Nitrification/Denitrification** - No plant can receive points in both the nitrification and denitrification categories. The nitrification fraction is built into the denitrification points.

16) **Chemical Addition for Neutralization** - To receive credit, the chemical addition must be performed for metals removal or be necessary to meet effluent pH limits .

17) **Solids Handling Aerobic Digester** - To be considered an aerobic digester the unit must have a volume of at least 5% of the design flow of the plant and have aeration and decant capability.

18) **Sludge Lagoons, Sludge Holding Tanks** and/or **Wet hauling sludge** to another facility does not receive points.

19) **Solids Handling** - To receive points for composting or land application, it must be the primary stabilization/solids disposal process of the WWTP (more than 50 percent of the sludge produced by the WWTP must be composted or land applied) and have a valid Part 360 Permit. Example; pilot composting projects do not receive points.

20) **Spray Irrigation** of waste is considered the same as raw sewage or effluent pumping and receives 3 points. There is no double scoring for pumping. Example; Influent pumping and spray irrigation only receives 3 points not 6.

21) **Miscellaneous** - Nutrient addition, nitrogen or phosphorus, must have permanently installed equipment with the proper tanks and metering pumps to receive points.

22) **Out-of-Service Equipment or Equipment not being used** - If a piece of equipment is at the WWTP and not regularly used, but is operable if needed, it does receive points. If a piece of equipment has been abandoned, or disconnected from the flow scheme, or is inoperable, it does not receive points.

23) **Overland Treatment** does not receive points.

When each subtotal and the Flow Points are determined, they are all added together to reach the Total WWTP Score. This score, with the following table, establishes the minimum grade of Chief Operator and the Assistant/shift Operator needed at the WWTP.

Total Treatment Plant Score	30 and less	31 - 55	56 - 75	76 and greater
Grade of Chief Operator Required	1/1A	2/2A	3/3A	4/4A
Grade of Assistant/Shift Operator Required	1/1A	1/1A	2/2A	3/3A

If you have any questions please contact the Bureau of Water Compliance, at (518) 402-8177.

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Appendix R:
WWTP Design Calculations

Project Number: 81235.09

The Chazen Companies
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Design Calculations

Symbols

a. $u_{max,AOB@T}$ – maximum specific growth rate for ammonia oxidizing bacteria at a specified temperature

b. u_{max} – maximum specific growth rate of specified bacteria at 20 °C

c. $u_{max,k}$ –theta coefficient for u_{max}

d. $b_{AOB@T}$ – specific endogenous decay rate for ammonia oxidizing bacteria at specified temperature

e. b - endogenous decay coefficient at 20 °C for specified bacteria

f. b_K – theta coefficient for b for specified bacteria

g. u_{AOB} – specific growth rate of ammonia oxidizing bacteria

h. S_e - substrate effluent concentration

i. k_A – half velocity coefficient for ammonia

j. k_O – half velocity coefficient for dissolved oxygen for ammonia oxidizing bacteria

k. D_O – dissolved oxygen Concentration in aeration basin

l. SRT – solids retention time

m. $u_{max,HB@T}$ – maximum specific growth rate for heterotrophic bacteria at a specified temperature

n. $b_{HB@T}$ – specific endogenous decay rate for heterotrophic bacteria at specified temperature

o. S – substrate concentration

p. $P_{x,Bio}$ – biomass production

q. Q – average day flow

r. Y_H – synthesis yield coefficient for heterotrophic bacteria

s. S_o – influent substrate concentration

t. b_H – heterotrophic cellular decay rate in endogenous respiration

u. f_d – fraction of cell mass remaining as cell debris

v. $P_{x,VSS}$ – net wasted volatile activated sludge produced each day

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w. $nbVSS$ – nonbiodegradable volatile suspended solids

x. $X_{VSS/V}$ – concentration of VSS per volume

y. $P_{x,TSS}$ – net wasted total activated sludge produced each day

z. VSS – volatile suspended solids

aa. TSS – total suspended solids

bb. $X_{TSS/V}$ – concentration of total suspended solids per volume

cc. X_{TSS} – concentration of total suspended solids

dd. $MLSS_{MBR}$ – mixed liquor suspended solids in MBR tank

ee. $MLSS_{WAS}$ – mixed liquor suspended solids of waste active sludge

ff. RAS – return activated sludge

gg. $\frac{F}{M}$ - return activated sludge

hh. V – volume of tank

Aeration Tank Sizing

Nitrifiers Specific Growth Rate

$$u_{max,AOB@T} = u_{max} * u_{max,k}{}^{(T-T_o)}$$
$$u_{max,AOB@T} = 0.9 * 1.072^{(10-20)}$$
$$u_{max,AOB@T} = 0.449\frac{g}{g} * day$$

$$b_{AOB@T} = b * b_k{}^{(T-T_o)}$$
$$b_{AOB@T} = 0.17 * 1.029 *^{(10-20)}$$
$$b_{AOB@T} = 0.128\frac{g}{g} * day$$

$$u_{AOB} = u_{max,AOB@T} * \left(\left(\frac{S_e}{S_e + k_A}\right) * \left(\frac{D_o}{(D_o + k_o)}\right)\right) - b_{AOB@T}$$
$$u_{AOB} = 0.449 * \left(\left(\frac{0.9}{0.9 + 0.5}\right) * \left(\frac{2}{2 + 0.5}\right)\right) - 0.128$$
$$u_{AOB} = 0.103\frac{g}{g} * day$$

Solid Retention Time

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$$SRT = 1/u_{AOB}$$
$$SRT = 1/0.103$$
$$SRT = 9.7\ days$$

Biomass Production

$$u_{max,HB@T} = u_{max} * u_{max,k}{}^{(T-T_o)}$$
$$u_{max,HB@T} = 6 * 1.07^{(10-20)}$$
$$u_{max,HB@T} = 3.05\frac{g}{g} * day$$

$$b_{HB@T} = b * b_k{}^{(T-T_o)}$$
$$b_{HB@T} = 0.12 * 1.045^{(10-20)}$$
$$b_{HB@T} = 0.081\frac{g}{g} * day$$

$$S = \frac{k_s * (1 + b_{HB@T} * SRT)}{SRT * \left(u_{max,HB@T} - b_{HB@T}\right) - 1}$$
$$S = \frac{8 * (1 + 0.081 * 9.7)}{9.7 * (3.05 - 0.081) - 1}$$
$$S = 0.514\ g\ bCOD/m^3$$

Assume 71.1% of TKN concentration is oxidized = 49.8 mg/L = S_N

$$P_{x,Bio} = \frac{Q * Y_H * (S_o - S)}{1 + b_H * SRT} + \frac{f_d * b_H * Q * Y_H * (S_o - S) * SRT}{1 + b_H * SRT} + \frac{Q * Y_H * S_N}{1 + b_H * SRT}$$

$$P_{x,Bio} = \frac{1296 * 0.45 * (350 - 0.514)}{1 + 0.081 * 19.3} + \frac{0.15 * 0.081 * 1296 * 0.45 * (350 - 0.514) * 9.7}{1 + 0.081 * 9.7} + \frac{1296 * 0.15 * 0.0498}{1 + 0.081 * 9.7}$$
$$P_{x,Bio} = 208.6\ VSS/day$$

Concentration and Mass of TSS and VSS in Aeration Basin

Assume 22.5% of TSS is non biodegradable VSS

$$P_{x,VSS} = P_{x,Bio} + Q * nbVSS$$
$$P_{x,VSS} = 208.6 + 1296 * 0.0903$$
$$P_{x,VSS} = 325.6\ kg/day$$

$$X_{VSS/V} = P_{x,VSS} * SRT$$
$$X_{VSS/V} = 325.6 * 9.7$$
$$X_{VSS/V} = 3154.9\ kg$$

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Assume VSS/TSS ratio is 79%

$$P_{x,TSS} = \frac{P_{x,Bio}}{\frac{VSS}{TSS}} + Q * nbVSS + Q * (TSS - VSS)$$

$$P_{x,TSS} = \frac{208.6}{0.79} + 1296 * 0.0903 + 1296 * (400 - 316)$$

$$P_{x,TSS} = 489.9\ kg/day$$

$$X_{TSS/V} = P_{x,TSS} * SRT$$

$$X_{TSS/V} = 489.9 * 9.7$$

$$X_{TSS/V} = 4747\ kg$$

Determine MLSS in Existing Aeration Basin

Aeration basin volume = 600 m^3 =158,400 gal
RAS Ratio = 4

$$X_{TSS} = X_{\frac{TSS}{v}}/V$$

$$X_{TSS} = 4747/600$$

$$X_{TSS} = 7920\ mg/L$$

$$MLSS_{MBR} = MLSS_{WAS} = X_{TSS}/(\frac{RAS}{1 + RAS})$$

$$MLSS_{MBR} = MLSS_{WAS} = 7920/(\frac{4}{1 + 4})$$

$$MLSS_{MBR} = MLSS_{WAS} = 9900\ mg/L$$

Food to Biomass Ratio and BOD Loading

$$\frac{F}{M} = (Q * S_o)/(V * X_{TSS} * \frac{X_{\frac{VSS}{V}}}{X_{\frac{TSS}{V}}})$$

$$\frac{F}{M} = (1296 * 0.350)/(600 * 0.792 * \frac{3154}{4747})$$

$$\frac{F}{M} = \frac{0.14kg}{kg} * day$$

$$BOD\ Loading = (Q * S_o)/V$$

$$BOD\ Loading = (1296 * 0.35)/600$$

$$BOD\ Loading = 0.75kg/m^3 * day = 0.00625\frac{lbs}{gal} * day$$

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Air Flowrate Required

$$R_o = \left(Q * (S_o - S)\right) - (1.42 * P_{x,bio,vss)} + (4.57 * Q * S_N)$$
$$R_o = \left(1296 * (0.56 - 0.000514)\right) - (1.42 * 0.208 + (4.57 * 1296 * .0498)$$
$$R_o = 730\ kg\ O_2/day$$

$$OTR = R_o/24$$
$$OTR = 730/24$$
$$OTR = 30.4\ kg\ O_2/hr$$

$$\frac{P_b}{P_a} = EXP\left(-\left(9.81 * 28.97 * \frac{E - E_o}{8314 * 273 + T}\right)\right)$$
$$\frac{P_b}{P_a} = EXP\left(-\left(9.81 * 28.97 * \frac{E - E_o}{8314 * 273 + T}\right)\right)$$
$$\frac{P_b}{P_a} = EXP\left(-\left(9.81 * 28.97 * \frac{200 - 0}{8314 * 273 + 10}\right)\right)$$
$$\frac{P_b}{P_a} = 0.98$$

Assumed diffuser depth = 3.64 m = 12 ft

$$SOTR = \frac{OTR}{a * d_f} * \frac{C^{20}}{b * \left(\frac{C_{S@T}}{C_{s20}}\right) * \frac{P_b}{P_a} * C_{20} - D_O} * (1.024^{(20-T)})$$
$$SOTR = \frac{30.4}{0.47 * 0.9} * \frac{10.33}{0.95 * \left(\frac{8.063}{9.09}\right) * 0.98 * 9.09 - 2} * (1.024^{(20-10)}$$
$$SOTR = 144.9\ kg/hr$$

$$P_{a@T} = \left(\frac{P_b}{P_a} * 1.01325 * 10^5 * 28.97\right)/(8314 * (273.15 + T_a))$$
$$P_{a@T} = (0.98 * 1.01325 * 10^5 * 28.97)/(8314 * (273.15 + 25))$$
$$P_{a@T} = 1.15\ kg/m^3$$

$$pO_2 = P_{a@T} * 0.2318$$
$$pO_2 = 1.15 * 0.2318$$
$$pO_2 = 0.268\ kg\ O_2/m^3 air$$

Assume oxygen transfer efficiency = 30%

$$Air\ Flowrate = SOTR/(O_{2T} * pO_2)$$
$$Air\ Flowrate = 144.9/(0.3 * 0.268)$$
$$Air\ Flowrate = 30.0\frac{m^3}{min} = 1059\ CFM$$

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Membrane Sizing

Assumed maximum daily flow per train = Q = 228,000 GPD
Surface area per membrane cassette = 500 SF
Number of membrane cassette = 48

$$Membrane\ Flux\ per\ Train = \frac{Q}{SA_{Membrane} * \#\ Membrane\ Cassettes}$$

$$Membrane\ Flux\ per\ Train = \frac{228{,}000}{500 * 48}$$

$$Membrane\ Flux\ per\ Train = 9.5\ GFD$$

Manufacturer Membrane Design Flux at 50 °F = 10 GFD.

Membrane Air Scouring Requirement per Train

Air requirement is 0.009 CFM/SF

$$Total\ MBR\ Air\ Scour\ Requirement = Total\ MBR\ Surface\ Area * Air\ Requirement$$

$$Total\ MBR\ Air\ Scour\ Requirement = 48 * 500 * 2 * 0.009\ CFM$$

$$Total\ MBR\ Air\ Scour\ Requirement = 432\ CFM$$

Sludge Production

Assumed specific gravity of fixed solids = 2.5
Assumed specific gravity of volatile solids = 1.005
Assumed specific gravity of secondary sludge = 1.001
Assume specific gravity of influent = 1.0
Assume strainer wastes 28.8 m^3/day of influent = 7603 gal/day

$$Strainer_{Wasted\ Solids} = V_{SW} * SG_{Influent} * S_o$$

$$Strainer_{Wasted\ Solids} = 28.8 * 1.0 * 0.4 * 1000$$

$$Strainer_{Wasted\ Solids} = 11.5\frac{kg}{day} = 25.3\ lbs/day$$

$$Volume_{WAS} = P_{x,TSS}/(SG_{WAS} * MLSS_{WAS})$$

$$Volume_{WAS} = 490/(1.001 * 9.9)$$

$$Volume_{WAS} = \frac{49.4\ m^3}{day} = 13{,}041\ gal/day$$

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$$Total\ Mass_{\ Wasted\ Sludge} = P_{x,TSS} + Strainer_{Solids}$$
$$Total\ Mass_{\ Wasted\ Sludge} = 490 + 11.5$$
$$Total\ Mass_{\ Wasted\ Sludge} = 501.5\frac{kg}{day} = 1103\ lbs/day$$

$$Total\ Volume_{\ Wasted\ Sludge} = Volume_{WAS} + Strainer_{Wasted\ solids}$$
$$Total\ Volume_{\ Wasted\ Sludge} = 49.4 + 28.8$$
$$Total\ Volume_{\ Wasted\ Sludge} = 78.2\frac{m^3}{day} = 20{,}644\ gal/day$$